THAI AGRICULTURAL STANDARD

TAS 7418 -2009

GOOD AQUACULTURE PRACTICES FOR SNAKESKIN GOURAMI FARM

National Bureau of Agricultural Commodity and Food Standards
Ministry of Agriculture and Cooperatives

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GOOD AQUACULTURE PRACTICES FOR SNAKESKIN GOURAMI FARM

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# Technical Committee on the Elaboration of the Thai Agricultural Standard on Good Aquaculture Practices for Snakeskin Gourami Farm

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Snakeskin Gourami is a freshwater fish that has good potential for expanded production and use in Thailand. The Committee of Agricultural Standards therefore deems it necessary to establish the Thai agricultural standard on good aquaculture practices for Snakeskin Gourami farms.

The standard is based on the information of the following documents:


Department of Fisheries. 2008. Study on Good Aquaculture Practice for Snakeskin Gourami farm.
NOTIFICATION OF THE MINISTRY OF AGRICULTURE AND COOPERATIVES
SUBJECT: THAI AGRICULTURAL STANDARD:
GOOD AQUACULTURE PRACTICES FOR SNAKESKIN GOURAMI FARM

Whereas the Agricultural Standards Committee deems it necessary to establish an agricultural standard on Good Aquaculture Practices for Snakeskin Gourami Farm as a voluntary standards in accordance with the Agricultural Standards Act B.E. 2551 (2008) to promote such agricultural commodity to meet its quality, standard and safety.

By virtue of Section 5, Section 15 and Section 16 of the Agricultural Standards Act B.E. 2551 (2008), the Minister of Agriculture and Cooperatives hereby issues this notification on establishment of Thai Agricultural Standard on Good Aquaculture Practices for Snakeskin Gourami Farm(TAS 7418-2009), established as voluntary standard, details of which are attached herewith.

Notified on 7 October B.E. 2553 (2010)
Mr. Theera Wongsamut
Minister of Agriculture and Cooperatives
THAI AGRICULTURAL STANDARD
GOOD AQUACULTURE PRACTICES FOR
SNAKESKIN GOURAMI FARMS

1. SCOPE
This Thai Agricultural Standard applies to good aquaculture practices (GAP) for Snakeskin Gourami farms, from production practices to post-harvest handlings in order to produce good quality and safe Snakeskin Gourami fish fit for consumption.

2. DEFINITIONS
For the purpose of this standard:

2.1 Snakeskin Gourami (also called Sepat Siam) means fish of the species *Trichogaster pectoralis*.

2.2 Snakeskin Gourami Farm means site for used Snakeskin Gourami farm consisting of rearing ponds, feed preparation area or building and facilities and facilities for sanitation services and a waste water treatment system.

2.3 Rearing Pond means a water-filled pond for raising Snakeskin Gourami.

2.4 Veterinary Drug means any substance applied or administered to any food-producing animal, whether used for therapeutic, prophylactic, or diagnostic purposes or for modification of physiological functions or behaviour.

2.5 Residues of Veterinary Drugs means any veterinary drug as in 2.4 including parent drug, metabolites and associated impurities in the animal tissue, produce and products of animal which are used for human food.

2.6 Major requirement means the mandatory requirement that shall be fully complied with. In case of non compliance, it will seriously affect the quality as well as safety for consumers, or the requirement that shall be complied with relevant laws and regulations.

2.7 Minor requirement means the requirement that shall be mostly complied with. In case of non compliance, it will affect the health of Snakeskin Gourami or product quality.

3. REQUIREMENTS AND INSPECTION METHODS
Good Aquaculture Practices for freshwater aquatic animal are as in Table 1.
Table 1 Requirements and Inspection Methods
(Section 3)

<table>
<thead>
<tr>
<th>Item</th>
<th>Criteria</th>
<th>Inspection methods</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farm site and location</td>
<td>1.1 The farm shall be registered.</td>
<td>1.1 Check farm registration documents or registration number.</td>
<td>Major requirement</td>
</tr>
<tr>
<td></td>
<td>1.2 Availability of farm location map and layout.</td>
<td>1.2 Check farm location map and layout.</td>
<td>Minor requirement</td>
</tr>
<tr>
<td></td>
<td>1.3 Adequate water source being located of suitable quality for Snakeskin Gourami culture.</td>
<td>1.3 Visual inspection for environment of water sources and adequacy of the water quantity.</td>
<td>Minor requirement</td>
</tr>
<tr>
<td></td>
<td>1.4 The farm shall not be impacted by sources of pollution</td>
<td>1.4 Inspect the environment; if there is risk of pollution, inspect the contamination prevention measures or test the soil and water quality</td>
<td>Minor requirement</td>
</tr>
<tr>
<td></td>
<td>1.5 Conveniently access to facilitate farm operation and transportation of the produce.</td>
<td>1.5 Visual Inspect transportation infrastructure</td>
<td>Minor requirement</td>
</tr>
<tr>
<td>2. Farm management</td>
<td>2.1.1 Operate properly according to technical recommendations such as the Department of Fisheries Manual on Aquatic Animal Farm or other practices according to the technical recommendations.</td>
<td>2.1.1 Interview the farmer and /or inspect the handbook or other printed materials</td>
<td>Minor requirement</td>
</tr>
<tr>
<td>2.1 General management</td>
<td>2.1.2 Attend technical meeting or training program on farm management, use of production inputs, harvesting, and relevant laws, and regulations.</td>
<td>2.1.2 Check evidence on the meeting attendance or training.</td>
<td>Minor requirement</td>
</tr>
<tr>
<td>Item</td>
<td>Criteria</td>
<td>Inspection methods</td>
<td>Level</td>
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<tr>
<td>-----------------------------------------------------------</td>
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</tr>
<tr>
<td>2.2 Rearing pond preparation and pest eradication</td>
<td>2.2.1 Proper preparation of new and old ponds or if required, repair pond bottom condition for raising Snakeskin Gourami</td>
<td>2.2.1 Inspect the ponds preparation or records</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td></td>
<td>2.2.2 Eradication predatory fish and insects of Snakeskin Gourami with suitable methods.</td>
<td>2.2.2 Inspect records of pest treatment methods</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>2.3 Pond water</td>
<td>2.3 The water shall be suitable for raising Snakeskin Gourami</td>
<td>2.3 Inspect records of water preparation or water quality analysis</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>2.4 Effluent water management</td>
<td>2.4 Effluent water quality shall comply with relevant laws and regulation.</td>
<td>2.4 Inspect records on effluent water quality testing.</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>3. Inputs</td>
<td>3.1.1 Snakeskin Gourami shall be healthy with non-infected diseases and of good quality</td>
<td>3.1.1.1 Question of selecting fish seeds or inspect purchasing records /criteria for selection fish seed. 3.1.1.2 Observe the physical characteristic and behavior of fish fry.</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>3.1 Snakeskin Gourami</td>
<td>3.1.2 If additional brood stock are added, there shall be a record of the purchase</td>
<td>3.1.2 Check the copy of fry movement document (FMD).</td>
<td>Major Requirement</td>
</tr>
<tr>
<td></td>
<td>3.1.3 Use optimal stocking density of fry or fingerlings in rearing pond.</td>
<td>3.1.3 Inspect records on the number of Snakeskin Gourami fingerlings released.</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>Item</td>
<td>Criteria</td>
<td>Inspection methods</td>
<td>Level</td>
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<tr>
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<tr>
<td>3.2 Snakeskin Gourami Feed</td>
<td>3.2.1 Use formulated feed registered with competent authority</td>
<td>3.2.1 Inspect the registration number, production date and expiration date on the feed package labels</td>
<td>Major Requirement</td>
</tr>
<tr>
<td></td>
<td>3.2.2 Raw materials used for farm-made feed and raw materials used as feed shall be free from veterinary drugs and legally prohibited substances.</td>
<td>3.2.2.1 Inspect records of raw materials and feed supplements used on farm</td>
<td>Major Requirement</td>
</tr>
<tr>
<td></td>
<td>3.2.3 On-farm feed shall be hygienically produce and have suitable quality for aquaculture system.</td>
<td>3.2.3.1 Inspect the quality and source of raw materials 3.2.3.2 Visual inspection on equipment, fish feed production and/or interview the farmer 3.2.3.3 Take feed samples to test for quality 3.2.3.4 Inspect feeding records or feed production records</td>
<td>Major Requirement</td>
</tr>
<tr>
<td></td>
<td>3.2.4 Availability of separated hygienic storage areas for raw materials.</td>
<td>3.2.4.1 Visual inspection for hygienic practices of feed and raw materials in storage areas 3.2.4.2 Inspect records on storage of feed, supplements and raw materials</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>Item</td>
<td>Criteria</td>
<td>Inspection methods</td>
<td>Level</td>
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</tr>
<tr>
<td>3.3 Other inputs (non-feed)</td>
<td>3.3.1 Storage areas are separate and hygienic</td>
<td>3.3.1.1 Visual inspection on hygienic practices in storage area. 3.3.1.2 Inspect storage records 3.3.1.3 Inspect records of the use of production inputs</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td></td>
<td>3.3.2 Non feed inputs shall be free from veterinary drugs and other prohibited substances</td>
<td>3.3.2.1 Inspect test records certifying the factors are free from contamination 3.3.2.2 Inspect for evidence of the use of prohibited substances</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>4. Fish health management</td>
<td>4.1 Fish health management</td>
<td>4.1.1 The farm shall regularly monitor and check the health of the fish 4.1.2 If large numbers of fish die the farm shall notify the responsible authorities and use appropriate methods to dispose of the dead fish and effluent water</td>
<td>Major Requirement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.1.1.1 Inspect the farm’s management records 4.1.1.2 Interview the farmer 4.1.2.1 Interview the farmer 4.1.2.2 Inspect farm records for reports of disease epizootics</td>
<td></td>
</tr>
<tr>
<td>4.2 Disease prevention and treatment</td>
<td>4.2.1 The farm shall use accepted methods for preventing and treating diseases caused by parasites and bacteria</td>
<td>4.2.1 Inspect farm records or interview the farmer</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>Item</td>
<td>Criteria</td>
<td>Inspection methods</td>
<td>Level</td>
</tr>
<tr>
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</tr>
<tr>
<td>4.2.2.1</td>
<td>Inspect the registration number, production date and expiration date on the drug package labels</td>
<td>4.2.2.2 Test samples of fish for prohibited veterinary drugs or chemicals/examine analysis records</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>5.1</td>
<td>Household discharge and waste shall be separated from culture pond.</td>
<td>5.1 Visual inspection</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>5.2</td>
<td>Toilet shall be separated from culture pond area and shall have sanitary waste management practices in place.</td>
<td>5.2 Inspect the toilet site and practices and preventive measure for cross-contamination into culture pond</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>5.3</td>
<td>Set up system for fish carcass disposal, expired or left over fish feed container.</td>
<td>5.3.1 Visual inspection 5.3.2 Inspect records of waste disposal</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>5.4</td>
<td>Keep cleaned tools, utensils and equipment in good order and in a hygienic condition.</td>
<td>5.4 Inspect the storage area and condition of utensils and equipments</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>Have good storage practices and waste disposal</td>
<td>5.5 Inspect records of waste management</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>6.1</td>
<td>Have harvesting plan of grown fish</td>
<td>6.1 Inspect records of fish harvests/sales</td>
<td>Minor Requirement</td>
</tr>
</tbody>
</table>

**5. Farm hygiene**

| Minor Requirement | Major Requirement |

**6. Snakeskin Gourami Harvest**
<table>
<thead>
<tr>
<th>Item</th>
<th>Criteria</th>
<th>Inspection methods</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2</td>
<td>Feeding shall be stopped one day before harvest</td>
<td>6.2 Inspect feeding records</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>6.3</td>
<td>The capture method shall harm the fish as little as possible</td>
<td>6.3 Interview the farmer or observe fish collection</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>6.4</td>
<td>The fish are handled in a hygienic manner during capture</td>
<td>6.4 Interview the farmer about capture methods</td>
<td>Minor Requirement</td>
</tr>
<tr>
<td>6.5</td>
<td>The farm shall keep movement documents (MDs)</td>
<td>6.5 Inspect copies of MDs</td>
<td>Major Requirement</td>
</tr>
<tr>
<td>7.</td>
<td>Data recording system</td>
<td>7. Inspect records information</td>
<td>Minor Requirement</td>
</tr>
</tbody>
</table>

**4. JUDGMENT CRITERIA**

Judgments for inspection decision are as follows:

4.1 All of the “major requirement” level shall be complied.

4.2 All of the “minor requirement” level shall be complied not less than 60%. The improvement up to 80% shall be made within 1 year.

**5. GUIDANCE ON GOOD AQUACULTURE PRACTICE FOR SNAKESKIN GOURAMI FARMS**

The guidance on good aquaculture practices for Snakeskin Gourami farms are intended as guidelines for Snakeskin Gourami farm operators to provide farmers with good management practices so as to achieve good quality and safety to consumers. The details are described in Annex A.
Annex A

GUIDANCE ON GOOD AQUACULTURE PRACTICES FOR SNAKESKIN GOURAMI FARM

(Items 5)

These Minor Requirement guidelines on good aquaculture practice for snakeskin gourami farms are intended to help licensed snakeskin gourami farmers who are registered with the authorizing agency follow Minor Requirement standards so that they can qualify for certification and extension of registration.

A1. Farm site and location

The location is an important factor the farmer shall consider before setting up a farm. If the farm is located in a legal area that is suitable for aquaculture it will be possible to produce high quality fish with as few problems as possible.

A1.1 The farmer should register the farm with the proper authorities, such as the Department of Fisheries, following the accepted procedure. The local agency needs to register the farm to collect information and provide support. The farmer shall have the legal right to use the land and shall own or rent it properly according to the law.

A1.2 There should be a map showing the location and layout of the farm to provide convenience in inspections and data collection as well as for the orderliness of farm management and to help outsiders find the farm.

A1.3 The farm shall be located close to a source of good quality water that is suitable for raising snakeskin gourami and there shall be enough water to meet the needs of the farm at all times. The farm shall have a good water circulation system and should ideally be located in a flood-free area or have good protection from flood damage.

The soil should be able to retain water or should be adaptable for aquaculture with the following soil qualities:

<table>
<thead>
<tr>
<th>Soil quality</th>
<th>Acceptable range</th>
<th>Ideal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (soil:water 1:1)</td>
<td>6.0-8.5</td>
<td>7.0-8.0</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>50-2,000 mg/kg</td>
<td>500-1,000 mg/kg</td>
</tr>
<tr>
<td>Potassium</td>
<td>10-500 mg/kg</td>
<td>100-300 mg/kg</td>
</tr>
<tr>
<td>Organic Carbon</td>
<td>0.5%-3.0%</td>
<td>1.0%-2.0%</td>
</tr>
</tbody>
</table>


A1.4 The farm should be far from sources of pollution or should not be impacted by pollution. If there is a suspicion of pollution risk, soil and water samples should be taken for analysis.

A1.5 Transportation infrastructure should be conducive to the transport of fish fry and feed to the farm and grown fish to the market or factory. The farm should have sufficient and suitable infrastructure and utilities such as electricity and tap water.
A.2 Farm management

A.2.1 General management

A.2.1.1 The farmer should be able to demonstrate that the farm is run following the guidelines of an accepted handbook, such as that of the Department of Fisheries, or another academically sound management system.

A.2.1.2 The farmer and workers should attend training on aquaculture management, use of factors of production, harvesting techniques and laws and regulations related to freshwater aquaculture in order to increase their knowledge and improve their practices.

A.2.2 Pond preparation and pest extermination

A.2.2.1 When snakeskin gourami are raised in earthen ponds bottom the ponds should be properly prepared for the best results.

A.2.2.1.1 For new ponds
The pond should be left to dry out entirely first. If the soil is acid, as evidenced by orange-red marks from iron rust, the acid can be neutralized by filling the pond with water for 7 days and then emptying it, and repeating this procedure several times until the pH level is suitable. If there is not sufficient water for this method, then lime can also be added. The farmer should take care not to let the pond dry out until the soil cracks, because exposure to the air can increase the acidity again.

A.2.2.1.2 For old ponds
After a batch of fish is harvested, if there is a large amount of sludge at the pond bottom, it should be dredged out before the pond is left to dry. The sludge should not be left around the edges of the pond or dumped into public water sources. It should be deposited in a separate pond used for this purpose. Another alternative is to use a tractor to plough the soil and sludge at the bottom of the pond 2 or 3 times to increase oxygen exchange before leaving it to dry in the sun for about 2 weeks. The edges of the pond should also be reshaped to remain usable. For ponds that have been used repeatedly for raising snakeskin gourami or ponds in which there was a disease outbreak, the farmer should add burnt lime (calcium oxide) at the rate of 100-200 kg per 1,600 m² to kill germs and neutralize the soil in one step.

A.2.2.2 Fish such as striped snake-head fish (Channa striata), climbing perch (Anabas testudineus [Bloch]) and eels are natural enemies of snakeskin gourami. They may be found in the water used for snakeskin gourami raising, so the farmer should use these natural methods to eradicate these pests before introducing snakeskin gourami to the pond:

(1) Used tea seed cake contain about 10-20% saponin. They may be used at a concentration of 15-25 mg/l of water, depending on the quality of the tae seed cake, the temperature and salinity of the water and the species and size of fish to be exterminated. The addition of tea seed cake will kill the fish and change the water quality, such as reducing the pH and the amount of dissolved oxygen, so it should be used with caution. The snakeskin gourami should not be introduced into the pond while the concentration of tea seed cake is still high.
(2) Crushed derris root (*Derris elliptica* [Roxb.] Benth.) may be added to the pond at the rate of 20-40 g/m³. It should be crushed in a small amount of water first and left overnight, then broodstock over the pond. The active ingredient is rotenone, which is lethal to cold blooded animals such as fish and insects but relatively harmless for warm blooded animals. If you use a 5% rotenone product in liquid or powdered form, you should add 1-2 grams or 1-2 cm³ for every cubic meter of water in the pond. Dissolve it in a small amount of water first, then broodstock over the pond.

Once the pond is prepared, water may be added, but it should be filtered through a double layer of net or screen (24-26 per inch mesh) to prevent other pests from entering the pond. Next, compost, fertilizer or factory by-products such as ami ami may be added to promote plankton growth. All the grass around the edges of the pond should be cut and added to the pond to encourage the growth of plankton. When the water is greenish or tea colored it is suitable for snakeskin gourami.

### A.2.3 Water quality

Water for raising snakeskin gourami should have the following qualities:

<table>
<thead>
<tr>
<th>Water quality</th>
<th>Acceptable range</th>
<th>Ideal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.5-9.0</td>
<td>7.0-8.0</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>3 mg/l</td>
<td>5 mg/l to saturated</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>50-400 mg/l</td>
<td>75-150 mg/l</td>
</tr>
<tr>
<td>Hardness</td>
<td>50-400 mg/l</td>
<td>75-150 mg/l</td>
</tr>
<tr>
<td>NH₃</td>
<td>&lt;0.1 mg/l</td>
<td>0.01-0.05 mg/l</td>
</tr>
</tbody>
</table>

Source: C.E. Boyd 1990. *Water Quality and Pond for Aquaculture*

Normally snakeskin gourami subsist mainly on plankton, especially zooplankton that are found attached to aquatic plants or rotting grass, as well as insect larvae and algae. As soon as the snakeskin gourami fry are 20 days old, the farmer should begin cutting the grass by cutting every other row, and dropping the cuttings in the pond to encourage the growth of plankton. Grass should be added only every 15 days so the water quality will not be negatively affected and so that the grass has time to grow back. The farmer should closely monitor the water quality by observing the water color and transparency. This may be done by submerging a Secchi disc into the water and seeing how deep it falls before the tester is unable to distinguish the difference between the white and black markings on the disc. For appropriate water transparency, it should be at a depth of 30-40 cm. If a Secchi disc is unavailable, another easy method of testing is to put your hand in the water and look at the lines on the palm of your hand. You should be able to see them until your elbow is under water, or at a depth of about 30-40 cm under water, but no further. That means the water transparency is acceptable and the plankton population is sufficient for the fish. However, if you can still see the lines on your hand when more than your whole elbow is under water, or you can still see the marks on the Secchi disc at higher than 40 cm, then the water is too clear or lacks plankton. You should cut more grass and add it to the water to decompose and encourage plankton growth. It may also be advisable to add some manure at the rate of 100-200 kg per 1,600m² pond area or fertilizer from agro-industrial by-products such as ami ami at the rate of 100-150 l per 1,600m² pond area. However, ami ami should be added at no more than 10-20 l per time because the decomposition process uses a great deal of oxygen so the dissolved oxygen level in the water may become too low for the fish. On the other hand, if the water clarity test shows that you cannot see the marks on the Secchi disc at a
level of less than 30cm or you cannot see the lines on your hand when your elbow is not yet in the water, that means there is too much natural food in the water so you should temporarily stop adding fertilizer and should increase water exchange.

A.2.4 Effluent water management

A.2.4.1 Under the Ministry of Natural Resources and Environment’s Ministerial Regulation on Standards to Control Effluent Water Disposal from Freshwater Aquaculture Farms, snakeskin gourami farms are classified as “Type A freshwater aquaculture ponds” and thus there are legal controls on effluent water disposal from ponds that are 16,000 m² or larger.

The waste water shall meet the following standards:

1. biochemical oxygen demand or BOD of no more than 20 mg/l
2. suspended solids of no more than 80 mg/l

A.2.4.2 Five per cent of the area of the farm should be reserved for keeping sludge or allowing effluent water to settle.

A.3 Inputs

A.3.1 Snakeskin gourami

The essential factors of production for snakeskin gourami farms are the fish fry, broodstock fish, fish feed, feed additives, lime and chemicals. The choice of factors of production depends on the age and size of the fish, the stocking density, the farm management system, and the desired size at time of harvest.

A.3.1.1 The quality of the fish fry is important for the success of the venture. The fish fry should be strong and healthy so they can adapt to changes in the environment.

A.3.1.2 If the farmer wishes to add more fish when the population density is too low, he or she should keep the record of sale when purchasing additional fish fry or broodstocks.

A.3.1.3 The stocking density should be kept at a suitable level according to farm management system used, as follows:
**A.3.2 Snakeskin Gourami Feed**

Fish feed means processed fish feed, supplementary feed or feed that is produced on the farm.

A.3.2.1 Commercial feed shall be produced by a manufacturer that is registered with the responsible agency (if registration is Major Requirement) and the nutritional value, date of production and date of expiry shall be clearly marked on the label. The feed should be in a normal condition, not moist or moldy.

A.3.2.2 Raw materials that are used to produce fish feed on the farm or are added directly to the pond shall be free from veterinary drugs and prohibited chemicals. To insure that the raw materials are free from prohibited substances, the farmer should request certification from the producer.

A.3.2.3 When producing fish feed, the farmer should choose high quality ingredients such as fish meal and rice bran. The feed should contain the necessary nutrients for fish health and should be free from veterinary drugs and prohibited chemicals. The farmer should use proper and hygienic production methods.

A.3.2.4 The fish feed and raw materials should be stored in an orderly manner in a clean shed, protected from direct sun and heat, with sufficient air circulation. Sacks of feed should be placed on top of a rack above the floor and not in contact with the walls to prevent excess moisture or mildew. The feed and raw materials should be stored and rotated systematically (first in, first out) and measures shall be taken to prevent potential disease carriers such as rats, cockroaches, flies, birds, dogs or cats from getting into the feed storage areas.

**A.3.3 Non-feed factors of production**

A.3.3.1 The factors of production should be stored in an orderly manner in a clean shed, protected from direct sun and heat, with sufficient air circulation. Sacks of feed should be

<table>
<thead>
<tr>
<th>Farm management system</th>
<th>Size of fry</th>
<th>Appropriate population density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive: The fish are fed with pelleted feed from the start</td>
<td>2-3 cm</td>
<td>20,000-30,000 per 1,600 m²</td>
</tr>
<tr>
<td>Semi-intensive: Only grass is added to the pond in the initial period and later the fish are fed pelleted feed in addition</td>
<td>2-3 cm</td>
<td>8,000-20,000 per 1,600 m²</td>
</tr>
<tr>
<td>Natural: Only grass is added to the pond to promote natural plankton growth</td>
<td>2-3 cm</td>
<td>Less than 8,000 per 1,600 m²</td>
</tr>
<tr>
<td>Brooders adults are raised in the pond to produce fish fry</td>
<td>10-30 kg per 1,600 m² (male: female 1:1)</td>
<td>If too few fry survive, additional fry may be added at the rate of 2,000-3,000 per 1,600 m²</td>
</tr>
</tbody>
</table>
placed on top of a rack above the floor and not in contact with the walls to prevent excess moisture or mildew. The materials should be stored and rotated systematically (first in, first out) and measures shall be taken to prevent potential disease carriers such as rats, cockroaches, flies, birds, dogs or cats from getting into the storage areas.

A.3.3.2 Non-feed factors of production such as lime, compost, manure, chemical fertilizer, plankton promoters or inhibitors, and formalin shall be free from veterinary drugs and prohibited chemicals (according to related laws).

A.4 Fish health management

A.4.1 Fish health management

In raising snakeskin gourami, it is important to pay attention to farm management and the pond environment.

A.4.1.1 The farm should use suitable management techniques as follows:

A.4.1.1.1 The farmer should regularly monitor fish health, such as by carefully observing the fishes’ appearance and behavior, checking the results of daily water quality tests and examining the condition of fish both on and off the farm.

A.4.1.1.2 When any abnormality is detected, the farmer shall hurry to find the cause and take action to solve the problem. For instance, it may be necessary to change the water, reduce the amount of feed, or increase oxygen in the water. Measures to improve water quality should be used before any veterinary drugs or chemicals.

A.4.1.2 If an outbreak of a target disease occurs and snakeskin gourami die from it, the owner shall notify the responsible agency immediately to prevent spread of the disease to nearby farms. Dead fish shall be disposed of properly, such as by being buried or incinerated, and the waste water shall be disposed of following the Minor Requirement procedures.

A.4.2 Disease prevention and treatment

Snakeskin gourami are normally easy to culture. As long as the pond is prepared properly, the fish fry are healthy, and there is sufficient water and proper feed management, then it is unlikely that the fish will get any disease.

A.4.2.1 The following principles and methods should be followed to prevent and treat diseases from external or internal parasites or bacteria:

A.4.2.1.1 External parasites
The most common external parasites are protozoa of the genus *Trichodina*, monogenean trematode of the genera *Dactylogyrus* and *Gyrodactyurus*, myxospores of the genus *Henneguya*, fish lice of the genus *Argulus*, and anchor worms of the genus *Lernaea*. The clinical signs of these parasites are all similar. The fish swim erratically because their skin is irritated. They tend to swim near the surface. They open and close their gill flaps more quickly because they can’t get enough oxygen. Sometimes there are sores that bleed, which appear as red spots. Sometimes white cysts of various sizes are apparent on the gills. They
can be seen with the naked eye. The cysts are filled with the spores of parasites. Besides these signs, the farmer may notice that the fish grow slowly and small numbers of them die frequently.

The best way to prevent external parasites is to prepare the pond properly. Before stocking fish fry, the farmer should add 100-200 kg of lime per 1,600 m² of pond, broadcasting it all over the pond, in order to kill germs and parasites. The farmer should get rid of red worms, which are intermediate hosts of several kinds of parasites, by releasing bottom feeding fish such as carp. After the snakeskin gourami are released, they should be fed at regular times every day and the farmer should observe their feeding behavior. When the weather is cooler, or if feed remains after several minutes, the amount of feed should be reduced.

If the fish have external parasites, they should be quarantined in a cement tank and 100% formalin (37-40% formaldehyde) should be added at the concentration of 25-50 ml/l every other day. The water should be changed three or four times until the severity of the parasites has decreased. In the earthen pond, the amount of feed should be reduced and the dead fish should be removed quickly to reduce the amount of waste that could encourage the growth of more parasites. If large numbers of parasites can be seen on the fish and the above method is not effective, the farmer may consider using an insecticide such as trichlofon at the rate of 0.25 – 0.5 mg/l with 3 applications, 3 days apart, or until the parasites are under control.

A.4.2.1.2 Internal parasites

In cases of digenean trematodes of the genus *Clinostomum*, internal investigations reveal the metacercaria-stage larvae living along the fishes’ abdominal cavity, on the gut linings, the liver, the digestive track and the muscles. Sometimes they are also found in the gills. The parasites are flat and tapered towards the head end with no divisions into segments. When alive, they are mobile, creamy white and large enough to be visible to the naked eye. They have two round suckers to attach to the host fish. The smaller oral sucker is found in the front and the larger ventral sucker or acetabulum is in the middle of the trematode’s body. Digenean trematodes are hermaphrodites with a complicated life cycle. They depend on 2 different host organisms to grow to adulthood. They produce eggs through sexual reproduction and the larvae pass through various stages. The first stage is the miracidium stage when the larvae live freely in the water. Then they enter the body of a freshwater mollusk of one type or another, usually a univalve, where they develop to the sporocyst or ridia stage and then the cercaria stage. Next the trematode larvae leave the mollusk and swim freely in the water again to find their secondary host, which is a fish or mollusk. They burrow into the host’s muscle tissue and then develop to the metacercaria stage, where they remain unless they find their final host, which is a specific species fish, or until the secondary host is consumed by a vertebrate such as a mammal or bird. The metacercaria then develop to adults inside the final host, usually inhabiting organs such as the intestines, liver, blood or lungs. The severity of the invasion depends on the number of parasites, the healthy of the fish, and the quality of the fishes’ environment. The mortality rate will be higher if the fish are also infected by complications such as bacteria or another kind of parasite.

The clinical signs of trematodes are weakened fish that are thin and don’t eat normally; their skin may be swollen and puffed; they may swim as if irritated and breathe abnormally. The mortality rate is low to medium depending on the number of parasites. If the invasion is serious there may be hemorrhagic lesions on the fishes’ body as the parasites eat their way through the muscles and skin.
Prevention and treatment

Prevention

1. The first method of prevention is to prepare the pond properly before stocking fish fry by adding 100-200 kg of lime per 1,600 m² of pond, broadcasting it all over the pond, in order to kill germs and parasites. The farmer should also use copper sulphate or nicosamide according to the directions on the product label to kill shellfish that are the important first hosts to trematodes.

2. When water is added to the pond it should be filtered through a fine-mesh filter to prevent any snail eggs or larvae from getting in.

3. It is also advisable to keep some carp with the snakeskin gourami to reduce the snail population.

4. Of course, water quality should be maintained for as long as the fish are raised.

Treatment

Trematode invasions can be treated with an anti-parasite drug such as magnesium sulfate at the rate of 1-3% added to the fish feed and administered just once a month.

A.4.2.1.3 Bacterial diseases
Bacterial infections can occur when the fish are raised at a high stocking density or when there are sudden changes in water temperature or water quality. The most common disease in snakeskin gourami is Motile Aeromonas Septiceamia caused by \textit{Aeromonas} spp. Fish with this disease often have hemorrhage on their skin, swollen abdomens, and blood and lymph collected in their abdomens. The morbidity rate and mortality rate are rather high.

Prevention and treatment

The best way to prevent an infection is to keep the fish in good health and monitor their health constantly. Internal or external parasites are a contributing factor that lead to opportunistic infections of bacteria.
In the early stages of a bacterial infection, it is possible to treat it by adding antibiotics to the fish feed for at least 7 days in a row. However, there are many kinds of antibiotics with different properties and the appropriate dosage is different in different circumstances, so the farmer should always consult an aquaculture expert or veterinarian to find an appropriate treatment plan that will not harm the health of the fish or human consumers.

A.4.2.2 When it is necessary to use veterinary drugs
Prevention is better than cure and veterinary drugs should be considered a last choice. When snakeskin gourami appear to have a disease, the farmer should first consider changing the feed management and should take measures to improve the water quality. These measures alone can help improve the fishes’ health and reduce the mortality rate. When it is deemed necessary to use veterinary drugs, they should be procured from an accredited source that is legally registered and should not be among those drugs or chemicals that are prohibited by law. The drugs should be used strictly according to the directions and only for as long as
prescribed. The concentration of active ingredients varies from product to product, so if the farmer is unsure of the safety of a product or the best method to use it, he or she should consult an aquaculture expert or veterinarian.

A.5 Farm hygiene

The following guidelines can help insure the cleanliness of the farm in order to produce safe fish for consumption.

A.5.1 The pipes for disposing of sewage and waste water from human homes and facilities shall be kept separate at a suitable distance from the farm.

A.5.2 The toilets shall be separate from the fish raising ponds and human waste shall be disposed of in a sanitary manner that will not infect the ponds. Water in the fish raising ponds should be regularly tested for disease-causing bacteria. The total coliform count shall be less than 5,000 MPN/100 ml (most probable number per 100 milliliters) and the fecal coliform count shall be less than 1,000 MPN/100 ml. If it is higher, then it means the pond was somehow contaminated with human or animal waste.

A.5.3 Rubbish and waste, including used containers and expired or leftover factors of production, shall be disposed of in a sanitary manner as Minor Requirement by the manufacturer and dead fish should be disposed of by burial or incineration.

A.5.4 All tools, equipment and factors of production should be stored neatly and maintained properly to be in good working order at all times. The farmer’s or workers’ housing, rest areas, fish feed preparation areas and storage sheds should be kept clean and orderly.

A.5.5 Rubbish bins should be tightly closed to prevent flies, rats, cockroaches, and pets from getting in. Rubbish and waste should be disposed of properly in an appropriate place.

A.6 Harvest of the fish

The harvest and post harvest of the fish is the last step in the farming process. The farmer should take care to plan and prepare for the harvest, storage, transport and sale of the fish in advance to insure that good quality is maintained for the consumers.

A.6.1 The farmer should have a plan to sell the fish quickly directly after harvesting them so that they will be of good quality and will not get contaminated during or after capture.

A.6.2 The farmer should stop feeding the fish for one full day before capture so that they can eliminate all their feces before capture and will remain clean in transit.

A.6.3 Proper capture and storage methods should be used to prevent damage to the fish. For instance, they may be gently placed and carried in plastic baskets with not too many fish in each basket so the ones on the bottom will not be crushed.

A.6.4 The harvest of snakeskin gourami should be carried out in a hygienic way as follows:

A.6.4.1 Containers and equipment
(1) The containers and equipment should not be likely to harm or damage the fish or reduce their storage quality. The containers and equipment should not be sources of contamination that would make the fish unsuitable for consumption. The fish should not come in contact with the ground.

(2) All the containers and equipment should be maintained in good working order and should be washed thoroughly directly after use each time to kill germs.

A.6.4.2 Personnel
The farmer and workers handling the fish should be in good health with no contagious diseases or other conditions that would make the fish seem unattractive for consumption. If workers fall ill, they should temporarily stop work until they are better.

A.6.4.3 Pets such as dogs and cats should not be allowed near the fish raising ponds because they might cause contamination.

A.6.5 The farm shall have a record of sale issued by the Department of Fisheries or an agency authorized by the Department of Fisheries so that the purchaser, processor or consumer can trace the sale back to its source.

A.7 Data and data storage system

The farm should record important data from every step of the production process, such as the source of brooder fish or fish fry, the source and type of feed, the method and amount of feeding each day, other farm management operations, the use of permitted drugs or chemicals, water quality, fish growth, observations of fish health, and management of output. Good data recording will help improve the farm’s efficiency because the farmer can review the information to make improvements or solve problems. Data should be kept up to date.
Annex B

Veterinary drugs and chemicals that are prohibited for use in Snakeskin Gourami aquaculture

(Item 4.4.2)

Table B.1 Veterinary drugs and chemicals that are prohibited for use in snakeskin gourami aquaculture

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nitrofurans</td>
</tr>
<tr>
<td>2</td>
<td>Nitroimidazoles</td>
</tr>
<tr>
<td>3</td>
<td>Chloramphenicol</td>
</tr>
<tr>
<td>4</td>
<td>Diethylstilbestrol (DES)</td>
</tr>
<tr>
<td>5</td>
<td>Malachite Green</td>
</tr>
</tbody>
</table>

Notes

1. Numbers 1 through 4 are veterinary drugs or chemicals that are prohibited under the 2002 announcement of the Ministry of Agriculture and Cooperatives on the names, types or characteristics of animal feed products that are prohibited for import and sale and the names, types, characteristics, qualities and components of raw materials that are prohibited to be added to animal feed products

2. Number 5 is a dangerous substance that is prohibited for import, production, export and possession under the 1992 Dangerous Substances Act except for use in products for raising aquarium fish.
**Appendix C**  
**Units of Measurement**

The units and symbols used in this standard and the accepted units under the International System of Units or *Systeme International d’Unites* (SI) are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>SI symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>centimeter</td>
<td>cm</td>
</tr>
<tr>
<td>mass</td>
<td>milligram</td>
<td>mg</td>
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<tr>
<td></td>
<td>liter</td>
<td>l</td>
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<td></td>
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<td>cm³</td>
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<tr>
<td>concentration</td>
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<td>ml/l</td>
</tr>
<tr>
<td></td>
<td>milligrams per liter</td>
<td>mg/l</td>
</tr>
<tr>
<td></td>
<td>milligrams per kilogram</td>
<td>mg/kg</td>
</tr>
</tbody>
</table>