GOOD AQUACULTURE PRACTICES
FOR MARINE SHRIMP FARM

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Published in the Royal Gazette Vol.126 Section 187D,
Dated 28 December B.E. 2552 (2009)
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Marine shrimp is an economically important product of Thailand. The establishment of the standard for good aquaculture practices for marine shrimp farm is to promote and develop the production in terms of quality and safety to establish a trust of shrimp production to be accepted by both domestic and international level as well as the safety of consumer and promotion Thai shrimp export. The Committee of Agricultural Standards therefore deems it necessary to establish the Thai agricultural standard on good aquaculture practices for marine shrimp farm as developed guidance for marine shrimp farmers.

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

Department of Fisheries. 2005. Good Aquaculture Practice (GAP) in Marine Shrimp Farm.


Notification of the Ministry of Agriculture and Cooperatives  
Subject: Thai agricultural standard:  
Good Aquaculture Practices for marine shrimp farm  
In accordance with the Agricultural Standards Act B.E. 2551 (2008)

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

By virtue of Article 5, Article 15 and Article 16 of the Agricultural Standards Act B.E. 2551 (2008), the Minister of Agriculture and Cooperatives, hereby issue this Notification on Establishment of Thai Agricultural Standard: Good Aquaculture Practices for marine shrimp (TAS 7401-2552) is established as voluntary standard, details of which are attached herewith.

Notified on 29 September B.E.2552 (2009)

Mr. Theera Wongsamut

Minister of the Ministry of Agriculture and Cooperatives  
Chairperson of the National Committee on Agricultural Commodity and Food Standards
THAI AGRICULTURAL STANDARD
GOOD AQUACULTURE PRACTICES FOR MARINE SHRIMP FARM

1. Scope

This Thai Agricultural Standard applies to good aquaculture practices (GAP) at all stages of farm practices in marine shrimp culture including harvesting and post-harvest handlings prior to transportation in order to produce good quality and safety for consumption. The farming system considers welfare of the animal as well as environmental integrity and social responsibility. This standard, however, does not cover the practices at the stage of hatching and nursing.

2. Definitions

For the purpose of this standard:

2.1 **Marine shrimp** means shrimp in genus *Penaeus* (*Penaeus* spp.), *Metapenaeus* (*Metapenaeus* spp.) and *Litopenaeus* (*Litopenaeus* spp.) such as Black tiger shrimp (*Penaeus monodon*), White shrimp (*Litopenaeus vannamei*).

2.2 **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.

2.3 **Residues of veterinary drugs** mean the veterinary drugs as in 2.2 including parent drug, metabolites and associated impurities that are retained in the animal tissue, produce and products of animal of which are used for human food.

2.4 **Hazardous Substances** mean chemicals that are used in aquaculture in accordance with the Hazardous Substances Act B.E. 2535 (1992) and its amendments overseen by the Department of Fisheries. Compliance levels

2.5 **Major requirement** means the mandatory requirement that must be fully complied with. In case of non-compliance, it will seriously affect the quality of shrimps as well as the safety of consumers. It means the requirement that must be complied with relevant laws and regulations as well.

2.6 **Minor requirement** means the requirement that must be mostly complied with. In case of non-compliance, it will affect the health and welfare of shrimp, product quality and safety of consumers as well as the environment and social responsibility.

2.7 **Recommendation** means the requirement that is partly complied with for sustainable shrimp farming. In case of non-compliance, it may affect the health and welfare of shrimp, as well as to the environment and social responsibility.

3. REQUIREMENTS AND INSPECTION METHODS

Good Aquaculture Practices for marine shrimp farm specifications are as Table 1.
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<th>Requirements</th>
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<tr>
<td>1. Farm site and registration</td>
<td>1.1 Farm shall not be located in the environment that has a risk of contamination which affects shrimp health and safety of consumer.</td>
<td>1.1.1 Visual inspection that the site shall be located far from the factory that releases effluent, polluted water or areas not being affected with polluted water. 1.1.2 In case where a farm located in the environment that has a risk of contamination affecting shrimp health and safety of consumer, water treatment prior to shrimp farming shall be inspected.</td>
<td>Major requirement</td>
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<td>1.2 Closely located to quality water suitable for shrimp culture i.e.  - DO &gt; 5 mg/l  - pH 7.0 to 8.3  - Salinity 0.5 to 35 mg/g</td>
<td>1.2 Inspection of water quality (DO, pH and salinity).</td>
<td>Recommendation</td>
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<td>1.3 Conveniently access to transportation both outside and inside the farm, in order to provide a convenient operation and rapid transportation of shrimp.</td>
<td>1.3 Visual inspection</td>
<td>Recommendation</td>
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<td>1.4 Farm shall be registered with the Department of Fisheries.</td>
<td>1.4 Inspection of the document or evidence.</td>
<td>Major requirement</td>
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<td>1.5 Farmer shall have legally land rights or other land use permits.</td>
<td>1.5 Inspection of the document or evidence.</td>
<td>Major requirement</td>
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<td>1.6</td>
<td>Farm shall be located outside mangrove and/or conserved wetland areas regarding to laws.</td>
<td>1.6 Inspection of the document or evidence.</td>
<td>Major requirement</td>
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<td>1.7</td>
<td>Farm shall not be located in the prohibited area/zone by laws.</td>
<td>1.7 Inspection of the document or evidence.</td>
<td>Major requirement</td>
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</table>
| 2. Farm management | 2.1 Manual of Farm Management shall be made available and implemented. | 2.1.1 Inspection of the manual for the following details:  
- Farm layout  
- Production plan  
- Pond preparation  
- Water preparation  
- Feed management  
- Shrimp health management  
- Harvesting  
- Post-harvesting  
- Training of workers on farm so as to understand the use of manual and proper practices | Major requirement |
<p>|       | 2.2 Water testing from sources according to the specified time intervals in the manual | 2.2 Inspection of the record of water analysis | Recommendation |
|       | 2.3 Vacating and/or preparing pond between crops. | 2.3 Visual inspection of pond conditions and record of such operation. | Minor requirement |
|       | 2.4 Stocking density of shrimp larvae shall be appropriate. | 2.4 Inspection of the record of stocking density. | Minor requirement |</p>
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<tr>
<td>2.5 Availability of record/ certificate/ health test report.</td>
<td>2.5 Inspection of record or health test report</td>
<td>Minor requirement</td>
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<tr>
<td>2.6 Inlet water shall be infiltrated to prevent the entering of exotic species to pond.</td>
<td>2.6 Visual inspection of the water filtering</td>
<td>Minor requirement</td>
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<td>2.7 Aerator or other aeration system shall be adequately placed in the pond.</td>
<td>2.7 Visual inspection of the aerator and other aeration system</td>
<td>Minor requirement</td>
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</table>
| 2.8 Use of registered, good quality and not expired formulated feed. In case the feed is prepared on the farm, feed ingredients shall be clearly stated, and legally prohibited ingredients shall not be used. | 2.8.1 Visual inspection  
2.8.2 Inspection of the formulated feed registration manufacturing and expiry dates  
2.8.3 Inspection of the relevant documents regarding the feed prepared on the farm | Minor requirement                                                                |
<p>| 2.9 Efficient feeding management shall be provided according to the requirements of shrimp. | 2.9 Inspection of the feeding record and the leftover feed                    | Recommendation                                                                  |
| 2.10 Feed shall be stored in secured place to prevent the contamination and maintain its quality. | 2.10 Visual inspection of feed storage.                                       | Minor requirement                                                                |
| 2.11 Analysis of water quality in shrimp pond on a regular basis     | 2.11 Inspection of record of water quality analysis                           | Minor requirement                                                                |</p>
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<td>2.12</td>
<td>Preventive measures for predators and disease carriers to enter the ponds during pond, water preparation and shrimp culturing shall be in place.</td>
<td>2.12 Visual inspection and inspection of the record of preventive measures</td>
<td>Minor requirement</td>
</tr>
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<td>2.13</td>
<td>Shrimp health shall be monitored regularly.</td>
<td>2.13.1 Inspection of the record of shrimp health monitoring.</td>
<td>Minor requirement</td>
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<td>2.13.2 Visual inspection of the behaviour and symptom, if any, of shrimp in the pond.</td>
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<td>2.14</td>
<td>In case where shrimp shows any sign of poor health and/or symptom, diagnosis, causation analysis and corrective actions shall be carried out.</td>
<td>2.14.1 Inspection of the records of diagnosis, causation analysis and corrective actions</td>
<td>Minor requirement</td>
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<td>2.14.2 Interview farmers.</td>
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<td>2.15</td>
<td>Preventive measure and control of disease outbreak shall be in place.</td>
<td>2.15.1 Inspection of the record of preventive measure and control of disease outbreak</td>
<td>Minor requirement</td>
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<td>2.15.2 Inspection of training document or evidence or understanding of shrimp health and determination on preventive action</td>
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<td>2.16</td>
<td>In case of disease outbreak, farmer shall inform the competent authority immediately.</td>
<td>2.16 Inspection of the record or evidence that the disease outbreak was informed.</td>
<td>Minor requirement</td>
</tr>
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<td>3. Use of veterinary drugs, chemicals, hazardous substances and probiotics used in aquaculture</td>
<td>3.1 Veterinary drugs, chemicals, hazardous substances and probiotics shall be registered with the competent authority and prudently used. Veterinary drugs, chemicals, hazardous substances and probiotics as prohibited by law shall not be used.</td>
<td>3.1.1 Inspection of the registration of veterinary drugs, chemicals, hazardous substances and probiotics. 3.1.2 Check the record of veterinary drugs, chemicals, hazardous substances and probiotics. 3.1.3 Visual inspection</td>
<td>Major requirement</td>
</tr>
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<td></td>
<td>3.2 In case authorized veterinary drugs or chemicals are applied prior to harvesting, withdrawal period shall be strictly followed or used according to the label instruction.</td>
<td>3.2.1 Check the record of withdrawal period or chemical usage. 3.2.2 Sampling of shrimp from the pond for analysis of residues, in case where there may be of such risks.</td>
<td>Major requirement</td>
</tr>
<tr>
<td></td>
<td>3.3 Veterinary drugs, chemicals, hazardous substances and probiotics shall be appropriately stored to prevent deterioration and danger.</td>
<td>3.3 Visual inspection of the storage place</td>
<td>Recommendation</td>
</tr>
<tr>
<td>4. Effluent and Sediment management</td>
<td>4.1 Quality of effluent shall be complied with relevant laws and regulations.</td>
<td>4.1 Check the record of effluent quality testing.</td>
<td>Major requirement</td>
</tr>
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| 4.2   | Effluent shall be treated or controlled its quality prior to discharge. | 4.2.1 Visual inspection  
4.2.2 Check the records of effluent treatment /water quality control prior to discharge. | Recommendation |
| 4.3   | Preventive system of saline water discharged into freshwater area shall be in place for environmental protection. | 4.3.1 Visual inspection  
4.3.2 Interview the people in surrounding community or neighbouring farm. | Major requirement |
| 4.4   | Sediment shall not be disposed into public or non-permitted area. | 4.4 Visual inspection, interview the people in surrounding community or neighbouring farm. | Minor requirement |
| 5.1   | Fuel and lubricant shall be stored properly and securely. | 5.1 Visual inspection | Recommendation |
| 5.2   | Machine used on farm shall be in good condition without any fuel or lubricant leakage to water source. | 5.2 Visual inspection | Recommendation |
| 5.3   | Used lubricant shall be disposed of in container and properly eliminated. | 5.3.1 Visual inspection  
5.3.2 Check the record of lubricant disposal or elimination. | Recommendation |
<p>| 5.4   | There shall be safe electricity system on farm. | 5.4 Visual inspection | Minor requirement |
| 5.5   | Save use of energy and/or renewable energy sources. | 5.5 Visual inspection | Recommendation |</p>
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| 6. Farm sanitation         | 6.1 Garbage, refuse, veterinary drug containers and hazardous substances shall be separately managed to prevent cross-contamination. | 6.1.1 Visual inspection  
6.1.2 Check the record on related issues. | Minor requirement |
|                            | 6.2 Keep in order the production inputs, materials and equipment so as not to harbour disease carrier animals/pest. | 6.2.1 Visual inspection  
6.2.2 Check the records of preventive system for carrier animals. | Minor requirement |
<p>|                            | 6.3 Bathroom and toilet shall be hygienically designed to prevent contamination to culture pond, canal and/or water sources. | 6.3 Visual inspection | Major requirement |
|                            | 6.4 Manure shall not be used if necessary, it shall be completely decomposed. | 6.4 Visual inspection | Major requirement |
|                            | 6.5 Pets are not allowed in the production area. | 6.5 Visual inspection | Minor requirement |
| 7. Harvest and post harvest handlings prior to distribution | 7.1 Prohibited chemicals shall not be used during harvesting. | 7.1 Visual inspection and check on harvesting records. | Major requirement |
|                            | 7.2 If chemicals are used, it shall be properly used in terms of type and quantity. | 7.2 Check the record of chemicals used during harvesting | Minor requirement |</p>
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<td>7.3 Select buyer/collector that has been certified in good hygienic practices of the post-harvest handling and transportation or registered with the Department of Fisheries.</td>
<td>7.3 Inspection of the certificate or buyer/collector registration number.</td>
<td>Minor requirement</td>
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<tr>
<td>7.4 Good hygienic practices on harvesting to prevent contamination</td>
<td>7.4 Visual inspection</td>
<td>Minor requirement</td>
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<td>8.1 Farm workers shall be legally employed.</td>
<td>8.1 Check the employment record.</td>
<td>Major requirement</td>
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<tr>
<td>8.2 Wages shall be abided by law.</td>
<td>8.2 Check the employment record.</td>
<td>Major requirement</td>
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<tr>
<td>8.3 Welfare for workers shall be appropriately provided.</td>
<td>8.3.1 Visual inspection 8.3.2 Interview of workers.</td>
<td>Recommendation</td>
<td></td>
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<td>8.4 Provide precautions and working equipment for safe operation.</td>
<td>8.4.1 Visual inspection 8.4.2 Interview of worker.</td>
<td>Recommendation</td>
<td></td>
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<td>8.5 Workers shall be trained on safety of operation.</td>
<td>8.5 Check the training record.</td>
<td>Recommendation</td>
<td></td>
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<td>9.1 Farm site shall not obstruct the customary access and/or interfere with the living condition and activities of the local community.</td>
<td>9.1.1 Visual inspection 9.1.2 Interview people in the surrounding community.</td>
<td>Major requirement</td>
<td></td>
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<tr>
<td>9.2</td>
<td>Having good relationship with local community.</td>
<td>9.2 Interview people in the surrounding community.</td>
<td>Recommendation</td>
</tr>
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<td>9.3</td>
<td>Join and participate in shrimp farm organizations or other related professional organizations.</td>
<td>9.3 Inspection of evidence of membership and organization participation.</td>
<td>Recommendation</td>
</tr>
<tr>
<td>9.4</td>
<td>Participate in conference, seminar, or training on issues related to environmentally friendly shrimp culture, shrimp health and animal welfare and food safety.</td>
<td>9.4 Inspection of any evidence or certificate of training, conference or seminar.</td>
<td>Recommendation</td>
</tr>
<tr>
<td>10.1</td>
<td>Fry movement document (FMD) and Movement Document (MD) shall be present upon request.</td>
<td>10.1 Check the relevant documents</td>
<td>Major requirement</td>
</tr>
</tbody>
</table>
| 10.2  | Records shall be made on the followings:  
10.2.1 Use of veterinary drugs, chemicals, hazardous substances and probiotics.  
10.2.2 Use of chemicals during harvesting.                                                                                                     | 10.2 Check the farm records on use of veterinary drugs, chemicals, hazardous substances and probiotics    | Major requirement |
| 10.3  | Records on the relevant data/ other necessary information shall be kept for further inspection.                                                                                                               | 10.3 Check the farm records and record keeping.                                                           | Minor requirement |
4. Judgment for inspection

Judgments for inspection according to the standard requirements 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 70%. The improvement up to 95% shall be made within 1 year.

4.3 All of the “Recommendation” level shall be complied not less than 60%. The improvement up to 75% shall be made within 1 year.

5 Guidance on good aquaculture practices for marine shrimp farm

The guidance on good aquaculture practices for marine shrimp farm is 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 Marine Shrimp Farm
(Items 5)

A.1 Farm site and registration
Site selection is the priority factor in marine shrimp farming business. Shrimp farm should be located by the sea with access to infrastructures. Water or soil quality should be appropriate for raising shrimp. The recommendations are as follows:

A.1.1 Farmer shall register with the Department of Fisheries at the local offices nearby. The registered information will be on a database in order to receive the services from the government.

A.1.2 The requirement of site selection shall be complied with relevant laws. Farm shall not be located in a mangrove conservation area. This includes rights of land use and holding or legal land rent.

A.1.2.1 Legal land ownership documents are as follows:
(1) Title deed or
(2) N.S. 3 or
(3) N.S. 3 K or
(4) Land Use Certificate (ALRO 4-01) or
(5) S.K. 1 or
(6) G.S.N 5 in case located in industrial zone or
(7) P.S. 23 in case located in the reserved forest or
(8) S.T.G. in case located in the reserved forest or
(9) Other relevant documents indicating legal rights to use the land

A.1.2.2 In case farmer does not own the land, evidence of land use permits or aquaculture permit such as land lease, land rent or documents permitting of use for aquaculture shall be available.

A.1.3 Farm site should meet technical requirements to achieve efficient aquaculture. The guidance for farm site selection is as follows:

A.1.3.1 Water in pond should be at the optimum depth. There should be appropriate management to supply sufficient oxygen.

A.1.3.2 Water quality should meet the requirements in Annex B.

A.1.3.3 Farm site should be located by the sea with normal tide. Water should be of suitable quality or can be treated to meet the suitable quality for shrimp farming.

A.1.3.4 Water source and soil condition shall not be at risk of contamination from agricultural hazardous substances and contaminants which may affect shrimp health and safety of consumer.

A.1.3.5 Farm site shall not be located in polluted area and shall have good water circulation.
A.1.3.6 Farm site should have basic infrastructures such as electricity, tap water and transportation to facilitate the transport of fry and feed. Farm shall also be located near processing plant and distribution center in order to keep product freshness.

A.1.3.7 Farm should be located in area that shrimp feed are available in adequate amount all year round.

A.2 Farm management

Good management plan will prevent contamination and environmental deterioration. Good farm management may be done by the use of disease resistant shrimp fry, selection of farming season, suitable farming system. Nevertheless, selection of shrimp fry is one of the success factors of shrimp farming. The good quality shrimp fry will grow well and have high survival rate. Stocking density is the other success factor that is essential to shrimp management. In case of stocking at high density, large amount of feed used may cause water pollution which will lead to shrimp stress and disease susceptibility. The guidance for good farm management is as follows:

A.2.1 Farmer shall develop a manual of shrimp farming practices in accordance with the requirements of the standard. The manual shall provide clearly and understandably operating procedure and working instruction. In case where any document is referred in the standard, it shall be sited in the manual and such document shall be made available at all times.

A.2.2 For the efficient shrimp farm management, water in the pond should be maintained in appropriate depth as well as oxygen management because water depth will affect the culture management and water quality in accordance with the Annex B.

A.2.3 Equipment used on farm and buildings shall be always in good working conditions.

A.2.4 Farm layout should be technically designed in order to facilitate further inspection and record keeping.

A.2.5 Places for feed preparation, equipment and buildings should be separately located and orderly kept clean at all times.

A.2.6 Pond vacating and/or appropriate preparation should be practiced prior to starting new crop.

A.2.7 Fry should be obtained from hatchery certified by the Department of Fisheries. Fry should be healthy. The record of certificate of, or testing report on health should be made available. Stocking density shall be appropriate in order to minimize stress and single species is preferable. The stage of shrimp post larvae (PL) 12 at the stocking density of 100,000-150,000 PL/rai is appropriate for a period of 4 month culturing and yielding expected size of 50-60 shrimp/kg. In case target size is 40-50 shrimp/kg, the appropriate stocking density is about 80,000-100,000 PL/rai. Farmer shall increase water exchange rate and aeration in accordance with the density. The Fry Movement Document (FMD) shall be available as information for farmer and other stakeholders as a source of fry origin.

A.2.8 Materials and equipment such as seine and net should be used to screen out pest and disease carrier into the pond during the periods of pond preparation, water preparation and raising.

A.2.9 Aerator should be installed to maintain suitable living condition of shrimp and located in proper position to reduce soil leaching into the pond.

A.2.10 Feed for marine shrimp can be categorized into three groups namely natural feed, fresh feed and formulated feed.
A.2.10.1 Natural feed means living animals and plants in the pond directly fed to shrimp.

A.2.10.2 Fresh feed means feed that is made from animal or plant origin which does not process in the same way of formulated feed.

A.2.10.3 Formulated feed means manufactured feed for aquatic animal in accordance with the Animal Feed Quality Control Act B.E.2525 (1982)

A.2.11 In practice, farmer should feed at the rate of 1-2 kg /100,000 shrimp/day depending on stocking density of fry and amount of natural feeds available in pond. The increase of daily feeding is fixed at the rate of 0.5-1 kg /100,000 shrimp/day until the shrimp reaching the age of 15-20 days, where the examination of shrimp feeding will be detected by using feeding tray when possible, the adjustment of feeding rate will be practiced each meal according to the results of feeding tray examination.

A.2.12 Prohibited substances indicated in the Animal Feed Quality Control Act B.E.2525 (1982) and its amendments and other relevant laws are not allowed.

A.2.13 Farmer should regularly examine quality of feed.

A.2.14 Feed storage shall be separately located. The storage area shall be dry, clean and with a proper condition to maintain feed quality, temperature, and prevent the disease-carriers such as rats, birds and other animals.

A.2.15 Feed bag or sac shall be elevated by pallet for moisture prevention and good ventilation.

A.2.16 Fresh feed is allowed only in necessary case and if used, proper management shall be practiced to prevent water pollution.

Prevention is the most suitable approach to control and maintain shrimp in good health. The health management could reduce stress and maintain normal growth and high survival rate. The health management will be involving other management such as the examination on shrimp health, feed quality and feeding, water and sediment quality management. The recommendations on shrimp health management are as follows:

A.2.17 Regularly check for shrimp health and water quality. If the health problem was found, diagnosis and analysis shall be done immediately.

A.2.18 If the dead or sick shrimp is found, the cause of symptoms diagnosis shall be done immediately. While, improving water quality, reducing feed or increasing aeration should be performed in order to reduce shrimp stress. If the mortality is continuously observed, the harvest of shrimp production is recommended.

A.2.19 Strictly preventive measures such as disinfect the farm equipment, assign responsible worker for such infected pond and stop water exchange shall be in place to control the disease transmission from pond to pond or from farm to farm.

A.2.20 In case of the outbreak of aquatic animal disease, competent authority and surrounding farmers, members of the shrimp organization shall be notified immediately. The particular diseases required immediate notification are White Spot Syndrome Virus (WSSV), Yellow Head Virus (YHV), Taura Syndrome Virus (TSV) and Infectious Hemopoeitic Hepato-pancreatic Necrosis Virus (IHHNV).
A.3 Use of veterinary drugs, chemicals, hazardous substances and probiotics in aquaculture

Uses of veterinary drugs and chemicals should be regarded as the last resort for shrimp health management when diseases are found because veterinary drugs and some chemicals may be residual in shrimp that would be harmful to consumer health. In fact, the improvement of culture pond environment is the best way for better health and recovery from the disease infection. The prevention and disease treatment are specifically depended on causes of a particular disease, the recommendations are as follows.

A.3.1 Veterinary drugs registered with the competent authority shall be applied. The veterinary drugs on the banned list for aquaculture under the national regulation and of the importing countries are not allowed. The application of veterinary drugs shall be restricted according to the manufacturer’s instruction of relevant drugs as well as a withdrawal period.

A.3.2 The storage of veterinary drugs shall be adhered to the label and direction. The veterinary drugs prescribed by veterinarian shall be separately kept from the unprescribed drugs.

A.3.3 Veterinary drugs shall be used when disease was properly diagnosed under supervision of veterinarian or fishery biologist who is expert in aquatic animal disease. The expired veterinary drugs according to product label shall not be used. The handling or disposal of expired veterinary drugs shall be in responsible manner.

A.3.4 Hazardous substances and probiotics for aquaculture registered with the competent authority shall be used. The banned list for aquaculture under the national regulation and of the importing countries is not allowed. The application shall be used according to label and provided information.

A.4 Effluent and Sediment Management

Effluent contains high level of nutrients, microorganisms, planktons, and other substances. A good farming practice will reduce effluent but enhance quality. Efforts shall be taken to improve the quality of effluent and to meet standard as required by laws. Sediment and effluent management should be done with the proper method to avoid the environmental impact. The recommendations are as follows:

A.4.1 Regularly maintain inlet and outlet canals and dike to reduce soil leaching and sedimentation.

A.4.2 Use organic fertilizer from organic agricultural farm to increase the natural feeds, if necessary. This should be done with efficient feeding to minimize the excessive feed supply.

A.4.3 Effluent shall be treated or subject to quality control before discharged. The effluent parameters shall meet qualifications as required by laws as follows:

1. pH 6.5-8.5.
2. BOD not exceeded 20 mg/l.
3. Suspension solid not exceeded 70 mg/l.
4. NH$_3$-N not exceeded 1.1 mgN/l.
5. Total phosphorus not exceeded 0.4 mgP/l.
6. Total nitrogen not exceeded 4.0 mgN/l.
7. Hydrogen Sulfide not exceeded 0.01 mg/l.
**Source:** Notification of the Ministry of Natural Resource and Environment Re: Specification of the Standard Controlling Discharge of Effluent from Coastal Aquaculture Pond (B.E. 2550)

A.4.4 Material or tools such as net or seine at the inlet and outlet water should be used for prevention the escaped shrimp.

A.4.5 Precaution should be taken during effluent discharge, in order to control floating of suspension particles. Flow rate of the effluent discharge should be controlled.

A.4.6 Effluent and sediment shall not cause environmental impact.

A.4.7 Effluent should not be discharged to the fresh water canals and arable lands.

A.4.8 Sediment discharge shall not cause environmental impact. If possible these sediments shall be reused.

A.4.9 Sediments from culture ponds, outlet canals and reservoirs should be reused or discharged without causing environmental impact.

A.5 Energy source and fuel

Fuel, lubricants and grease for lubrication of farm machines namely, vehicles, water pumps, aerator and other farm machines, are normally used in shrimp farm. Some of those fuels are highly potentially flammable and/or explosive. Farmer should pay much attention on potential danger to workers. Moreover, the spillover of unconventional removal of those fuels may have adverse affect to shrimps and pollute wider area. The recommendations are as follows:

A.5.1 Fuels and lubricants should be labeled and stored away from flammable and explosive materials and be careful about the spillover.

A.5.2 Changing of lubricant should be done carefully and avoid leakage or spillover.

A.5.3 Devices and equipments for removal and cleaning up fuels on the ground should be promptly provided.

A.5.4 Using of water pump and aerator should be under control measure for water conservation and energy saving.

A.6 Farm sanitation.

Shrimp farm normally has large amount of waste that could be a source of pollution. If waste is not manage properly, may cause smell or hazardous substances to health of people living in farm and surrounding area. The kitchen leavings, expired food and other wastes might attract waste feeders such as disease carrier animal. In this regards, farm sanitation is necessary for maintaining good quality of shrimp more appetizing. Daily maintenance of farm sanitation will greatly contribute to farm management in compliance with farm standard requirements. The recommendations are as follows:

A.6.1 Garbage and refuse should be separately kept for proper disposal and to prevent the contamination to the culture pond.

A.6.2 Keep in order the production input, materials and equipment so as not to harbour disease carrier animals.
A.6.3 Bathroom and toilet shall not be located near the culture pond and not directly drained that may contaminate the pond. Disposal tank of the toilet shall be no leakage and equipped with highly efficient decomposed system. Besides, waste water and effluence from other resident buildings shall be well managed away from production pond and surrounding area.

A.6.4 Fresh manure such as chicken or cow manures shall not be used in shrimp farm. If necessary, the manure shall be treated by any means in order to prevent contamination to the culture pond.

A.6.5 Pets are not allowed in the culture pond. In case guarding dog is needed, much attention should be paid to dog droppings and regular cleaning the place.

A.7 Harvest and post harvest handling prior to distribution

Harvesting is a vital stage to control shrimp quality and prevent pollution. A good practices for harvesting such as quick harvest, primary cleaning, quick chilling and proper transportation will keep the freshness and quality of shrimps. Selling method such as direct sell to processor (cold storage) is one among those good practices for keeping freshness and quality of shrimps. The recommendations are as follows:

A.7.1 There shall be a plan for harvesting and quick sell while shrimps are in good health in order to keep the premium quality as well as to prevent contaminations during harvesting and post harvest handlings prior to distribution.

A.7.2 Sampling of shrimp for analysis of chemical residues prior to harvesting shall be in place, in case where there may be of such risk.

A.7.3 Force to death or anesthetic technique shall be simples, quick, less suffered and good hygienic. The best way is to use icy-water with controlled temperature between 4 °C to 5 °C. If possible, water can be saturated by adding carbon dioxide for quicker anesthetic, uninjured and good quality shrimp.

A.7.4 Chemicals used during harvest or post harvest shall be in appropriate quantity and prohibited substances shall not be used for harvesting.

A.7.5 Farm worker who is responsible for harvest shall not be infected with contagious disease or other disease that may cause an objectionable shrimp product for consumption.

A.7.6 Containers, harvesting and transportation technique shall not cause any negative effect on shrimp quality as well as storage quality and contamination that affect to safety of the consumers. Containers shall not directly contact with ground or floor.

A.7.7 All equipments for shrimp transportation shall be cleaned, made from corrosive resistant materials and in good working condition. After work, all equipments shall be cleaned immediately in order to prevent accumulation of microbials.

A.7.8 Water and ice shall be clean, safe and complied with standards under the notification of the Ministry of Public Health. They shall not be definitely reused.

A.7.9 The Movement Document (MD) issued by the DOF or accredited agency is required for identification of origin of shrimp for the sake consumers or other concerned party in the supply chain.
A.8 Labour and welfare

Working in shrimp farm is considered to be risky from using of potentially dangerous equipments and hazard materials. In addition, some of shrimp farms would rather pay a low wage or do not strictly observe the labor laws. The recommendations are as follows.

A.8.1 Wages shall be abided by laws.

A.8.2 Welfare for worker should be appropriately provided for such as accommodation, drinking water, water, medicine cupboard and other facilities.

A.8.3 Safety environment for work and living condition such as well ventilate dwelling place, bathroom and toilet should be provided adequately.

A.8.4 Adequate training on work safety and first aid in particularly the accident from electric shock, loss in blood, drowning and other possible emergency first aid should be provided.

A.9 Social and environmental responsibilities

The problems between shrimp farmers and vicinity, residents as well as between employer and employee are rather complicated. A large or commercial scale of shrimp farm with good management can reduce these problems. However, most of the farms in Thailand are relatively small scale. Thus, farmer organization should be an effective approach to enhance farming efficiency. The recommendations are as follows:

A.9.1 Participating in social activities with local community.

A.9.2 Local resources should be efficiently utilized and mangrove plantation should be extended. This will strengthen a good relationship with local community and reduce adverse affect to the environment.

A.9.3 Contribution shall be provided to the local community in conserving environment.

A.9.4 Disseminating information on a proper functions and form working system to workers.

A.9.5 Consideration should be paid to hiring local labors.

Base on the shrimp developments in Thailand, it was found that the farmer organization to exchange views and experiences on techniques and management will greatly contribute to developing shrimp farm more efficiently. In addition, technical knowledge on farm and environmentally friendly management require practical training. The recommendations are as follows:

A.9.6 Group activities should be well organized to regularly exchange the knowledge on shrimp farming.

A.9.7 Meeting or technical training should be conducted on the issues of farm management, inputs application as regards to marine shrimp production.

A.9.8 Training on relevant laws and regulations regarding shrimp industry should be provided.

A.9.9 Code of Conduct and Ethics towards social and environment should be promoted.
A.10 Record keeping

To achieve efficient production in marine shrimp farming, regular improvement and capable tracing for problems at certain stage of production, good data and record keeping are required with possible review for the improvement of production efficiency, or enhance the efficiency in the future crops or in case of production problem such as disease outbreak. This requirement is also of great benefit to farmer for identifying the cause of problem and finding solution for the next crop. or in case there is production problem such as disease outbreak. More importantly, after completion of each production cycle, data analysis should be conducted. Farmer should keep those data on farming at least 4 years since the date of recording.
Annex B  
Recommendation on water quality suitable for marine shrimp farming production  

Table B1: Recommendation on water quality suitable for marine shrimp farming production  

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Suitable Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>28°C to 32°C</td>
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<tr>
<td>Dissolved Oxygen</td>
<td>≥ 5 mg/l</td>
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<tr>
<td>pH</td>
<td>7.0 to 8.3</td>
</tr>
<tr>
<td>Salinity</td>
<td>0.5 to 35 mg/g</td>
</tr>
<tr>
<td>Chloride</td>
<td>≥ 300 mg/kg</td>
</tr>
<tr>
<td>Sodium</td>
<td>≥ 200 mg/kg</td>
</tr>
<tr>
<td>Calcium hardness (as CaCO₃)</td>
<td>≥ 100 mg/kg</td>
</tr>
<tr>
<td>Magnesium hardness (as CaCO₃)</td>
<td>≥ 50 mg/kg</td>
</tr>
<tr>
<td>Total Alkalinity (as CaCO₃)</td>
<td>≥ 100 mg/kg</td>
</tr>
<tr>
<td>Ammonia (NH₃)</td>
<td>≤ 0.4 mg/l</td>
</tr>
<tr>
<td>Nitrite (NO₂⁻)</td>
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<tr>
<td>Nitrate (NO₃⁻)</td>
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<tr>
<td>Total suspended solid</td>
<td>≤ 100 mg/l</td>
</tr>
<tr>
<td>Total coliform bacteria</td>
<td>≤ 1,000 MPN/100 ml</td>
</tr>
<tr>
<td></td>
<td>(Most Probable Number per 100 milliliters)</td>
</tr>
<tr>
<td>Fecal coliform bacteria</td>
<td>&lt; 70 cfu/100 ml</td>
</tr>
<tr>
<td></td>
<td>(colony forming unit per 100 milliliters)</td>
</tr>
</tbody>
</table>
Annex C

Unit

The units and symbols used in this standard and the units of SI (International System of Units or Le Système International d’Unités) recognized to be used are as follows:

<table>
<thead>
<tr>
<th>Fundamental Quantities</th>
<th>Unit Name</th>
<th>Unit Symbol</th>
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</thead>
<tbody>
<tr>
<td>Mass</td>
<td>milligram/gram</td>
<td>mg/g</td>
</tr>
<tr>
<td></td>
<td>milligram/kilogram</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Temperature</td>
<td>degree Celsius</td>
<td>°C</td>
</tr>
</tbody>
</table>