DOF STANDARD

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Code of good aquaculture practices for marine shrimp farming

DEPARTMENT OF FISHERIES MALAYSIA

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Foreword

This DOF-SIRIM Standard was developed by the Project Committee on Good Aquaculture Practices for Marine Shrimp Farming.

This standard was developed with the following objectives:

a) to provide technical guidance on key aspects of marine shrimp farming activities that can be followed voluntarily by farmers;

b) to provide guidance that can be used to produce shrimp products that are disease free, safe and of good quality; and

c) to provide guidance to ensure that the farming activities are conducted in an environmentally sound, socially acceptable and economically viable manner.

This standard will be subjected to review to reflect current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration into future versions.

Compliance with this standard does not by itself grant immunity from legal obligations.

Code of good aquaculture practices for marine shrimp farming

0. Introduction

This code of good aquaculture practices for marine shrimp farming has been developed with the aim of upgrading the aquaculture industry in Malaysia. It is intended that marine shrimp farms registered with the Department of Fisheries will be able to implement the good management practices specified in this document and successfully obtain Malaysian Good Agricultural Practices) MyGAP certification. Additionally, this code of good practices will ensure that the monitoring of activities in these farms under the official control programmes of the Department of Fisheries is carried out in a more consistent and effective manner.

The adoption of these good practices will not only ensure the quality and safety of the shrimp produced for human consumption but will also ensure that shrimp farming is conducted in a socially responsible manner and promote the sustainability of the industry. These good practices also take into account the welfare of the farm's workers including their health to ensure that the workers are free from diseases that could potentially affect the safety of the shrimp produced.

These good practices are intended to address the generally recognised key elements in marine shrimp farming and the subsequent handling processes in order to ensure food safety along the processing environment and operation up to the point of delivery.

1. Scope

This standard prescribes a code of good aquaculture practices for sustainable marine shrimp farming to ensure that the shrimps produced that are safe, disease free and of good quality.

This standard covers aspects from site selection until post-harvesting practices (delivery point). It does not include activities such as processing, distribution, and retailing.

The marine shrimp species covered by this standard are black tiger shrimps *(Penaeus* monodon) from the Penaeidae family, and white shrimps (*Penaeus* vannamei).

2. Normative references

The following normative references are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the normative reference (including any amendments) applies.

World Organisation for Animal Health (OIE) Aquatic Animal Health Code

World Organisation for Animal Health (OIE) Terrestrial Animal Health Code

Occupational Safety and Health Act 1994

Food Hygiene Regulations 2009

Environmental Quality (Industrial Effluents) Regulations 2009

3. Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1 animal welfare

How an animal is coping with the conditions in which it lives.

NOTE. An animal is in a good state of welfare if (as indicated by scientific evidence) it is healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing. Animal welfare refers to the state of the animal; the treatment that an animal receives is covered by other terms such as animal care, animal husbandry, and humane treatment".

3.2 antibiotic

Substance produced by a micro-organism or any other product, produced wholly or partially by chemical synthesis and, which in low concentration. inhibits the growth of or kills micro-organisms and that is used for the purpose of growth stimulation and prevention of diseases.

3.3 sustainable

Holistic farming approach that is efficient in resource management and focuses on the interrelationship of social, economic and environmental processes. This approach ensures efficient production of safe and high-quality aquaculture products.

3.4 biosecurity

Set of management and physical measures designed to mitigate the risk of introduction of pathogenic agents into, or spread within, or release from, aquatic animal populations.

3.5 competent authority

Any person or organisation that has the legally delegated or invested authority, capacity and power to perform a designated function.

4. Site selection

4.1 The location of the site for aquaculture faming activities shall be approved by the relevant competent authority(ies). Farm operators are encouraged to select areas located in designated Aquaculture Industrial Zones (AIZ).

4.2 The area selected should have the appropriate type of land with suitable water resources, e.g. coastal and estuarine areas. The area selected should be such that the risk of contamination is minimal and shall be without any conflict of land and water use.

Topographically, the best areas for shrimp culture are those with average natural ground elevations of about 1 m to 3 m above mean sea level or at least 1 m above the highest high tide level to allow drainage and harvesting.

4.3 Farm site selection and infrastructure construction should take into consideration the conservation of natural habitat, minimisation of disturbance to the surrounding environment and the potential to cause adverse impacts on human health.

4.4 There should be sufficient infrastructure and facilities, such as access roads, electricity and transportation systems, to facilitate operations and the rapid transport of inputs and outputs. Infrastructure such as for water intake and discharge, and access roads, should minimise negative impacts on local communities and other resource users.

4.5 The location of marine shrimp farms in the following areas is not encouraged:

a) flood-prone areas or areas where there are no proper flood prevention measures;

b) mangrove forest reserves;

c) natural conservation areas; and

d) problematic areas such as polluted areas or areas prone to erosion.

4.6 The type of soil is the most critical factor in site selection, since the shrimps will spend most of their time at the pond bottom during the culture period. Clay or loam-based soil containing more than 90 % clay with pH value of between 6.5 - 8.5 is preferable.

4.7 Sites with sandy or silty soil should be avoided due to their porous nature as these types of soil can lead to erosion, seepage of water and easy infiltration of waste into the soil.

4.8 If a site that is selected does not have the preferred soil type, appropriate action such as the use of plastic lining, cementing, or soil top-up to improve the soil properties may be taken.

5. Farm construction

5.1 General

5.1.1 The farm design and layout shall be in accordance with the requirements as recommended by the relevant competent authorities.

5.1.2 The clearing of the site shall consider conservation or preservation of the natural habitat. Buffer zones should be maintained to minimise the effect of site operations on the environment.

5.1.3 All materials used in the farm construction should be environmentally friendly.

5.1.4 Shrimp farms should use good hygienic practices including sanitisation of equipment and machinery to reduce the potential spread of diseases.

5.2 Farm design

5.2.1 The shrimp pond should be designed according to the characteristics of the selected site and the culture system.

5.2.2 The design and size of the pond should facilitate farm management and operations. The recommended size and design criteria are as detailed in Table 1 and an example of the design and layout of a typical farm is illustrated in Annex A.

Table 1. The recommended minimum size and design

Type of pond	Recommended minimum size and design
Culture pond	Size of pond: 0.07 ha - 0.5 ha Shape: square or rectangle shape, rounded at each corner or round shape Elevation: 1 - 1.2 m The depth of the pond: 0.8 m - 1.8 m Pond bottom gradient: 10 degrees inclination towards the water outlet Width of the bund: 2 - 4 m Pond water outlet: shall be higher than the perimeter discharge outlet.
Reservoir pond and treatment pond	Recommended minimum size is: 10 - 15% of the culture pond size; and 5 - 10 % of the sedimentation pond. Bottom of the reservoir pond should be higher than the water inlet to the culture pond.

5.2.3 Factors affecting safety and hygiene should be taken into account in the design of the farm.

5.2.4 The reservoir pond and treatment pond should be constructed separately. A reservoir is important for the control of the pond environment and storage of water supply when water quality is inconsistent, or the supply is intermittent.

5.2.5 Ponds or other suitable areas shall be provided for sediment disposal.

5.2.6 The pond should be separated from the quarters and office areas.

5.2.7 The design and size of the pond should facilitate farm management and operations. A well-designed pond is one that allows circulation of the water such that wastes will accumulate at the centre of the pond.

5.3 Culture systems

5.3.1 There are three type of culture systems widely practiced for shrimp farming, i.e. semi-intensive, intensive and super intensive as follows:

a) Semi-intensive culture:

Fry should be stocked into the pond at 10 - 25 fry/m^2 and fed with commercial diets and/or fresh diets. The shrimp should be harvested at 90 - 120 days after stocking.

b) Intensive culture:

Stocking density of 25 - 120 fry/m^2 with feeding rate of 4 - 6 times daily and strong aeration should be maintained. The shrimp should be harvested at 70 - 120 days after stocking.

c) Super intensive culture:

Stocking density 150 - 300 fry/m^2 with feeding rate of 4 - 6 times daily and strong aeration should be maintained. The shrimp should be partially harvested at 55 - 60 days after stocking, and fully harvested at least 90 days after stocking.

5.4 Drainage system

The farm should have separate inlet and outlet water drainage systems. The drainage system should use gravity force or pumps.

5.5 Water supply

5.5.1 Water used in marine aquaculture, including brackish water aquaculture, shall be in the salinity range from 10 -30 ppt. The water may be sourced from sea water and/or brackish water.

5.5.1.1 Sea water

Sea water or salt water is water from the sea or ocean. Normal salinity of the sea water is around 35 ppt.

5.5.1.2 Brackish water

Brackish water is a mixture of sea water and fresh water. The salinity of brackish water is usually in the range of 5 - 20 ppt.

5.5.2 Where pumps are used to get water, the pumps should be installed at locations where they can obtain water from the middle of the water column with least sedimentation and pollution. The best time for pumping or filling the pond is when the tide is calm.

5.5.3 Fresh water supply should be available to be used if the salinity of the water needs to be reduced to the range recommended in 5.5.1.

5.6 Facilities

Shrimp farming facilities should be designed and operated in ways that prevent contamination of the shrimp by workers, sewage/toilets, domestic animals, machinery oil/fuel, and other possible sources. The facilities should include biosecurity and sanitary facilities as described in 6.13.

5.7 Utilities

The farm shall have a reliable power source or mains electricity supply. A back-up supply or secondary power source (e.g. generator with power of 60kVa) shall be available.

6. Farm preparation

6.1 Pond preparation

The base of the pond shall be left to dry naturally. This is to ensure that the pond is free from disease or pest. The pond shall be cleaned of any leftover from the previous cycle (e.g. leftover feed, carcass, shrimp faeces etc).

6.2 Water filling

6.2.1 The pond can be filled either through the use of a pump or by the force of gravity. Where a pump is used, the pump capacity and inlet canal should be large enough to allow the ponds or the reservoir to be filled within 4 - 6 h.

6.2.2 The time needed to fill the pond or reservoir should be determined to ensure that the process can be conducted efficiently and in a timely manner. The time needed to fill in the pond can be calculated by measuring the flow rate of the water per unit time, l/s.

Example: the pump filled in 100 l of water in 30 s

The flow rate of the water:

100 l/30 s X 60 s/1min = 200 l/min

6.2.3 A filter of 1000 µm should be installed at the inlet canal before the inlet to the pumps to prevent clogging at the inlets**.**

6.2.4 The volume of water needed per pond shall be determined prior to filing the water into the pond. The volume of the water need shall be in accordance to the area of the pond which can be calculated as follows:

a) Square or rectangle shaped pond: (length x width x height) of the pond.

b) Round shaped pond: π x (radius of the pond)^2 x height.

6.3 Liming

6.3.1 Liming is the process carried out to reduce acidity of the pond soil which has the impact of improving fertility and oxygen level. The pond should be filled with water and drained the next day to get rid of any trash. The liming process should be conducted after the pond has been cleaned and drained.

6.3.2 The lime should be sown after the pond is dry. The type of lime chosen depends on the pH value of the soil. Agricultural lime, $CaCO_3$ should be used if the pH value of soil is neutral or at pH 7. Hydrated lime, Ca $(OH)_2$ should be used when the pH value is less than 5.

6.3.3 The amount of lime used shall be carefully calculated to avoid inducing excessive highwater pH which may increase ammonia toxicity and result in the mortality of the shrimp. The amount of lime used should be in accordance with Table 2.

Table 2. Recommended amount of lime for liming

pH of the soil	**Quantity of the lime (MT/ha)**	
	Agricultural lime $CaCO_3$	**Hydrated lime, $Ca(OH)_2$**
5.0 - 6.0	2.0 - 3.0	1.0 - 1.5
< 5.0	3.0 - 5.0	1.5 - 2.5

6.3.4 During the process, lime should be sown evenly to cover the entire surface of the pond from the bottom of the pond until the top of the pond bund.

6.3.5 After liming, the pond should be filled to its maximum depth with the water passing through a filter with fine mesh (24 per square inch) to prevent the predators and pest from entering the pond.

6.3.6 The liming process is considered to have been completed when the average pH value of water in the pond is in the range of 7.5 - 8.5 with a daily variation of the pH value not exceeding 0.5. If this reading is not achieved, agricultural lime, dolomite or hydrated lime should be added at 100 kg/ha/day to achieve the required pH value.

6.4 Aeration

6.4.1 To ensure that there is adequate aeration to achieve the oxygen requirement and to facilitate the cleaning process, 6 - 8 units of paddle wheel/ha should be used.

6.4.2 The capacity of the paddle wheels used should be based on the shrimp biomass should be in the range of 250 - 350 kg/hp. The paddle wheels should be arranged in such a way as to ensure that the pond sludge settles in the middle of the pond. A typical paddle wheel arrangement to achieve this result is shown in Figure 1.

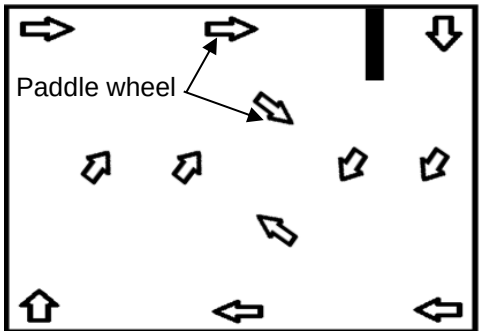

Figure 1. Paddle wheel arrangement

6.5 Pond productivity management

Pond productivity refers to the biological productivity of the pond. Productivity of the pond depends on overall management of the pond and other factors such as good water management, fry management, feed management, shrimp health management, and equipment management. To increase the pond productivity, processes such as fertilisation and water quality conditioning should be carried out.

6.5.1 Pond fertilisation

6.5.1.1 The pond should be fertilised to stimulate plankton growth. Plankton is needed to shade the bottom of the pond and prevent the growth of algae. Plankton also helps in composting waste such as phosphorus and nitrogen impurities.

6.5.1.2 Chemical fertiliser of 46 % of Nitrogen (46 % N) or mixed fertiliser such as ammonium phosphate (16:20:0) or N:P:K fertiliser (16:16:16) should be used at the rate of 2-3 kg/ha.

6.5.1.3 Chemical fertiliser shall be soaked and dissolved in water before being sown on the surface of the water

6.5.1.4 Between 3 days to 7 days after the fertilisation process, the water in the pond should turn greenish. If the water does not turn green, the process of fertilisation should be repeated. To maintain plankton growth in the shrimp ponds, more fertiliser should be sown over time at the rate of 5 % - 10 % of the initial rate.

6.5.2 Water quality conditioning

6.5.2.1 The use of probiotics shall follow the supplier’s instructions.

6.5.2.2 Where molasses is used, the rate of usage should be at 5 kg/ha - 30 kg/ha.

6.5.2.3 Molasses shall be soaked and dissolved in water before being sown on the surface of the water.

6.6 Fry preparation and fry management

6.6.1 The farm operator should use healthy fries and/or fries of good quality from reliable sources that have been verified by competent authorities.

6.6.2 The source of broodstock for fry production and shrimp farming (larvae, post larvae, fry etc.) shall minimise the transmission of pathogens into the growing stocks and potential human health hazards, i.e. use of hazard chemical and vaccination for production of fry and to human health.

6.6.3 The stocking of fry shall be based on age, size and density according to the production and sales plan. High density of stocking shrimp will cause them to be susceptible to disease. The recommended stocking density of shrimps is follows:

a) For black tiger shrimp: density should be at 25 fry/m^2 - 45 fry/m^2

b) For white shrimp: density should be at 80 fry/m^2 -120 fry/m^2

6.6.4 The recommended size of fry is post larvae size of > P.L 15 for black tiger shrimps, and post larvae size of > P.L 10 for white shrimps.

6.6.5 Only single species of disease-free shrimp should be stocked at a time in order to avoid the possibility of contagion among species, which may increase the spreading and severity of the disease. For this purpose, a traceability document shall be provided with the species of stocking shrimp.

6.6.6 The post larvae shrimp shall be allowed to acclimatise before stocking, such as by floating the plastic bag in the pond for 10 min to 20 min for the shrimp to adjust to the surrounding water temperature. The shrimp shall be stocked during soft sunlight.

6.6.7 During acclimatisation and quarantine, the specified salinity of water shall be ensured. Salinity and temperature of the water shall be stabilised before the fry is released into the pond. Hygienic practices and other disease prevention measures shall be applied. Salinity and temperature values shall be as specified in Table 7.

6.6.8 Stress tests may be conducted to determine and confirm on the quality of the fry. Strong and healthy fry will be able to survive under reasonable pressure while the weak or low-quality fry may die.

6.7 Feed management

6.7.1 The feed shall be free from prohibited antibiotics, banned substances, porcine and filthy materials and/or their derivatives. The feed shall not contain unsafe levels of pesticides, biological, chemical and physical contaminants and/or other adulterated substances.

6.7.2 The use of antibiotics, hormone and chemicals in feed, where necessary shall be approved by the competent authorities and their use shall be within permitted levels. Banned or unapproved anti-bacterial, veterinary drugs and/or chemicals shall not be used in any stage of shrimp production.

6.7.3 Where feed is used, aquaculture operations shall include procedures for avoiding contamination of the feed, in compliance with national regulations and/or international standards.

6.7.4 The farm operator shall purchase and use commercial feed that has been registered with the competent authority and properly labelled in compliance with requirements of the competent authority.

6.7.5 The feeding practice should follow the requirements as recommended by the feed manufacturers. The feeding system shall be managed efficiently by ensuring that the amount of feed used takes into account the survival rate of the shrimps. Appropriate feeding will result in healthy shrimp with low risk of disease.

6.7.6 Natural feed shall only be used when necessary because it is more likely to contain diseases.

6.7.7 The feed used shall be suitable with the species and age of the culture. The selection of feed used should consider the feed profile and its stability. The recommended feeding system should be as detailed in 6.7.7.1 and 6.7.7.2.

6.7.7.1 First month feeding

At this stage, the feed is in the form of starter meal and should be mixed with some water before being sown into the pond. Feed should only be sown around the pond not exceeding 4 m from the pond's dike as during the first month, the fry will usually be on the edge of the pond. Recommended quantity for the feeding is as in Table 3.

Table 3. Recommended feeding quantity

Day of Culture (DOC)	Feeding per day for 100 000 fry (kg)	Estimation of live shrimp (%)
DOC 1 - 5	1 - 5	100
DOC 5 - 10	5 - 7	98
DOC 10 - 15	7 -12	95
DOC 15 - 20	12 - 16	90

6.7.7.2 Second month feeding and onwards

In the second month and onwards, the feeding rate should be in accordance with the overall shrimps' weight (biomass), which can be determined by sampling. Sampling may be conducted by using a cast net.

6.7.7.2.1 Feeding trays should be used to control feeding. By using feeding trays, information such as feed intake rate can be monitored.

6.7.7.2.2 The feeding trays can be of a square shape with size of 80 cm x 80 cm x 5 cm or a round shape with diameter of 80 cm and height of 5 cm. A nylon net which covers the bottom and the sides of the tray may be used.

6.7.7.2.3 The feeding trays should be placed at least 5 m from the edge of the pond with the recommended number as specified in Table 4.

Table 4. Recommended number of feeding tray

Pond size (ha)	Number of feeding trays
0.2 – 0.3	2
0.4 – 0.5	4
0.6 – 0.8	6

6.7.8 The feed on the feeding tray shall be soaked with water before the tray is lowered to the bottom of the pond. The feeding trays shall be cleaned regularly.

6.7.9 Feed rate, percentage of feed on the feeding tray and observation time should be as per Table 5, to ensure that feeding is in a well-controlled manner.

Table 5. Recommended feed rate and percentage of feed on the feeding tray

Average body weight of shrimp (ABW), (g/*shrimp*)	Percentage of feed weight (from the shrimps' biomass) (%)	Percentage of feed in the feeding tray (%)	Observation time (h)
2 - 5	6.0	2.0	2.0
5 - 10	5.5	2.4	2.0
10 - 15	4.5	2.8	2.0
15 - 20	3.8	3.0	1.5
20 - 25	3.5	3.3	1.5
25 - 30	3.2	3.6	1.5
30 - 35	2.8	4.0	1.0
35 - 45	2.5	4.2	1.0

6.7.10 If the feed in the feeding trays is fully consumed before the end of observation time, it is a sign that the feed given is insufficient and the amount of feed shall be increased. If the feed is fully consumed at the time of observation, it shows that the feed given is sufficient. If there is excess feed at the end of observation time, it is a sign of excessive feeding and the amount of feed shall be reduced.

6.7.11 The recommended feeding frequency is around 2 – 3 times per day in the first month and 4 times per day in the second month onwards. The recommended feeding time is as specified in Table 6.

Table 6. Recommended feeding time

Feeding time	Feeding ration (%)
6.00 am - 7.00 am	25
11.00 am - 12.00 pm	20
6.00 pm -7.00 pm	30
10.00 pm - 11.00 pm	25

6.7.12 Feed should be stored under clean, dry and ventilated conditions within a room with a proper floor and walls avoiding high humidity and direct sunlight. Feeds should be handled and stored in such a way to prevent spoilage, mould growth and contamination.

6.7.13 Bags containing feed should be stored on pallets and in such a manner so as to facilitate good air circulation between individual bags and should never be allowed to rest directly against floor or walls.

6.7.14 Specified dosages and withdrawal periods of the feed should be strictly respected. Veterinary drugs and chemicals that are potentially hazardous should be disposed of in a proper manner.

6.8 Water management

6.8.1 The quality of the water for the culture shall be maintained within specified conditions to ensure good growth and health of the species cultured and that it is safe for human consumption.

6.8.2 The water quality shall be monitored and recorded throughout the culture period. Approved probiotics may be used to improve the water quality. The most important factors to consider are pH and salinity. Table 7 specifies the optimum values for various parameters that determine the quality of the water for the culture.

Table 7. Optimum values for water quality

Parameter	Value
Dissolved oxygen	> 4.0 mg/L
Salinity	15 – 25 ppt
Temperature	28 – 32 °C
pH	7.5 – 8.5
Secchi reading	25 – 50 cm
Ammonia (unionised)	< 0.10 mg/L
Nitrit-(Nitrogen)	< 1.28 mg/L
Hydrogen sulphide	< 0.033 mg/L
Alkalinity	> 80 ppm
Calcium	> 400 ppm
Magnesium	> 1200 ppm

6.8.3 The water that is used shall be obtained from non-polluting sources and have suitable water quality parameters (physical, chemical and biological) for shrimp culture. The water used shall not be wastewater from any activity that may cause contamination affecting shrimp health. In case it is necessary to use such water, suitable treatment shall be carried out and the quality of the water analysed to ensure it meets the specified quality requirements before it is used.

6.8.4 In situations where the requirements as in Table 7 are not met, chemical treatment by adding calcium chloride, magnesium chloride, sodium bicarbonate or molasses, as applicable, shall be carried out, as follows:

a) Low level of alkalinity - Add sodium bicarbonate

b) High pH - Add molasses

c) Low level of Magnesium - Add magnesium chloride

d) Low level of Calcium - Add calcium chloride

6.8.5 Molasses shall be added at the rate of 10 ppm every day to control plankton growth.

6.8.6 Water shall be changed at the rate of 5 cm (water level) per day to ensure the water is always clean and to remove dirt and residual waste.

6.9 Effluent management

6.9.1 Effluent from the aquaculture farm shall not be discharged into the public or municipal water body without undergoing proper treatment.

6.9.2 Discharges of water, sediment and sludge from the farm should not cause negative environmental impacts to the surrounding area.

6.9.3 The farm shall take appropriate measures to:

a) avoid salinisation of soil and freshwater resources;

b) dispose of solid wastes and garbage in an environmentally sound way;

c) dispose of dead shrimps in a hygienic manner especially after disease outbreak;

d) implement appropriate industrial effluent treatment in accordance with the Environmental Quality (Industrial Effluents) Regulations 2009. The parameter for marine water quality index as in Annex B; and

e) provide means to collect sludge from the culture ponds and disposal treatment ponds in order not to allow the sludge contaminating the outside environment.

6.9.4 In cases where diseases are detected, the wastewater shall be disinfected by applying permitted chemicals such as chlorine with a concentration of 30 mg/l and left to dissolve for at least two days before discharging in order to minimise the risk of disease spreading

6.9.5 Treatment technologies for shrimp farming effluent can range from the conventional flow-through settlement pond design to recirculation and bioremediation methods that recycle the pond water, and to the use of filtration equipment to reduce particulate matter in the effluent.

6.9.6 A suitable method for effluent treatment in accordance with the needs of the farm shall be selected.

6.10 Chemical storage

6.10.1 All chemical compounds shall be stored in a secure lockable store and in accordance with the manufacturer's instructions or as recommended by the competent authority and, where appropriate, be physically separated. Compliance includes a visual assessment of the chemical store.

6.10.2 The manufacturer's product specification and the Material Safety Data Sheet (MSDS) shall be made available for all chemical compounds.

6.11 Disease control

6.11.1 Cultured shrimp shall be regularly monitored, and monitoring results recorded for early detection of health problems. In the case of occurrence of an outbreak of any, the farm operator shall immediately notify and seek advice from the relevant competent authority. See Annex C for the common diseases listed by the OIE and the clinical signs or symptoms of the diseases.

6.11.2 Prohibited antibiotics, chemicals and banned substances shall not be used for disease treatment. The farm operator shall only use registered veterinary drugs and chemicals. If necessary, treatment shall follow the prescription or as advised by the competent authority.

6.11.3 Each culture pond shall be left vacant for a period after each harvest to reduce the risk of accumulation of disease vectors.

6.11.4 If an infection of a specified disease is detected, the disease shall be controlled to prevent the spread from one pond to another or to neighbouring farms or to natural water sources. The relevant competent authorities shall be informed immediately so that nearby farms can be alerted.

6.11.5 Infected and dead shrimp shall be disposed of by burying or burning in a suitable area and shall be carried out in a sanitary manner to avoid cross-contamination.

6.12 Pest and predator control

6.12.1 The farm operator shall control the risk of pest and predator infestation in the shrimp farm. The location of all pest and predator control measures shall be identified on a layout plan.

6.12.2 Monitoring records of identified risk locations and preventive measures shall be in place and available.

6.12.3 To prevent pest and predators from entering the pond, the area around the pond shall be clean. Pond inspection should be carried out from time to time.

6.13 Biosecurity and sanitary measures

6.13.1 Farm operators are encouraged to provide physical bio-security measures (e.g., traps, fencing, bird nets, etc.) which are effective to prevent any disease outbreak.

6.13.2 The farms shall have systems to prevent the escape of shrimps to public water bodies to prevent the spread of exotic diseases and to prevent the shrimps from encroaching on the habitat or feed sources of native shrimps or causing genetic manipulation.

6.13.3 Pets and domestic animals shall not be allowed in the culture pond area.

6.13.4 Sanitary facilities shall be provided that allows for disinfection at the entry or exit point of the shrimp farm including the cleaning and sanitisation of vehicles. The layout of buildings and facilities shall be arranged in an orderly manner and separated based on sections to facilitate regular cleaning and maintaining hygiene.

6.13.5 Measures shall be in place to minimise the risk of the introduction of pathogens into the farm by personnel and visitors. For example, no one shall be allowed to enter the farm for at least three days after visiting any risk area of infection or declared specified disease outbreak area of marine shrimp farm, hatchery, or nursery or visiting any aquatic disease laboratory.

6.13.6 The bathrooms and toilets shall be located at a suitable distance from the culture ponds to prevent the likelihood of direct contamination. Rubbish and waste shall be disposed of in a hygienic manner.

6.13.7 There shall be only one entrance and exit from the farm. The entrance. for both vehicles and people on foot, shall be equipped with a disinfection system in order to prevent the introduction of pathogens.

6.13.8 All equipment used in the ponds shall be cleaned and disinfected prior to use. Equipment shall not be moved from farm to farm.

6.13.9 Personal protective equipment (PPE), wherever applicable, shall be cleaned after every use and stored separately from contaminants. A separate storage area should be provided for clean and used PPE. Clean PPE shall be stored in such a manner that it will not cause cross contamination when used.

6.13.10 All staff entering the production area should wear personal protective clothing that is clean and uncontaminated. Where foot bath is used, it shall:

a) incorporate a cleaning procedure to remove accumulation of organic material and mud;

b) be sufficiently deep to cover the boots;

c) use disinfectant solution that is not inactivated by organic matter; and

d) be regularly refreshed with new solution.

6.14 Harvesting and post-harvest handling

6.14.1 Harvesting results in live shrimp or chilled shrimp. Harvesting may be carried out as a full harvest or a partial harvest. Harvesting and post-harvest handling shall be carried out such that the food safety, quality and the value of the shrimp produce is maintained.

6.14.2 Shrimp shall be transported without undue delay. Refer to Clause 11 for requirements relating to the transportation of shrimp.

6.14.3 Minimising stress to the shrimp produce immediately prior to transportation is necessary to prevent welfare problems and to maintain quality of the shrimp produce.

6.14.4 It is recommended that harvesting should be carried out in the morning or in the evening.

6.14.5 Water and ice used during harvesting and grading should be of quality suitable to ensure that the shrimp produce is safe for human consumption.

6.14.6 Appropriate techniques for harvesting and post-harvest handling should be applied to minimise contamination and physical damage.

6.14.7 Requirements for sizing and grading of shrimp are specified in Clause 12.

6.14.8 Shrimp should be harvested at the right stage of maturity and should be of good quality, i.e. free from any defects or sign of decomposition. The workers shall be trained on the capability in selecting shrimps that are at the right stage of maturity. The best way of assessing the freshness or spoilage of shrimps is by using organoleptic evaluation techniques.

It is recommended that sensory evaluation charts be used to verify acceptability of fresh shrimps and to eliminate shrimps showing an unacceptable level of decomposition. Annex D illustrates organoleptic evaluation charts together with related sensory guidelines for black tiger shrimps and white shrimps and Annex E describes unacceptable characteristics of fresh shrimps.

7. Animal health and welfare

7.1 Shrimp farming should be conducted in a manner that assures the health and welfare of farmed shrimp, by optimising health, minimising stress, reducing shrimp disease risks and maintaining a healthy culture environment at all phases of the production cycle.

7.2 Movement of live shrimp and shrimp products should take place in accordance with the relevant provisions in the OIE Aquatic Animal Health Code to prevent introduction or transfer of disease and infectious agents pathogenic to shrimp while avoiding unwarranted sanitary measures.

7.3 Good feeding, fertilisation, water management and stocking practices should be performed to create a sound culture environment and minimise stress of cultured shrimp.

7.4 Shrimp health management programmes should be implemented in compliance with relevant national legislation and regulations and OIE Aquatic Animal Health Code.

7.5 Routine monitoring of shrimp health should be performed, and records of health and corrective actions should be maintained.

7.6 In the case of occurrence of an outbreak of any disease of shrimp, the farm shall be prepared with measures to effectively control, prevent and respond to the incident. The responsible persons and procedures shall be clearly determined to prevent spread of the disease within the farm and to the outside. For instance, if a disease is detected, the farm shall be closed, and production shall be temporarily suspended. The farmers should then notify and seek advice from the competent authority or other available experts.

8. Transboundary

8.1 Aquatic animal health management programmes and movement of aquatic animal should take place in accordance with relevant provisions in the OIE Aquatic Animal Health

Code to prevent introduction or transfer of diseases and pathogens to aquatic animals while avoiding unwarranted sanitary measures.

8.2 Farm operators shall seek an approval from competent authorities to import and culture any alien species and genetically modified organism (GMO). All alien species and GMO shall be cultured under closed aquaculture systems.

8.3 Alien species and GMO shall be disposed of upon approval from the relevant competent authorities.

9. Workers safety, health and welfare

9.1 Workers (including foreign migrant workers) shall be treated responsibly and in accordance with national labour laws and regulations and, where appropriate, relevant International Labour Organization (ILO) conventions.

9.2 Workers shall not be discriminated on the basis of gender.

9.3 Workers of both genders shall be provided with decent working conditions.

9.4 Child labour shall not be used in a manner inconsistent with national regulations or ILO conventions.

9.5 Workers directly involved in production or at the farm level shall be in good health condition and receive basic training in hygiene requirements.

9.6 Safe farm work conditions shall be ensured at all times in line with the *Occupational Safety and Health Act 1994* and ILO conventions to ensure safe and healthy working conditions.

9.7 Shrimp farm workers should not be exposed to hazards which may pose danger to their health and safety. Workers shall be equipped with suitable personal protective equipment (PPE) appropriate to the danger posed to health and safety.

9.8 First aid boxes shall be available at permanent sites on the farm.

9.9 Hazards shall be clearly identified by warning signs where appropriate.

9.10 Accident and emergency procedures shall be made available with clear instructions to all workers and displayed appropriately.

9.11 Farm operators shall be provided with basic amenities for on-site living in compliance with national regulations and local laws.

10. Personal hygiene

10.1 All personnel involved in the production shall have relevant knowledge on practices for a disease-free shrimp production such as proper cleaning methods, disinfection of tools and working places, methods for waste disposal, methods for primary shrimp health examination and water quality testing methods.

10.2 The shrimp shall be handled under hygienic conditions in accordance with the *Food Hygiene Regulations 2009*.

10.3 The minimum personal hygiene and health requirements are as described below.

a) Footwear shall be changed before entering the workplace.

b) Hands and feet shall be cleaned before and after work.

c) The workers shall not have any contagious diseases or infected wounds that may infect or contaminate the marine shrimp farm.

10.4 Details on personal hygiene and health requirements are described in Annex F.

11. Transportation of shrimps

11.1 The selection of a suitable container, packing material and adherence to good packaging practices for transportation is of primary importance in order to protect shrimps from physical damage and to ensure that it will arrive in a good condition.

11.2 The container shall be strong enough to withstand external pressure, be leak-proof, light weight, easy to handle, easy to clean and shall be insulated against both heat and cold.

11.3 The packing material shall be such that it helps to maintain humidity in the container and absorb water when transporting the live shrimps.

11.4 It is also essential for the farm operator to check with the cargo carrier for any requirements such as size, weight, selection of packing materials, etc.

11.5 During transportation of shrimps, the following should be considered:

a) the temperature of the product before loading and during transportation should comply with the specific product standard;

b) exposure to elevated temperatures during loading and unloading of shrimps should be avoided;

c) product arrangement during loading should ensure good air flow between product, wall, floor and roof panel; and

d) transportation facility should provide adequate protection against contamination from dust, exposure to high temperatures and the drying effects of the sun or wind.

11.6 In the case of live shrimps, the important factors of cold temperature and aeration to ensure adequate dissolved oxygen supply shall be considered.

12. Sizing and grading

12.1 Shrimps may be selected for different quality parameters (grades and sizes) in accordance with specification requirements. The grading process shall be carried out promptly to prevent quality and safety deterioration.

12.2 Sizing and grading process of shrimps should be as described in Table 8.

For example, the shrimps are sampled with an estimated weight of 5 kg, then the total number of the sampled shrimps is calculated. If 5 kg of shrimp is equivalent to 300 shrimps, then the size of shrimp is determined as 60. The size of shrimp is determined by the number of shrimps per kg.

Table 8. Recommended sizing and grade

Size (pcs/kg)	Grade
90 - 120	SS
70 - 90	S
65 - 75	M
40 - 64	L
30 - 45	XL
20 - 30	XXL

13. Training

13.1 Training shall be given to all workers on good aquaculture practices including aquatic animal health and welfare management.

13.2 Workers should be trained in good hygienic practices to ensure that they are aware of their roles and responsibilities in protecting aquaculture products from contamination and deterioration.

13.3 General training on safe working practice, accident prevention, emergency procedures, risk reduction and safety should be provided to all shrimp farm workers. Information relating to this should also be made available and displayed appropriately.

14. Traceability

The produce shall be traceable to the farm where it was originally produced. All data related to shrimp produce should be recorded, maintained, and made accessible to the relevant authorities, if required.

15. Record keeping

15.1 Records shall be maintained on the quantities and origin of inputs. Types of records that should be maintained include the following:

a) Records of pond preparation and treatment;

b) Records of water management;

c) Records of fry management;

d) Records of shrimp management;

e) Records of feed management;

f) Records of pond performance;

g) Records of employee; and

h) Record of use of drugs and chemicals.

15.2 All records shall be kept up to date for a minimum of two years unless stipulated by any specific legislation. Record keeping system shall be established in which all the essential elements are captured. The records shall be accessible and monitored.

15.3 Example of feeding record is specified in Annex G.

16. Social responsibility

16.1 Shrimp farming should be conducted in a socially responsible manner which does not jeopardise the livelihood of shrimp farmers and local communities. It should be conducted in accordance with national rules and regulations, and where appropriate, relevant International Labour Organization (ILO) guidelines and conventions on labour rights. Socio-economic aspects should be considered at all stages of shrimp farming planning and operation (which can enhance benefits and equity in local communities and alleviate poverty and to promote food security).

16.2 Farm operators shall ensure rights on public land and water use for local communities in accordance with the requirements of the competent authorities.

16.3 Shrimp farming should have mechanisms in place for communication and to build engagement with the local community and to take positive actions to respond to complaints.

Annex A
(informative)

Typical design and layout of a shrimp farm

Figure A.1 Layout plan of marine shrimp farm

Annex B
(normative)

Parameter for marine water quality index

B.1 The parameter for shrimp farm effluent before releasing to the marine water is as specified in Table B.1.

Table B.1 Parameter for marine quality index

Parameter	Value
Dissolved oxygen (mg/L)	> 5
Total suspended solid (mg/L)	50.0
Phosphate (µg/L)	75.0
Nitrate (µg/L)	60.0
Ammonia (µg/L)	50.0
Mercury (µg/L)	0.04
Cadmium (µg/L)	2.0
Chromium (VI) (µg/L)	10.0
Copper (µg/L)	2.9
Cyanide (µg/L)	7.0
Lead (µg/L)	8.5
Zinc (µg/L)	50.0
Arsenic (III) (µg/L)	3.0
Aluminium (µg/L)	27
Tributyltin (TBT) (µg/L)	0.01
Polycyclic Aromatic Hydrocarbon (PAHs) (µg/L)	200
Total Phenol (µg/L)	10
Oil and grease (mg/L)	0.14
Faecal coliform (Cfu/100 ml)	100
Temperature (°C)	≤ 2°C increase over maximum ambient
pH	6.5 - 9.0
Marine litter	Free from marine litter

Source: Malaysian Marine Water Quality Standard (MMWQS), Class 2, 2019.

Annex C
(informative)

Diseases and pathogens and clinical signs/symptoms

C.1 The diseases and pathogens in this annex have been assessed in accordance with OIE list of aquatic animal diseases. The following diseases of crustaceans are listed by the OIE:

a) Acute hepatopancreatic necrosis disease, AHPND

b) Infection with *Aphanomyces astaci* (crayfish plague)

c) Infection with *Hepatobacter penaei* (necrotising hepatopancreatitis), HP

d) Infection with infectious hypodermal and haematopoietic necrosis virus, IHHNV

e) Infection with infectious myonecrosis virus, IMNV

f) Infection with *Macrobrachium rosenbergii* nodavirus, MrNV (white tail disease)

g) Infection with Taura syndrome virus, TSV

h) Infection with white spot syndrome virus, WSSV

i) Infection with yellow head virus genotype 1, YHV

C.2 Clinical signs or symptoms of the diseases are specified in Table C.1 below.

Table C.1 Clinical signs or symptoms of the disease listed by OIE

Diseases	Symptoms/Clinical signs
Acute hepatopancreatic necrosis disease, AHPND	The onset of clinical signs and mortality can start as early as 10 days post-stocking. Clinical signs include a pale-to-white hepatopancreas (HP), significant atrophy of the HP, soft shells, guts with discontinuous, or no contents, black spots or streaks visible within the HP (due to melanised tubules).
Infection with *Aphanomyces astaci* (crayfish plague)	Clinical signs of infection with *A. astaci* include behavioural changes and a range of visible external lesions.

Diseases	Symptoms/Clinical signs
Infection with *Hepatobacter penaei* (necrotising hepatopancreatitis), HP.	A wide range of gross signs can be used to indicate the possible presence of infection with H. *penaei.* These include lethargy, reduced food intake, atrophied hepatopancreas, anorexia and empty guts, noticeably reduced growth and poor length weight ratios ('thin tails'); soft shells and flaccid bodies; black or darkened gills; heavy surface fouling by epicommensal organisms; bacterial shell disease, including ulcerative cuticle lesions or melanised appendage erosion; and expanded chromatophores resulting in the appearance of darkened edges in uropods and pleopods. None of these signs are pathognomonic.
Infection with infectious hypodermal and haematopoietic necrosis virus, IHHNV	Certain cuticular deformities, specifically a deformed rostrum bent to the left or right, which may be presented by *P. vannamei* and *P. stylirostris* with RDS, are pathognomonic for infection with IHHNV However, this clinical sign is not always apparent in shrimp populations chronically infected with IHHNV. As *P. vannamei, P. stylirostris,* and *P. monodon* can be infected by IHHNV and not present obvious signs of infection (e.g. they may show markedly reduced growth rates or 'runting'), molecular tests are recommended when evidence of freedom from infection with IHHNV is required. In acute disease, *P. stylirostris* may present behavioural changes but with RDS, no consistent behavioural changes have been reported for affected shrimp.
Infection with infectious myonecrosis virus, IMNV	In early juvenile, juvenile, or adult *P. vannamei* in regions where infection with IMNV is enzootic, outbreaks of infection with IMNV associated with sudden high mortalities may follow stressful events such as capture by cast-netting, feeding, and sudden changes in water salinity or temperature. Shrimp in the acute phase of infection with IMNV will present focal to extensive white necrotic areas in striated (skeletal) muscles, especially in the distal abdominal segments and tail fan, which can become necrotic and reddened in some shrimp. Severely affected shrimp become moribund and mortalities can be high immediately following a "stress" event and continue for several days. Affected shrimp present with visibly white tails. Such severely affected shrimp may have been feeding just before the onset of stress and may have a full gut.
Infection with *Macrobrachium rosenbergii* nodavirus (white tail disease), MrNV	Infected PL become opaque and develop a whitish appearance, particularly in the abdominal region. The whitish discolouration appears first in the second or third abdominal segment and gradually diffuses both anteriorly and posteriorly. In severe cases, degeneration of telson and uropods may occur. Mortality may reach a maximum in about 5 days after the appearance of the first gross signs. PLs are highly susceptible to infection with MrNV and mortality reaches a maximum in about 5 days after the appearance of whitish discolouration. Floating exuviae (moults) in the tanks appear abnormal and resemble 'mica flakes'. The infected PL show progressive weakening of their feeding and swimming ability.

Infection with Taura syndrome virus, TSV	Infection with TSV is best known as a disease of nursery- or grow-out-phase *P. vannamei* that occurs within ~14-40 days of stocking PLs into grow-out ponds or tanks, hence, shrimp with infection with TSV are typically small juveniles of from ~0.05 g to <5 g. Larger shrimp may also be affected, especially if they are not exposed to the virus until they are larger juveniles or adults. Only shrimp with acute-phase clinical infection with TSV present behavioural changes. Typically, severely affected shrimp apparently become hypoxic and move to the pond edges or pond surface where dissolved oxygen levels are higher. Such shrimp may attract seabirds in large numbers. In many disease outbreaks, it is the large numbers of seabirds attracted to the moribund shrimp that first indicates the presence of a serious disease outbreak (which is often either infection with TSV or white spot syndrome virus) to the farm manager.
Infection with white spot syndrome virus, WSSV	White spots embedded within the exoskeleton are the most commonly observed clinical sign. In most shrimp, these spots range from barely visible to 3 mm in diameter, and they sometimes coalesce into larger plates. However, it should be noted that environmental stress factors, such as high alkalinity, or bacterial disease can also cause white spots on the carapace of shrimp, and that moribund shrimp with infection with WSSV may have few, if any, white spots. Therefore, the appearance of white spots is not a reliable diagnostic sign of infection with WSSV infection. High degrees of colour variation with a predominance of reddish or pinkish discoloured shrimp are seen in diseased populations. WSSV infections can be subclinical or manifest as clinical disease. The penaeid shrimp in aquaculture will generally show clinical signs associated with high morbidity and mortality. Some animals may die without showing any clinical signs. The affected animals can show lethargy, decreased or absent feed consumption and abnormal swimming behaviour – slow swimming, swimming on side, swimming near water surface and gathering around edges of rearing units. A very high mortality rate in the shrimp population can be expected within a few days of the onset of behavioural signs.
Infection with yellow head virus genotype 1, YHV	Shrimp from late post larvae stages onwards can be infected experimentally with YHV1. In cultured shrimp, infection can result in mass mortality occurring, usually in early to late juvenile stages. Moribund shrimp may exhibit a bleached overall appearance and a yellowish discoloration of the cephalothorax caused by the underlying yellow hepatopancreas, which may be exceptionally soft when compared with the brown hepatopancreas of a healthy shrimp. In many cases, the total loss of a pond crop occurs within a few days of the first appearance of shrimp showing gross signs of YHV1. However, these disease features are not particularly distinctive, and in the absence of other more pathognomonic gross signs are not reliable even for preliminary diagnosis of YHV1. Exceptionally high feeding activity followed by an abrupt cessation of feeding may occur within 2-4 days of the appearance of gross clinical signs of disease and mortality. Moribund shrimp may congregate at pond edges near the surface.

Annex D
(informative)

Organoleptic evaluation chart

D.1 Raw fresh shrimp shall be sound, wholesome condition and fit to be sold as fresh shrimp for human consumption. It should exhibit the quality requirements as described in the following Tables D.1 and D.2.

Table D.1 Sensory guidelines for black tiger shrimp

Grade	Approximate day(s) in ice	Illustration	Characteristics					
			Head	**Head-body attachment**	**Body**	**Odour**	**Texture**	**Black spots**
Acceptable	0 - 4		Bluish grey to slightly faded carapace	Intact to slightly loose	Bluish green, dark blue or brownish green to slightly faded, translucent	Sea weedy, neutral, fresh odour or characteristic odour	Firm, elastic, hard shell	Not present
Borderline acceptable	4 – 7		Black	Very loose	Faded, slightly yellowish along dorsal line	Neutral to slight stale odour	Firm	Present in head
Unacceptable or reject	> 7		Completely black	Very loose to detached	Faded, slightly greenish or yellowish along dorsal, reddish (cooked appearance), opaque meat, black tail	Fishy, stale, musty, sour, putrid, ammoniacal, faecal	Slightly firm to soft or mushy soft shell	

Reference: A guide to grading of fish and shellfish (SEAFDEC)

Table D.2 Sensory guidelines for white shrimp

Grade	Approximate day(s) in ice	Illustration	Characteristics					
			Head	Head-body attachment	Body	Odour	Texture	Black spots
Acceptable	0 - 5		Pink to slightly dark top, yellowish carapace	Intact to slightly dropping	Transparent, pinkish yellowish	Neutral, slight sea water (characteristic odour)	Firm, and resilient	Not present
Borderline acceptable	5 – 10		Black head, orange carapace, bleached	Very loose	Bleached, more purple dots	Slight fishy, stale, slight musty, slight ammoniacal	Firm to slightly soft	Present in head
Unacceptable or reject	> 10		Black head, orange carapace, very bleached	Detached	Bleached, black tail	Putrid, ammoniacal, musty, sour	Soft, mushy	Some on body and/or tail

Reference: A guide to grading of fish and shellfish (SEAFDEC)

Annex E
(informative)

Unacceptable characteristics of fresh shrimps

E.1 The unacceptable characteristics of fresh shrimps is specified in Table E.1.

Table E.1 Unacceptable characteristics of fresh shrimps

Characteristic	**Black tiger shrimp (*Penaues monodon*)**	**White shrimp (*Penaues vannamei*)**
Head	Completely black	Black head, bleached carapace
Head and body attachment	Very loose to detached	Detached
Body	Faded, slightly greenish or yellowish along dorsal, reddish (cooked appearance), opaque meat, black tail	Very bleached, black tail
Odour	Fishy, stale, musty, sour and putrid, ammoniacal, faecal	Putrid, musty, sour
Texture	Soft or mushy, soft shell	Soft, mushy
Black spot	Some on body and/or tail	Some on body and/or tail

Annex F
(normative)

Personnel hygiene and health requirements

F.1 General

An appropriate degree of personal hygiene shall be maintained in order to avoid contamination.

F.2 Medical examination

Top management shall ensure that persons who come into contact with food in the course of their work should have a medical examination prior to their employment. Medical examination of food handlers should be carried out at other times when clinically or epidemiologically indicated.

Food handlers shall be vaccinated by a registered medical practitioner.

F.3 Communicable diseases

Top management shall ensure that no person, while known or suspected to be suffering from, or to be a carrier of, a disease likely to be transmitted through food or while afflicted with infected wounds, skin infections, sores or with diarrhoea, is permitted to work in any food handling area in any capacity in which there is any likelihood of such a person directly or indirectly contaminating food with pathogenic microorganisms. Any person so affected should immediately report to the management that he is ill.

F.4 Hygiene training

Top management shall arrange for adequate and continuous training to all food handlers in the hygienic handling of food and in personal hygiene so that they understand the precautions necessary to prevent contamination of food.

F.5 Injuries

Any person who has a cut or wound shall not continue to handle food or be in contact with food contact surfaces until the injury is completely protected by a waterproof covering which is firmly secured, and which is conspicuous in colour. Adequate first-aid facilities should be provided for this purpose.

F.6 Washing of hands

Every person, while on duty in a food handling area shall wash his hands frequently and thoroughly with a suitable hand-cleaning preparation under running water. Hands should always be washed before commencing work, immediately after using the toilet, after handling contaminated material and whenever necessary.

After handling any material which might be capable of transmitting disease, hands shall be washed and disinfected immediately. Notices requiring hand washing shall be displayed. There should be adequate supervision to ensure compliance with this requirement.

F.7 Personal cleanliness

Every person engaged in the food handling area shall maintain a high degree of personal cleanliness while on duty, and shall at all times wear suitable protective clothing including head covering and footwear, all of which articles shall be cleanable unless designed to be disposed-off and shall be maintained in a clean condition consistent with the nature of the work in which the person is engaged. Aprons and similar items shall not be washed on the floor. Personnel shall not wear any jewellery or watches when engaged in food handling.

F.8 Personal behaviour

Any behaviour which could result in contamination of food such as eating, use of tobacco, chewing gum etc. or unhygienic practices such as spitting shall be prohibited in food handling areas.

F.9 Gloves

Gloves, if used in the handling of food products, shall be maintained in a sound, clean and sanitary condition. The wearing of gloves does not exempt the operator from having to thoroughly wash hands.

F.10 Visitors

Precautions shall be taken to prevent visitors to the process and handling areas from contaminating the product. These may include the use of protective clothing and other provisions deemed necessary.

Annex G
(informative)

Example of shrimp culture management record to be kept

G.1 The following items should be recorded as part of the shrimp culture management records

a) Farming month;

b) Number of ponds;

c) The area of pond;

d) Species of culture;

e) Date of stocking;

f) Number of fry; and

g) Source of fry;

G.2 Example of record keeping and maintenance for shrimp culture is as specified in Table G.1.

Table G.1 Example of record keeping and maintenance for shrimp culture management record

Date	Age of the culture	Feed (Type and weight in kg)				Maintenance		Average Body Weight (ABW)	Survival rate, %	Biomass	Remarks
		0600	1000	1400	1800	change	clean				

G.3 The following data should be recorded in the report

G.3.1 The date of stocking into the pond. This needs to be recorded to plan for the harvesting date and to determine the actual duration of the culture until harvesting date. This could also help in planning the time for next batch of stocking into the pond.

G.3.2 The pond's number is important for the purpose traceability and to determine the cycle period of the culture for the purpose of overall operation planning of the farm.

G.3.3 The area of the pond is important in determining the rate of fry release, type of treatment needed and number of equipment that will be used.

G.3.4 Stocking date is important to determine the actual culture start date. This is important to analyse the growth rate of the culture.

G.3.5 Species of the culture need to be recorded to ensure that the management, growth monitoring, treatment and disease control is suitable with the species cultured.

G.3.6 Number of fry released into the pond needs to be recorded to analyse the rate of fry release, survival rate, feeding rate and harvesting rate.

G.3.7 The source of fry cultured is an important record as it is needed for traceability and to analyse the quality of source.

G.3.8 Date of culture start until harvesting date is important to analyse culture period, to determine the growth rate, feeding rate and to plan for treatment or harvesting.

G.3.9 The feed used should be recorded to analyse feeding rate and type of suitable feed. It is also important to plan for the feeding rate and to analyse feed conversion ratio (FCR) after harvesting.

G.3.10 Average Body Weight (ABW) should be recorded to analyse weekly growth rate of the culture, to plan for feeding rate, culture period and date of harvesting.

G.3.11 Mortality rate should be recorded to analyse cause of mortality and to plan for treatment of the culture.

G.3.12 Survival rate is important to be recorded to determine the number of healthy culture and to plan the number of harvests.

G.3.13 Biomass is the overall weight of the culture in the pond.

G.3.14 Remarks column in the table is to record any physical observation at the pond such as the colour of the water, any symptom of the culture, treatment planned for the culture, etc.

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