1.1 FISH RESTOCKING IMPLEMENTATION

1.1.1 Fish Fry Procurement

Considering the cost effectiveness of the restocking programme, efforts should be made to source the fish fry/ fingerlings locally. This will lower the cost and also mortality associated with transporting juvenile fish. A hatchery or farm that can supply healthy fish fry of the target species should be identified in advance. If local hatchery is not available, priority will then be made to identify the hatcheries in Guangdong Province in order to shorten the transportation time and maintain the health of the fish.

The followings are considered as basic requirements of the hatchery from where fish fry should be sourced from:

- Possess valid aquaculture production permit locally in Hong Kong or from the exporting countries;
- Sufficient water supply;
- Broodstock should be sourced from Hong Kong or adjacent waters with relevant certification (e.g. genetic audit);
- High quality broodstock should be maintained with proper management to avoid inbreeding;
- Prevent mixing of hybrid or genetically modified fish;
- Fulfil the water quality requirements of the area (e.g. WQO in Hong Kong; Water Quality Standard for Fisheries in China); and
- Apply general good aquaculture technique for fish production.

In case of fish fry being imported outside Hong Kong, it is recommended to obtain health certificates issued by health authorities of the exporting countries to certify that the fish fry/ fingerlings are free from harmful substances.

1.1.2 Quarantine

Quarantine is to rear animals under conditions which prevent escape of the animals or the organisms and potential disease agents infecting or associated with them into the natural environment \(^{(1)}\). Quarantine process for fish generally involves examination of animals for disease agents and certification to state that a particular batch of animals and/or a production facility has

\(^{(1)}\) http://www.fao.org/docrep/003/W3594E/W3594E02.htm
been inspected to be free from infection by a particular pathogen or pathogens.

In Hong Kong, there are no laws on the quarantine of imported fishes but health/ quarantine inspection/ medical testing documentations are required for custom clearance in trans-boundary procedures. It is also difficult to implement an effective quarantine programme in hatcheries of Hong Kong, mainly due to the long period of time and high cost in maintaining a virus-free water condition (1). Some diseases may be difficult to discover and thus it may be too late to apply drugs to cure the diseases when symptoms are discovered (2). Therefore, instead of quarantine in Hong Kong which is not cost-effective with uncertain performance, it is suggested that precautionary measures should be taken to safeguard the quality of fish fry.

1.1.3 Culturing

To safeguard the health of fish fry, it is recommended to implement the following general precautionary measures developed by the AFCD (3) throughout fish culturing in the hatcheries:

1. Maintain a good culture environment
   - Maintain a suitable stocking density as a crowded culture environment may cause disease infection. Also, the fish may knock against each other and get surface wounds on which infection could be resulted easily.

2. Prevent the deterioration of water environment
   - Fish carcasses should be promptly removed to avoid contamination caused by excessive organic matters depositing on the bottom.
   - Fouling organisms or other physical obstructions should be cleared regularly to maintain water circulation and thus organic matter could be removed or treated.
   - Fish feed should be applied in phases and in appropriate quantities to avoid water pollution by excessive fish feed.
   - Use floating feed to reduce pollution to the bottom of the water column if possible.

3. Use hygienic and nutritious fish feed to boost resistance of the fish stock

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(2) ftp://ftp.fao.org/it/cdrom/fao_training/FAO_Training/General/x6794e/x6794e15.htm
o Dry pellet feed which is hygienic, nutritious and low in bacteria level is preferable over trash fish.

o Vitamins and minerals could be added into the fish feed to enhance fish immunity.

o Sterile live feed could be used in small quantity to allow the fish to experience natural habitats and search for live food.

4. Minimise the chance of introducing pathogens to the water body

o Disinfect fish culture gear before culturing using appropriate methods such as sun drying or chemicals to remove any residual pathogens remained during previous usage.

o The fish feed should be stored in a cool, dry and covered place properly to prevent bacterial growth.

o Use quality fry either from quality broodstock or healthy fry with health certificates from reputable suppliers.

5. Regular monitoring of fish health

o Observe fish behaviour to monitor if the fish reduce feed intake or show abnormal swimming patterns.

o Examine the body surface, fins and gills to check if there are any surface parasites.

o Maintain contact with and approach relevant authorities to seek for assistance if disease symptoms are detected.

1.1.4 Fish Release

During the fish release exercises, the fish should be packed in plastic bags with oversaturated oxygen and stored in numbers of polystyrene boxes for the transportation to the release site at the IWMF Phase 1 project area. Ice bags or frozen gel packs should be placed in the polystyrene boxes to slightly lower the water temperature to slow down the metabolic rates of the fish, reduce their activity and stress levels.

Good packing technique is important in order to reduce mortalities in transport and involves the optimum packing density according to the fish size (1), as follows:

- Fish of 5 cm should be packed at 400 seeds per foam box;

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• Fish of 7.3-10 cm should be packed at about 120 seeds per foam box;

• Fish of 10-15 cm should be packed at about 40 – 70 seeds per foam box; and

• Fish of 15-20 cm should be packed at about 40 - 70 seeds per foam box.

The fish should be starved for at least 24 hours before packaging to reduce their wastage from polluting the small volume of packing water during transportation. Anaesthetic may be added to the packing water depending on the transportation time. Water temperature should be lowered to 18-20 °C for transport which could be achieved by adding ice into the foam box. There should not be any direct contact of ice with the fish to avoid “cold-burn” (1).

It is suggested that the optimum temperatures of fish culture is 27-31°C for most tropical and 20-28°C for most temperate species (2). Lower temperature, which occurs in winter of Hong Kong, may inhibit the growth of fish and weaken their immune system. The fish release should thus be carried out in spring to autumn time from April to November when the seawater temperature is greater than 20 °C in Hong Kong. The fish release should be carried out in the morning or in the late afternoon to prevent the packed fish from heating under direct sunlight.

When the fish are transported to the pier near the release site, they should be kept in seawater tanks provided on vessel for at least 30 minutes for temperature acclimatisation together with the plastic bags. Upon arrival at the release site, health conditions of the fish should be checked. Temperature, pH and salinity of selected bag water should be measured and checked for acclimatisation. If there are large difference of temperature, pH and salinity between bag water and seawater, longer acclimatisation period will be required. After acclimatisation on the vessel, the fish will be transferred to cages submerged in the sea surface layer for 10-minute on-site underwater acclimatisation. The cage will then be descended slowly to the bottom of the eco-shoreline where the habitat enhancement features are installed for another 10-minute underwater acclimatisation and be released.

For each fish restocking exercise, it is recommended that ~5,000 fingerlings of the same fish species (i.e. orange-spotted grouper or yellowfin seabream) should be released at the eco-shoreline of the IWMF Phase 1 project area. The quantity of fish to be released will be further reviewed through the monitoring programme.

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