Code of Practice and Manual of Procedures for the Introduction of GIFT to Africa

The WorldFish Center

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Background

Movement of fish beyond their natural distribution range has been associated with human migration since ancient times (Pillay, 1977; De Silva *et al*, 2004). One of the most common reasons for fish introduction is for food fish production. Tilapias are the second most farmed fish after carps, being cultured in more than 84 countries (Asian Development Bank (ADB), 2005). Tilapias have significantly increased fish food supply and are a major contributor to inland capture fisheries production in Asia, having a major economic impact on poor people (De Silva *et al,* 2004). Asian countries contribute about 70 per cent of world farmed tilapia, whereas Latin American and Egypt contribute 19 and 4 per cent, respectively (ADB, 2005).

Tilapias originate from Africa and represent about 40 per cent of African aquaculture production (Bartley and Marttin, 2004). It is the most important fish contributed to world fisheries and aquaculture production by Africa. Aquaculture production from re-introduced tilapia in Africa is increasing. These re-introductions have different impacts at different places but introductions to Africa have been reported to have generally yielded positive socio economic benefits (Bartley and Marttin, 2004).

The WorldFish Center and other collaborating institutions have developed the Genetically Improved Farmed Tilapia (GIFT) strain in Philippines. GIFT tilapia (*Oreochromis niloticus)* is being widely distributed in Asia. Africa, the original source of the tilapia used in this project, by contrast, is yet to benefit from the improvement. African aquaculture would greatly benefit from the introduction of GIFT. Because of its greater growth rate and ability to perform in a variety of environments, the improved strain can increase farmers' profits and the availability of animal protein to rural and urban consumers (ADB, 2005). The option of African countries developing their own selective breeding program based on local stock, while desirable from a number of perspectives, entails greater investment of time and resources (Ambali and Malekano, 2004).

There are long standing concerns worldwide regarding the effects of the introduction of alien species and genetically improved lines into national waters. The expansion of global trade and aquaculture has augmented these concerns. National and international agencies have reviewed and continue reviewing policies and procedures related to proposed introductions of alien species and transfers within and between countries (e.g. Turner, 1988; FAO, 1995[1], 1997[2]).

It is important to integrate development objectives with conservation objectives. Appropriate authorities of the importing countries should examine the proposal and the justification for introduction in order to decide whether to go ahead with the proposed introduction or not. Abiding by an appropriate Code of Practice will help promote good decisions, avoid costly mistakes, and help improve the standard of living of the communities concerned.

We propose that in the introduction of GIFT to Africa the Code of Practice described here should be followed.

[1] Article 9.3 on "Use of aquatic genetic resources for the purposes of aquaculture…"
[2] Particularly Chapter 4 of the FAO Technical Guidelines for Responsible Fisheries and Chapter 5, which deals with 'Aquaculture Development'.

What is a Code of Practice

A Code of Practice provides a self imposed set of rules for the carrying out of a specific activity. It is the responsibility of the proponent of a Code of Practice to define the intended purpose and to specify the particular operational practices to be adopted.

A Code of Practice does not, however, replace the need for aquaculturists to obtain and comply with all necessary approvals and licenses.

Need for a Code of Practice

There is concern about the risk posed to biodiversity by the introduction of improved fish to African countries (e.g., Miller *et al.* 2004). The guidelines presented in this Code of Practice are intended to reduce imposition of such risks. The WorldFish Center views the Code of Practice as a guiding document for countries receiving GIFT. It is specifically targeted at the introduction of GIFT to Africa. There are practices to be implemented prior to and after receiving GIFT germplasm from the WorldFish Center. This code of practice can be adapted to deal with other introductions and movements of strains and species across geographical borders. It is intended to encourage responsible use of aquatic living resources for the benefit of the poor and in a manner that conserves aquatic biodiversity in accessible ecosystems.

GIFT farming exclusion areas

Requesting countries may have within their boundaries areas identified as of special value from a biodiversity viewpoint. Of special interest in the case of possible GIFT introductions would be areas in which unique wild populations of tilapia existed. Introgressive hybridization between GIFT and wild populations would homogenize genetic differences among wild populations which, in turn, might reduce their persistence and trigger out-breeding depression, a reduction in the fitness and thus productivity of the introgressed population (Miller *et al.* 2004). To reduce these risks, aquatic habitats with unique wild populations of tilapia should be identified through some kind of prioritization process and declared ‘off limits’ to farming of GIFT.

The introduction of GIFT will only take place after such areas have been jointly identified by WorldFish and the government of the country in question, and an agreement has been reached regarding the declaration of exclusion areas. Given the interconnectedness of water bodies within a watershed or basin, sites in watersheds and floodplains with especially valuable biodiversity should be declared as ‘off-limits’ to aquaculture in order to protect biodiversity.

Site selection in areas where GIFT farming is permitted

This is a very important component in establishing aquaculture facilities. Site selection can be influenced by various factors such as water and land availability and quality, access to infrastructure and markets. In the context of the present Code of Practice, the principal reasoning behind the suggested criteria for site selection focuses on minimizing ecological risks, including those posed by habitat preferably without compromising the profitability of the business.

Even in areas considered suitable for GIFT farming there are additional factors to be considered when selecting a site, namely:

1. Preferably, the farm should not be constructed in natural water ways. GIFT should not be cultured in cages in natural water bodies or in water that is connected to natural water bodies. In cage culture it is impossible to ensure that the cultured fish will not escape. Hence, cage culture in natural water bodies or in water bodies connected to natural water bodies should be avoided.

2. Proximity to 'off limits' areas. GIFT farms should not be established in any areas that may be connected to areas that have been declared 'off limits' to farming of GIFT. While this will often mean exclusion of GIFT farming from within the same watershed as a protected area, an analysis of water body connectivity within a watershed into which it is proposed GIFT be introduced must be provided to the relevant decision making authorities. This is particularly important when considering GIFT introductions to large drainage basins.

3. Construction of ponds must be in an area that is safe from floods. Flooding can cause the ponds to overflow and the fish to escape to the surrounding areas.

Protocol for the introduction of GIFT

Once agreement has been reached regarding the region(s) in which GIFT may be farmed and the decision has been made to introduce GIFT, the following aspects need to be addressed:

1. Inspection and certification of the stock to be introduced.
2. Establishment of brood stock in quarantine.
3. Discharge of water and solid wastes from the quarantine facility.
4. Progress report on the performance and condition of the introduced stock.

The activities involved in the implementation of each step are commented on below.

Inspection and certification

Health examination and disease diagnosis are important to detect sub-clinical or latent infections in the stock. External examination should include microscopic examination of the specimens to detect the presence of external protozoa and metazoa. Each country will most likely have its own protocol for inspection and certification. The specific activities to be conducted in this respect are listed in Appendix 1.

Quarantine

Quarantine refers to the maintenance of a group of aquatic animals in isolation with no direct or indirect contact with other aquatic animals, in order to undergo observation for a specified length of time and, if appropriate, testing and treatment, including proper treatment of effluent waters (Office International des Epizooties (OIE), 2006).

The aim of quarantine in this case is to confirm whether the animals that have been imported to the recipient country are free from disease. If they are, then the first generation of offspring (F1) may be released to another station. If it is not free then there are two options: (i) destroy the fish received (F0 generation), or (ii) maintain the F0 for breeding, quarantine the F1, and if found pathogen free, then allow the release of the F2 generation. If not, destroy all fish involved.

Quarantine programs for aquatic organisms typically involve protocols for inspection of the consignment, the examination of animals for disease agents, certification of freedom from disease by a competent authority issuing a certificate stating that a particular lot of animals or a production facility has been inspected and is free from infection by a particular pathogen or pathogens (Bartley *et al*, 1996).

Each country has its own detailed description of the quarantine procedures. In broad terms they should address the points mentioned in Appendix 2.

Water and effluent management

Responsible and appropriate water management is very important in aquaculture practices and even more so in quarantine procedures. Water intake that is contaminated may introduce diseases to the quarantined species. Appendix 3 presents a list of recommendations addressing the maintenance water quality and the safe management of effluent for quarantine systems.

Code of Practice for aquaculture farm operators

Aquaculture farms utilizing GIFT fish should fulfill their obligations in protecting aquatic biodiversity by ensuring that all the relevant measures listed in this Code of Practice are implemented. All reasonable and practicable measures must be adopted to:

1. Ensure that the farm using GIFT fish is situated in an approved geographical area. Approval should be by the relevant government authority.
2. Prevent the release of GIFT into any water bodies.
3. Ensure that the aquaculture operation does not lead to unacceptable direct or indirect impacts on aquatic biodiversity.

Appendix 4 provides guidelines on the design of aquaculture farms. We emphasize that this is not only important for financial success but also to minimize risks to aquatic biodiversity.

Expansion of the GIFT population

For impact at the farmer level, GIFT fish will have to be multiplied and introduced to a number of farming areas. When this happens, the same principles as outlined in the present Code of Practice should be applied.

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Further reading

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Appendix 1

Inspection and certification

To reduce risks of introducing diseases, the following steps must be taken:

1. The importing country should have an up to date list of species that are allowed for import, as well as a list of prohibited species. The lists should be made available to inspection staff involved in the examination and certification of the import and also to the public.

2. The import permit should list prescribed diseases of the imported species. The health certificate from the exporting country should certify that the consignment was examined and declared free of all prescribed diseases and pathogens.

3. The introduced stock should preferably be imported as frozen sperm, fertilized ova, or as early stage as possible to minimize disease risks.

4. Imported stock should come from a production facility or area which has been certified as disease free over a two year period.

5. Upon arrival, the stock should be checked for possible signs of disease and all packing materials, containers and other associated shipping materials must be destroyed or appropriately and adequately sterilized.

6. After the initial examination, the fish should be released to the quarantine containment facility, where it will be held for a period of four weeks. (such facilities and procedures are described in the section Quarantine).

7. If the stock proved to be harboring any disease, it should be destroyed in an approved manner to avoid the spread of diseases.

Appendix 2

Quarantine

1. Upon arrival, consignments must be disinfected regardless of approval certificate supplied. The consignment will be quarantined for specified duration.

2. The quarantined stock should be prevented from escaping. Under no circumstances should the individuals or pathogens be allowed to exit the facility.

3. The quarantine area should be accessible to authorized person only.

4. Samples may be sent for testing for specific diseases. Sampling should be such sufficient to enable a 95 per cent probability of detection of disease (see for example, des Clers 1994). Sampling should be carried out under the supervision of government employed animal health officer.

5. Used water, packing materials, containers and other associated shipping materials must be disinfected or sterilized.

6. Water supply for the quarantine unit should be sterilized and disinfected to ensure that the water do not contain any pathogen and pest. This will help deciding the source of pathogen if any outbreak happens.

7. Used water from the quarantine unit should be treated before discharge. If recirculation of water is practiced, control and assessment of water quality must be carried out.

8. Disposal of solid wastes such as feces and surplus food must be conducted by an approved method such as sterilization.

9. Treatment of infected fish should be carried out until all fish are free of disease. If the treatment is not successful then the consignment should be destroyed. Dead animals should be buried or destroyed in an incinerator.

10. Any abnormality or mortality during quarantine should be recorded and the cause should be investigated and a written report should be prepared.

11. Only fish certified as pathogen-free can be released from the quarantine holding.

12. Operating conditions and procedures must be recorded and made available for inspection by the regulatory authority on request.

13. Different stock or species must be kept in self contained compartments and precautionary measures instituted to ensure that staff cannot cause transmission of pathogens between different stocks. Separate equipment must be available for each stock or species.

14. Equipment must be disinfected before and after entering quarantine unit.

15. Personnel operating the quarantine unit must be supervised by qualified staff to ensure all biological and operating concerns are appropriately addressed.

16. Personnel should enter and leave the quarantine unit through a disinfection station which should be regularly serviced to ensure it is working properly.

17. Personnel operating the quarantine unit should not visit other aquaculture establishment on the same day.

18. In case of a disease outbreak while the stock is in quarantine, treatment to control the disease should be applied.

19. If the outbreak can not be controlled, the diseased stock should be disposed of in a safe manner and the relevant authorities should be informed. The quarantine unit or particular component that has come into contact with the species or its water must be disinfected prior to its re-use.

Appendix 3

Water and effluent management for quarantine systems

1. Intake of water

Water intake should be from clean, unpolluted sources such as ground and artesian water. The water should be filtered, disinfected or sterilized to prevent introductions of disease during the quarantine period.

2. Discharge of water

All water leaving the quarantine and culture facility should be regarded as potentially infected. Used water should be treated before discharge and it should not be discharged directly into natural water bodies. It can be contained in a sump or pond, followed by chemical disinfection. It can also be discharged into a land-based pit or pond as necessary.

3. Management of recirculated water systems

If recirculation of water is practiced, control and assessment of water quality must be done.

4. Management of continuous flow systems

Continuous flow systems in the culture facility should be avoided due to problems of disinfection or sterilization of large volumes of effluent water. If such systems are used, strategies including filtration and irradiation should be adopted.

Appendix 4

Farm design and facilities

1. All holding facilities must consist of solid constructions that prevent the escape of cultured fish at any stage, including adult, juvenile or egg.

2. Discharge systems using appropriate screen and filter devices must be used at all discharge points. Screens or filters must be able to retain the smallest size of fish or eggs and must be designed to prevent escape of cultured fish.

3. Secondary screens should be installed on the discharge structure to the farm in order to ensure that no fish escape from the facilities.

4. Sterilization of effluent water (such as ultraviolet light or ozone treatment in a retention unit prior to discharge) may be used in conjunction with the above precautions to ensure that no live fish or eggs escape.

5. Ponds and tanks must be fitted with spillway or overflow devices to prevent fish from escaping in case of water overflow.

6. Ponds must be constructed with adequate freeboard levels. The levels must be maintained throughout culture period.

7. Effluent management:
   i. Effluent should be discharged into retention ponds and water allowed to percolate. No water should be allowed to discharge directly into the environment. This will ensure that escaped fish do not find their way into the natural environment.
   ii. Effluent should never be discharged directly into wetland and other natural water bodies.
   iii. Effluent should never be discharged in a manner such that it may find its way into natural water bodies.
   iv. Discharge water may be used for irrigation purposes.

8. The facilities must be designed with minimum disturbance to the aquatic ecosystem.

9. Ponds and tanks must be completely drainable.

10. While harvesting the fish, techniques that minimize the risk of escapes should be used.