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Guidelines for managing the risks of introductions and transfers of Genetically Improved Farmed Tilapia (GIFT)

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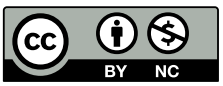

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Executive summary

Nile tilapia (*Oreochromis niloticus*) is a cichlid fish native to tropical and subtropical Africa and the Middle East. The Genetically Improved Farmed Tilapia (GIFT) strain of Nile tilapia was the first genetically improved tropical aquaculture fish species in the world—the result of over 30 years of selective breeding by WorldFish and partners. The development of GIFT was a major achievement in the history of tilapia aquaculture and has been instrumental in enhancing worldwide production of Nile tilapia.

WorldFish policy and a supporting code of practice and risk analysis guidelines have guided the organization's response and approach to GIFT dissemination, which is aligned with the Food and Agriculture Organization's (FAO) policies on aquatic resources. Over the years, however, public and private stakeholders have introduced GIFT into many countries. These introductions have involved varying levels of risk analysis, depending on national legislation and the mode of introduction. The extent to which risk analysis has been applied in all circumstances is not known.

It is evident that the increasing role of GIFT in future global fish supplies will increase GIFT introductions or transfers to more countries and territories in the coming years. Therefore, these risk management guidelines have been prepared to help move GIFT into any country or territory where risk analysis shows minimal risks using the highest safety standards and where cost-benefit analysis shows economic benefit potential. They are based on the strategies and recommendations of three comprehensive reviews of potential ecological, genetic and disease risks of GIFT introductions and transfers, as well as established international best practices provided by FAO and the International Council for the Exploration of the Sea (ICES). These guidelines complement earlier guidelines and policy documents prepared by the International Center for Living Aquatic Resources Management (ICLARM) and WorldFish.

Tilapia broodstock, Indonesia.

Introduction

Movement of live aquatic organisms, including introductions[1] and transfers,[2] has contributed to global aquaculture growth and supplies of fish and other aquatic foods. Nevertheless, illegal, accidental or poorly planned introductions and transfers have caused significant socioeconomic and environmental impacts because of accompanying aquatic animal diseases. Negative impacts have also been linked to genetic exchange between farmed and wild fish of the same species (principally salmonids), as well as environmental (ecological) impacts, such as competition for food and reproductive habitats of native species. Such outcomes have highlighted the need for risk analysis (hazard identification, as well as the combination of risk assessment, risk management and risk communication) to evaluate the potential for disease, genetic and ecological impacts associated with proposed introductions and transfers. The risk analyses provide the framework for developing appropriate risk management measures for each proposed introduction or transfer.

Nile tilapia is a cichlid fish native to tropical and subtropical Africa and the Middle East. It is widely distributed in the Nile and Niger river basins and in lakes Tanganyika, Albert, Edward and George. Numerous introduced populations are also found outside its natural range, in many smaller drainages and lakes in western and eastern Africa, and in the Yarkon River in Israel (Trewavas 1983). Several genetic improvement programs have been developed for farming this fish species, with the GIFT program being one of the most prominent and influential. The program was started in the 1980s by International Center for Living Aquatic Resources (ICLARM). The GIFT strain of Nile tilapia was the first genetically improved tropical aquaculture fish species in the world. It was the result of over 30 years of selective breeding by WorldFish (formerly ICLARM) along with partners in Norway and the Philippines. It used a selective breeding method approach pioneered in Norway in the 1970s for salmon and trout. The development of GIFT from a base population of seven Nile tilapia strains is considered a major achievement in the history of tilapia aquaculture (ADB 2004; Azhar et al. 2004; ADB 2005; FAO 2011). Undoubtedly, the GIFT strain has been instrumental in enhancing the worldwide production of Nile tilapia (ADB 2005; Li and Cai 2008; Ansah et al. 2014).

WorldFish has guided its dissemination of GIFT through policy and supporting code of practice and risk analysis guidelines (WorldFish 2006 and 2007; Lind et al. 2015). These have guided the organization's response and approach to GIFT dissemination and are aligned with FAO's policies on aquatic resources (FAO n.d.). Over the years, however, public and private stakeholders have introduced GIFT into many countries. These include Bangladesh, Brazil, India, Indonesia, Fiji, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste and Vietnam. These introductions have involved varying levels of risk analysis, depending on national legislation and the mode of introduction. There are also records of private and public sector introductions and transfers of GIFT-derived stock to some of these and other countries. The extent to which risk analysis has been applied in such circumstances is not known.

The increasing role of GIFT in future global fish supplies will increase GIFT introductions or transfers to more countries and territories in the coming years. These guidelines have therefore been prepared to guide the safe movement of GIFT from WorldFish Malaysia to any country or territory, with minimal risks and the highest level of safety.

The movements described in this document include introductions and transfers. The risk management guidelines provided are based on the strategies and recommendations of reviews of ecological, genetic and disease risks and established international best practices provided by FAO (Bondad-Reantaso et al. 2008) and the ICES (2005). They also complement earlier guidelines and policy documents prepared by ICLARM and WorldFish, and three comprehensive pathogen, genetic and ecology risk management plans developed by WorldFish (Arthur 2021; Bartley 2021; Amarasinghe 2021).

These risk management guidelines cover three stages of the introduction and transfer process: pre-border, border and post-border (Table 1).

The guidelines use this outline to provide more information on the respective roles and responsibilities of WorldFish and all essential partners to apply a robust risk management plan/strategy at all stages of the introduction/transfer to an importing country.

Introduction or transfer stage	Importer – general needs	Exporter (WorldFish) – general needs
Pre-border	• Conduct risk analyses, cost-benefit analyses and stakeholder consultations to determine whether or not GIFT should be introduced. • Ensure that the necessary government approvals and legal requirements are in place if it is decided to proceed. • Develop a plan for the introduction, including health certification needs, quarantine procedures/infrastructure, training/capacity building, contingency planning and other biosecurity measures. • Select fish and prepare the facilities and expertise required to receive and care for them. • Assess suitable areas for farming when the second generation fry are to be released from quarantine. • Prepare paperwork and authorizations to ensure smooth passage through the border control point and for transportation to quarantine.	• Ensure necessary export approvals and legal requirements are in place. • Provide information necessary for the importer to make an accurate risk assessment. • Maintain stringent biosecurity, health management and control of the facility where the GIFT broodstock is kept. • Advise the importer of the timing of the shipment and the preparation requirements (health certificate, packaging, labeling, cargo reservation), and share the waybill and expected time of arrival with the importer as soon as confirmed.
Border	• Inspection and clearance of authorizations, certificates and fish upon their arrival at the border of the receiving country. • Release of shipment to the importer.	
Post-border	• Maintain quarantine control (facility and personnel), monitor fish health and collect other information needed to prepare for the transfer of second generation fry to farm facilities in suitable areas.	• Maintain records from pre-border and border actions for any potential follow-up queries from import authorities (usually the competent authority).

Note: Importer in this document refers to the agency or company requesting to move GIFT from WorldFish Malaysia. Exporter in this document refers to WorldFish Malaysia.

Table 1. The roles and responsibilities of importer/exporter (WorldFish) at each stage of GIFT movement.

1. Pre-border

The importer should make a detailed cost-benefit analysis to assist authorities with their decision to support, or not, the proposed import of GIFT. Once the import authority (usually the competent authority) has approved proceeding with import preparations, the importer must establish the primary contacts with the exporter for planning and importation logistics.

Sections 2.1–2.2 provide greater detail for the summary points outlined in Table 1 to help ensure that both exporters and importers have a clear understanding of their respective roles and responsibilities.

1.1. Importer responsibilities

1.1.1. Exporting facility

As the exporting facility, WorldFish Malaysia regularly conducts health checks on the parent population and maintains health records to demonstrate regular health examinations. It also guarantees the overall health of the fish to be transferred and ensures all consignments are accompanied by an acceptable international certificate of health provided by the Malaysian competent authority.

The original GIFT is currently only available from WorldFish Malaysia. Selecting GIFT from a source other than WorldFish Malaysia represents a high risk of loss from unknown pathogens or genetic weakness.

1.1.2. Risk analysis and management strategy

In the case of a transfer of GIFT from WorldFish Malaysia, a risk analysis should be conducted to assess and, if necessary, manage the potential pathogen, genetic and ecology risks associated with the proposed introduction or transfer.

In the case of a first-time introduction, a risk analysis, including an evaluation of the pathogen, genetic and ecology risks associated with the proposed introduction, must be conducted. The decision to proceed with the proposed introduction should be based on the results of the risk assessments, a cost-benefits analysis and the importing country's acceptable level of risk.

Extensive stakeholder consultation in the decision-making process should be included.

All introductions and transfers should encompass an assessment of the three critical risk areas listed in sections 1.1.2.1–1.1.2.3.

1.1.2.1. Ecosystem considerations

Assessing the potential risks to the aquatic ecosystems of the importing country is required to evaluate the potential negative impacts from the escape or intentional release of farmed GIFT into the natural environment. Escapes from aquaculture facilities should be assumed and may occur for several reasons, both within farm control (nets and pond breaches, lack of emergency preparedness, unauthorized and accidental fish removal and release), as well as outside farm control (vandalism, floods, fires, monsoons, typhoons, hurricanes, earthquakes and tsunamis).

The conditions to be compared should be the range of environmental conditions that Nile tilapia can tolerate, not just the conditions in the originating culture facilities, which may not be particularly relevant for some import environments.

The range of environmental conditions that Nile tilapia can tolerate need to be compared with those in the area(s) proposed for GIFT introduction. (This is required less for transfers within the natural range of Nile tilapia.) Ecosystem impacts should consider optimal growth, maturation and reproduction conditions, such as seasonal water temperatures, dissolved oxygen, turbidity or pollution. This will provide information needed to assess the likelihood that escapees will establish a population, should such an event occur.

Areas selected for proposed aquaculture development or growth should also be clearly separated from wetland conservation areas under local, regional or national conservation authorities. Delineation should be done using hydrographic separation. Selection should comply with the Convention on Biological Diversity and be done with input from a national advisory committee (NAC) established by the relevant government agency.

The NAC should consist of expertise that spans all stakeholder interests for the importing country, including farmers, government authorities, scientists, extension officers, conservationists and fisheries.

1.1.2.2. Disease considerations

Pathogen risk analysis should focus on determining the potential hazards (pathogens), the likelihoods of their entry and exposure, the magnitude of consequence, the total risk posed by each pathogen, and the acceptability of this risk to the importing country. Should the estimated risk exceed the receiving country's acceptable level of risk, it should also examine possible risk management options to reduce the risk to an acceptable level. While there are a number of significant pathogens of Nile tilapia, including those listed by the World Organisation for Animal Health (OIE), the health history of the GIFT broodstock, combined with importer and exporter adherence to risk management measures (section 2.2), will reduce the likelihood of disease introduction.

Some key diseases concerning Nile tilapia that require confidence in proof-of-freedom testing include epizootic ulcerative syndrome, viral nervous necrosis virus, spring viremia of carp, tilapia parvovirus and tilapia lake virus.[3] The list of diseases to be certified will be specific to the importing country and should be based on the results of risk analysis and include all relevant OIE-listed diseases. It should also be compatible with the national list of pathogens and animal quarantine regulations of the receiving country, if available. Bacterial diseases that are ubiquitous, such as streptococcosis, columnaris, francisellosis, epitheliocystis, edwardsiellosis, hemorrhagic septicaemia (motile *Aeromonas* infection) and red egg disease (*hahellosis*) would not be of concern to the risk assessment, but testing for them might prevent disease outbreaks in the receiving facility.

1.1.2.3. Genetic considerations

In addition to establishing the genetic profile of the GIFT planned for transfers (where Nile or genetically compatible tilapia are in waters of the importing country), it is recommended that a sample of tilapia from the importing country's waters be taken for genetic screening and reference purposes, if an escape of GIFT occurs. Good genetic risk assessment is crucial to reduce associated genetic risks (Lind et al. 2015).

1.1.2.4. Risk analysis indicates an acceptable level of risk to the importing country

Risk analysis does not, in itself, support introduction or transfer. This is often a political decision in which the risks of introduction must be weighed against the possible benefits. As such, it is recommended that the importing country also do a cost-benefit analysis.

If the risk analysis indicates that the proposed introduction or transfer involves an acceptable level of risk, and a cost-benefit analysis indicates that potential benefits are likely to exceed potential costs, the competent authority, after appropriate stakeholder consultation, may decide to approve the proposed introduction or transfer. In this case, the importing authority needs to establish, and test, the receiving infrastructure and human resource expertise required to ensure success at the post-border stage (section 4).

1.1.3. Quarantine facilities

Effective quarantine containment means (i) preventing fish, genetic material or pathogens from escaping and (ii) providing evidence that helps demonstrate that any downstream occurrence of harm is, or is not, related to inadequate containment (section 2.1.5). FAO has provided a detailed procedure for live aquatic animal quarantine (Arthur et al. 2008). As such, land-based facilities to be used for GIFT quarantine need to meet stringent biosecurity measures (sections 2.1.3.1–2.1.3.10) and demonstrate that those measures are in place before the introduction/transfer and throughout the quarantine period.

1.1.3.1. Effluent

All effluent needs to be disinfected[4] (ideally sterilized[5]) before disposal. This can be done using filtration/ultraviolet systems with supporting settling tanks to trap solid waste within the quarantine boundary. All treated effluent must be chemically neutralized before release. Solid wastes should be treated as described for other materials (section 2.1.3.9). Alarm systems should be in place (and tested) to detect any failure in automated effluent treatment, such as an increase or decrease in effluent flow, and to warn of any risk of containment overflow. Under earthen pond-based systems, effluent water should be

collected and retained in sedimentation ponds for a period of time before releasing it into the outside environment. Effective effluent treatment must be practiced, and the effluents must be free of sediments and fully disinfected prior to discharge.

1.1.3.2. Chemical disinfection

If chemical disinfection is practiced, treatment efficacy should be verified using routine microbial screening (e.g. bacteriology plates) and/or pathogen-specific screening, such as polymerase chain reaction.

1.1.3.3. Equipment and materials

All equipment and materials entering the facility must be disinfected before entry and disinfected completely before disposal or movement to a non-quarantined area or facility.

1.1.3.4. Personnel

Personnel accessing the quarantine area must be authorized and trained and use dedicated outer clothing (boots, gloves, lab coats, etc.) for work within the quarantine area. This clothing cannot be removed from that area without disinfection. Access must be controlled to prevent entry by unauthorized personnel, such as by controlled key access, keypad or magnetic strip card access, and video surveillance.[6]

1.1.3.5. Quarantine delineation

There should be a clear delineation between "clean" and "uncontrolled" areas of the facility. Each entrance and exit point to the quarantine area must have a well-managed disinfection system, such as a footbath, handwash and a clothing exchange area, as well as a sign-in/sign-out procedure for personnel access.

1.1.3.6. Water and content containment in clean areas

Wet laboratories within the quarantine should have a raised barrier to contain all water if there is a leak/breach in the holding tanks. Where water flows to a catchment or disinfection tank, this should have an alarm in case there is a breach that reaches a level that could overflow the tank.

1.1.3.7. Feed

Feed used should be certified pathogen-free and of good quality. Any live feed used should also be certified pathogen-free. There should be a dedicated and closed area for feed storage designed to prevent potential exposure or entry of pests (insects, rodents, etc.) and to prevent potential exposure to microbes, such as fungi that produce aflatoxins, that cause poor feed quality.

1.1.3.8. Quarantine laboratory support

There should be a dedicated lab area equipped with basic equipment for collecting and examining samples, and it should ensure effective containment if the samples must be moved to another lab for testing.

1.1.3.9. Solid waste sterilization

Ideally, an autoclave or incineration capacity should be available for mortalities, disposable materials, solid waste, etc., within the quarantine area or via a sealed mechanism for disinfection outside the quarantine area.

1.1.3.10. Emergency preparedness

Plans need to be in place for power outages, fire or other disasters, such as flooding and earthquakes. This requires consultation with emergency response providers for the site and testing of the plan through emergency drill exercises before the GIFT arrive.

1.1.4. Human resources

In addition to the quarantine personnel, importing countries should consider setting up an independent NAC (section 2.1.2.1) to oversee the preparation and execution of the introduction of GIFT. This should include health, genetics and ecosystem expertise (science) as well as government, industry and community stakeholders. This committee would ensure that all interests receive the same information pre- and post-introduction and that all have a clear understanding of the risk reduction measures being implemented and why.

1.1.5. Knowledge of waters/watershed adjacent to the quarantine facility

Ideal preparedness includes baseline knowledge of the health status of aquatic resources upstream and downstream and in proximity to the quarantine facility. This involves sampling common species for parasites, pests and microbial pathogens. Although such samples will likely be from healthy populations, screening for the absence of the diseases listed in section 2.1.2.2 should be included. Measures to minimize the risk of transferring pathogens into the quarantine facility must be in place.

This suggestion also applies to a genetic profile or polymorphism screening of nearby tilapia populations to reinforce the selection of appropriate markers and/or a suite of polymorphisms to distinguish GIFT from wild tilapia populations (Lind et al. 2015; Moses et al. 2020) (section 2.1.2.3).

1.2. Exporter (WorldFish) responsibilities

1.2.1. Information sharing

It is incumbent on the exporter to provide timely and accurate information on genetics, ecology and disease history of the batch of GIFT being introduced, as required by the importer for the risk analysis. WorldFish will provide any relevant reports and technical guidance on GIFT transfer to importers so that they can ensure they are fully prepared to receive the fish when ready for shipment.

1.2.2. Broodstock isolation

Broodstock must be isolated from other fish at the production facility. This means using a water source that is not exposed to other fish and that, ideally, is independent of outside supply or is filtered/treated upstream of the holding tanks. This ensures that health testing (section 2.2.3) provides an accurate assessment of the fish to be transferred and reinforces health certifications prior to shipment.

1.2.3. Health testing

WorldFish Malaysia should provide access to official health records produced by recognized[7] diagnostic laboratory expertise. Testing the fish for diseases should be done so that results are available before export. This means holding more than the number of fish destined for shipping to permit pre-shipment testing. Note: if health sampling is to be done on fish post-transfer (recommended under section 3), planning for this rests with the importer, in discussion with WorldFish Malaysia, to secure enough fish for testing.

Disease testing should be done by a laboratory recognized by the competent authority for Malaysia or of the country where the certified GIFT broodstock supplier is located. It can be in-country or via an agreement with an internationally recognized laboratory with established testing expertise. In addition, basic health screening for opportunistic microbes or parasites is recommended before preparation for shipment. This is to ensure that the fish will be in optimal health for transportation and do not carry any infectious agents that could cause disease in the receiving facility.

The competent authority should sign or endorse the health certification for the shipment, as per the national legislation of the exporting country.

1.2.4. Transportation

For air transportation, the air cargo provider should establish timing and transportation needs. These include containers, tamperproof/security measures, environmental quality controls, priority shipping and requisite labeling of live animals, and pick-up requirements/contact information for the receiver at the import control point. Timing is critical for different life stages and should follow live fish transportation procedures to ensure optimal welfare and minimal stress, such as the use of oxygenated water, anesthetics and low temperature, as well as other measures.

Last, the exporter is responsible for providing safe and secure transportation of the fish to the transportation carrier and for collecting documentation confirming the date and time of receipt by the carrier.

The exporter should send the tracking information to the importing agency/company as soon as the fish are on-loaded with the carrier for shipment, even if copies also accompany the shipment. The GIFT exporter should keep copies of this information in case any issues arise with loss or damage to the GIFT cargo. The exporter should ensure that all necessary documentation is attached to the shipment so that there are no delays at the border control point.

2. Border

2.1. Importer responsibilities

2.1.1. Border controls

The importer should make sure all necessary permits and certificates (customs clearance, facility quarantine certification, etc.) for accepting a live fish consignment are ready by the time the fish arrive. All assessment procedures at the receiving end should be conducted appropriately by the competent authority. If anything goes wrong with the shipment and the fish arrive dead or dying, the pickup transportation must have the capacity to receive and contain the container for transportation to a facility equipped for biosecure disposal of the fish and all shipping materials.

Photo credits: Salini Kiruthikan

Cage cultured tilapia, Uganda.

3. Post-border

3.1. Importer responsibilities

Appropriate transportation for pickup and delivery to the receiving quarantine facility must be ready for immediate transfer on clearance of border point controls. This should be arranged in advance of the shipment but timed to coordinate with its arrival as closely as possible.

Upon successful transportation and delivery of healthy GIFT to the quarantine facility, the importing agency should ensure that the fish are regularly monitored for diseases and are adequately maintained and managed.

The importer should share information on the performance of the imported stock, including health issues and on-farm performance, with the exporter to support evidence of responsible dissemination of GIFT.

The importer should share GIFT experiences with relevant stakeholders, including professional and farmers societies.

3.1.1. Quarantine management

The quarantine facility should be equipped and staffed appropriately to receive the fish, including ensuring that holding units, feed and water quality controls (notably temperature) are in place.

Adequate and secure perimeter fencing is essential. Entry and exit points should maintain dedicated clothing stations, regularly replenished footbaths, hand- and eye-washing stations and log-in/log-out books. Access should be restricted to authorized staff via control measures such as restricted key access, number pads or another method that will exclude unauthorized entry. Good record-keeping and regular testing for pathogens during quarantine are necessary.

Contact with emergency response authorities should be previously established, and the supervising officer should ensure that the contact information is up to date for both the quarantine and emergency response support. It is recommended that an emergency drill, such as a fire drill, be done shortly after receiving the fish. Note: In the event of an emergency (drill or real), emergency responders will breach entry points to ensure personnel safety and limit facility damage to the best of their ability. Once the facility is secured, however, the responders will need to disinfect their outer clothing— either onsite or by bagged removal to their own decontamination site.

A robust animal-care schedule should be in place, with trained backup staff for all shifts in case of illness or emergency. Shifts may not be required 24/7 but must include all days of the week, including statutory holidays, to monitor and care for the fish.

In addition to sign-in/sign-out logs, staff should maintain logs for general facility observations. These include water temperatures, feed logs, morbidity/mortalities (counts and actions taken), waste disposal (laboratory materials, gloves, etc.) and disinfection schedules (equipment, footbaths, etc.). All logs must be available for government officers to inspect upon request.

Testing security alarms regularly is recommended to ensure they are working to the required specifications, such as controlled filling of the disinfection tank to the point of alarm.

3.1.2. Post-quarantine environmental responsibility

Areas requiring protection from the GIFT, such as wetland areas protected under the Ramsar Convention, can also be identified and delineated. The NAC should be tasked with collecting and summarizing relevant information to provide assurance to aquaculture development and conservation interests that all shared water resources have been taken into consideration in selecting areas for GIFT production. The importing agency/company should ensure that this issue has been discussed and confirmed with the appropriate national authorities.

3.1.3. Regulation and public Information

Diligent regulatory authority oversight and public awareness is needed to ensure (and provide evidence of) consistent compliance with the basic biosecurity measures described in section 4.1. This should be accomplished by regular monitoring and inspection of the quarantine facility and adjacent waters during quarantine and its logbooks by authorities to ensure that the relevant components of the risk management plan have been adequately implemented and that relevant regulatory requirements have been met. This is important to demonstrate government oversight and support of environmentally responsible GIFT aquaculture development. As with grow-out site selection, documentation of this oversight provides valuable information that can be used to address any industry development and environmental concerns or questions throughout the introduction/transfer and stocking process. This also underpins the education and awareness of risks associated with illegal or unauthorized transfers of GIFT. Relevant national authorities may assist and advise here.

3.1.4. Stocking: Post-quarantine

Areas proposed for producing GIFT, when the second-generation fry are ready for release from quarantine, need to be prepared in advance of the arrival of the fry. These include farm and hatchery personnel, outreach and local support authorities, and laboratories. The GIFT advisory team and national authorities also need to maintain oversight of data on growth, productivity, health and containment (escapees). This information is essential for tracking the cost-benefit to local food-supply security and economic development.

Farms and hatcheries receiving GIFT seed or broodstock should invest in best management practices, such as the following:

a. Use appropriate containment to reduce/prevent escapees and decrease loss to predation/poaching.

b. Use quality-controlled feed and feeding regimes.

c. Ensure employee education and awareness of stock production value, and provide biosecurity manuals to guide the application of effective biosecurity practices.

d. Keep diligent records and share them with the relevant national and/or local authorities. Records include health checks, feed-growth conversion, growth rates, off-feed/behavioral abnormalities, maturation, spawning success, stock losses or escapes, and genetic screening.

e. Report any unusual mortalities or escapes to the national competent authority.

Within the risk management procedure, local extension officers and laboratories should do the following:

a. Be aware of normal farmed GIFT characteristics to spot abnormalities quickly.

b. Collect samples for regular health examination by approved diagnostic laboratories.

c. Provide health reports to the farmer for filing and sharing with relevant authorities, as required, such as annually where no health issues are detected.

d. Be aware of surrounding fisheries and ecosystem characteristics to detect abnormalities, such as mass mortalities and biodiversity shifts, and accurately assess if they may be related to the GIFT or not. (Note: An ecosystem impact from GIFT post-quarantine would be highly unlikely, but observation records provide proof of due diligence.)

e. Maintain copies of observation/diagnostic reports for submission to the relevant authorities as appropriate—at least quarterly but perhaps bi-annually or annually.

3.2. Exporter (WorldFish) responsibilities

The exporter is responsible for maintaining all records related to the stock source and documentation (health, genetics, feed recommendations) supporting the GIFT export for a period of 5 years. WorldFish should inform the importing country of any confirmed introduction of an exotic pathogen to a new country along with importation of GIFT, or any finding of a serious pathogen in WorldFish GIFT broodstock.

4. Summary checklists

4.1. Exporter (WorldFish) checklist

Pre-border	Border	Post-border
Ensure all relevant legal requirements have been prepared.		
Assist with importer selection of broodstock by providing timely, accurate information and documents.	Provide secure and safe packaging, labeling and transportation of the GIFT to the shipper/cargo carrier.	File all documentation on broodstock, health/genetic records related to the transfer.
Provide the importer with information on the biology for shipping the GIFT.	Provide tracking information to the import authority (usually the competent authority)—copied and secured.	Provide access to the importer if requested to confirm due diligence at the exporter source.
Ensure that diagnostic testing and health certification meet all importing and exporting country requirements. Prepare shipping information to the carrier, secure documentation from the carrier, and share carrier tracking info with the importer.		Maintain documentation that supports selection of GIFT exported, risk analysis and importation (introduction/transfer) to the receiving waters authority.

4.2. Importer checklist

Pre-border	Border	Post-border
Undertake a risk analysis that includes the potential for negative disease, environment and genetic impacts on aquatic ecosystems in the country. Undertake a cost-benefit analysis to ensure that economic potential is worth investment in required biosecurity measures. Ensure that all relevant legal approvals have been secured and requirements met by the import authority (usually the competent authority).		
Select the source of fish based on information provided by WorldFish or the certified GIFT supplier.	Ensure pickup personnel have the transportation and paperwork required to swiftly acquire and then securely transfer the GIFT to the quarantine facility.	Conduct thorough quarantine management.
	Ensure personnel have a plan for the transportation and biosecure disposal of GIFT that have been injured or killed during shipping.	Monitor grow-out and surrounding areas.
Establish an NAC consisting of multistakeholder interests to monitor and advise on conditions to ensure a biosecure introduction or transfer process.		Provide ongoing advice as the introduction or transfer proceeds, including documentation of relevant authority oversight.
Prepare quarantine facilities and expertise for staffing, and provide laboratory support in advance of fry arrival.		Ensure steady communication with the national authority regarding the community interests of the receiving area (aquaculture, fisheries, environmentalists) and media before releasing the fry from quarantine.
Ensure that paperwork to support border authorization for entry is ready for shipment and complete, including contact information for any border authority questions.		

Notes

[1] Introduction in this document refers to the intentional or deliberate movement of GIFT to a geographic area where Nile tilapia is not native.

[2] Transfer in this document refers to the intentional or deliberate movement of GIFT to a geographic area where Nile tilapia is native.

[3] Note: If any of these are detected at the source and are known to be absent from the importer waters, this may halt the transfer until another source of fry can be found.

[4] Treatment that inactivates/kills a specific pathogen/group of pathogens.

[5] Treatment that inactivates all microbial life-forms (protozoans, bacteria, fungi, viruses).

[6] Note: Cleaning staff must be trained and approved for access, along with animal care personnel, facility maintenance and engineering support.

[7] Recognized laboratories in this document mean laboratories that are approved by a national or local authority to produce reports that can be used to support the movement of GIFT for grow-out or export (proof of freedom from pathogens of concern to importing waters).

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About WorldFish

WorldFish is a nonprofit research and innovation institution that creates, advances and translates scientific research on aquatic food systems into scalable solutions with transformational impact on human well-being and the environment. Our research data, evidence and insights shape better practices, policies and investment decisions for sustainable development in low- and middle-income countries.

We have a global presence across 20 countries in Asia, Africa and the Pacific with 460 staff of 30 nationalities deployed where the greatest sustainable development challenges can be addressed through holistic aquatic food systems solutions.

Our research and innovation work spans climate change, food security and nutrition, sustainable fisheries and aquaculture, the blue economy and ocean governance, One Health, genetics and AgriTech, and it integrates evidence and perspectives on gender, youth and social inclusion. Our approach empowers people for change over the long term: research excellence and engagement with national and international partners are at the heart of our efforts to set new agendas, build capacities and support better decision-making on the critical issues of our times.

WorldFish is part of One CGIAR, the world's largest agricultural innovation network.

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