INTERNATIONAL STANDARDS FOR RESPONSIBLE TILAPIA AQUACULTURE

Created by the
Tilapia Aquaculture Dialogue

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INTRODUCTION

Seafood is one of the most popular sources of protein worldwide. By volume, almost half of the seafood we eat is wild caught. But the other half is from aquaculture—the fastest growing food production system in the world—and aquaculture's contribution is expected to continue to rise.

As with any rapidly growing activity, the growth in aquaculture production has raised concerns about negative social and environmental impacts related to farming, such as water pollution, the spread of diseases and unfair labor practices at farms. And as in any industry, there are some businesses addressing these issues well and some who are not doing so at all or are doing so poorly. It is important that we face the challenge of identifying the key areas where production can be improved, and ultimately reduce or possibly eliminate negative impacts.

One solution to this challenge is creating standards for responsible aquaculture products, as well as a process for certifying producers who adopt the standards. Standards, when adopted, can help reassure buyers, retailers and consumers that the impacts related to aquaculture are minimized. Standards also can provide aquaculture industry stakeholders, as well as consumers, with the confidence that compliance with government and inter-governmental requirements has been achieved.

Through the Tilapia Aquaculture Dialogue (TAD), performance-based standards have been developed. The standards, called "The International Standards for Responsible Tilapia Aquaculture" (ISRTA), are the numbers and/or performance levels that must be reached to determine if an impact is being addressed.[1]

Each standard is based on an impact, principle, criteria and indicator, as defined below:

- Impact: The problem to be addressed. The TAD identified seven environmental and social impacts.
- Principle: The high-level goal for addressing the impact.
- Criteria: The area to focus on to address the impact.
- Indicator: What to measure in order to determine the extent of the impact.

Created in 2005, the TAD includes more than 200 tilapia producers, environmental and social non-governmental organizations (NGOs), development organizations, retailers, wholesalers, aquaculture associations, feed manufacturers, academics, researchers, government representatives and independent consultants. The TAD Steering Committee, which serves as the decision-making body for the TAD, includes representatives from three tilapia producing companies (Aquamar, Rain Forest Aquaculture and Regal Springs Trading Company) that operate re-circulating, cage, pond and/or flow-through production systems. The committee also includes representatives from three NGOs: New England Aquarium, Sustainable Fisheries Partnership and World Wildlife Fund-US. For more information about the roles and responsibilities of the TAD, see the TAD Process Document.

The full suite of standards (including principles, criteria and indicators) are described in this document. The document also details the targets the TAD has accepted. Auditor checklists and guidance documents that are under development will explain the methodologies used to determine if the ISRTA are being met. A Better Management Practices (BMP) manual for tilapia aquaculture also is being created. The manual, geared toward producers, will explain specific steps that can be taken to achieve the ISRTA. The BMP manual will be particularly useful to those producers who do not have the capability to test new and innovative techniques that could be used to meet or exceed the ISRTA.

[1] A numerical result is not necessary when an indicator cannot be quantified (e.g., the indicator for the principle "Obey the law," is "Documentation of compliance with national and local regulations." Thus, evidence of the necessary documentation satisfies the requirement.

UNDERSTANDING STANDARDS, ACCREDITATION AND CERTIFICATION

Certification is the validation that standards have been achieved by producers. Certification may also refer to the labeling of companies, practices, operations or products that conform to the standards. Certification schemes encompass the processes, systems, procedures and activities related to three primary functions: standard-setting, accreditation and certification (i.e., verification of compliance, also known as "conformity assessment"). Aquaculture certification schemes must be consistent with rigorous procedures for standard-setting, accreditation and certification to ensure that certification schemes are credible. With this in mind, the TAD sought to follow the International Social and Environmental Accreditation and Labelling (ISEAL) Alliance's "Code of Good Practice for Setting Social and Environmental Standards" when creating the standards.

For *standard-setting* (i.e., the process of creating the acceptable tolerance levels or limits of impacts), it is essential that the process is not dominated by one, or a few, stakeholder groups. The standards will be more credible and effective if they are based on the expertise and experiences of a broad and diverse group of people who are interested in aquaculture (e.g., producers who use different management practices, conservationists from international and local organizations, and scientists who specialize in different fields related to aquaculture).

For *accreditation* (i.e., the process of authorizing entities to verify compliance with the standards), it is important that there is no conflict of interest between the entities that participated in the standard-setting process, the entity that manages the standards, the entity that accredits third party certification bodies, and the entity that undertakes the third party certification. Firewalls are required between these various entities to assure that independence and credibility are maintained.

For *certification* (i.e., the process of verifying compliance with the standards), it is critical that there is no conflict of interest between the entity that conducts this function, the entities that participated in the standard-setting process, the entity that manages the standards, and the entity that accredits the certifiers. The organization that generates revenue from the labeling of products and distribution of certificates must not have any connections with the standard-setting body, as this could create an incentive to increase revenues by weakening standards. For the same reasons, the auditors determining compliance of a farm should not have a conflict of interest with the standards development body. The auditors also should not be housed in the certification body, given that the revenue generated from the certificates could influence the nature by which the audit is conducted. For this reason, third party certification is the most robust and credible process.

PURPOSE AND SCOPE OF THE INTERNATIONAL STANDARDS FOR RESPONSIBLE TILAPIA AQUACULTURE

Purpose of the Standards

The purpose of the ISRTA is to provide a means to measurably improve the environmental and social performance of tilapia aquaculture operations.

Scope of the Standards

Issue areas of tilapia aquaculture to which the standards apply

The ISRTA establish principles, criteria, indicators and measurable performance levels for responsible tilapia aquaculture with regard to social and environmental issues.

Supply or value-added chain of tilapia aquaculture to which the standards apply

The ISRTA address the most significant environmental and social impacts of tilapia aquaculture, which primarily originate from the production systems and the immediate inputs to production, such as feed, seed, chemicals and water. Additionally, social impacts related to on-farm labor and community relations are addressed.

Range of activities within aquaculture to which the standards apply

Aquaculture is the production of aquatic organisms. It involves the planning, development and operation of facilities, which in turn affect the inputs, production, processing and chain of custody components.

The ISRTA apply to the planning, development and operation of tilapia aquaculture production systems. Planning includes farm siting; resource use or extraction; and assessment of environmental, social and cumulative impacts. Development includes construction, habitat alteration and access to public areas by other resource users. Operation includes effluent discharge, working conditions, use of antibiotics and other chemicals, as well as feed composition and use.

Geographic scope to which the standards apply

The ISRTA apply to all locations and scales of tilapia farm-based aquaculture production systems in the world. The ISRTA are intended for internationally traded tilapia.

Although there has been an increased level of consumption of tilapia in wealthier countries during recent years, it is expected that tilapia production in less-developed countries will continue to be promoted in an effort to bolster food security in those regions. The ISRTA do not seek to impede or restrict the general development of tilapia operations, but rather to address the production of tilapia that is traded internationally. Every action that has an impact on natural resources could be perceived as limiting the resilience of the resources. Conversely, every action that human beings take could be perceived as necessary for survival. The ISRTA attempt to reduce the ambiguity between these extremes and clarify what is an acceptable level of impact.

Unit of certification to which the standards apply

The unit of certification is the system within the production chain sought to be examined. In the case of the ISRTA, the unit of production is the farming operation. The size of the production operation can vary considerably. Given that the focus of the ISRTA is on production and the immediate inputs to production, the unit of certification will typically consist of a single farm or some other type of collective grouping. Specific data collection protocols will be described in the ISRTA guidance document.

The unit of certification could be a group or cluster of facilities or operations that should, for a number of reasons, be considered collectively as the aquaculture operation under consideration. For example, they may share resources or infrastructure (e.g., water sources or an effluent discharge system), share a landscape unit (e.g., a watershed), have the same production system, and/or involve the same species and have a common market outlet. This group or cluster must be a legal entity that shares a common management structure so that the ISRTA are binding for each individual producer. Regardless of the specific situation, farms and other users often can have cumulative effects on the environment and society. As a result, some of the ISRTA are independent of what a producer can achieve at the farm level and rely on the efforts of the producer to act as an advocate and steward of their environment.

Under the compliance assessment of the ISTRA, part of the unit of certification determination will include the geographic and/or receiving water body delineations in which the farm cultures in or discharges. In this context, a company that owns multiple grow-out sites will be subject to compliance at the particular site they chose to undergo certification. Certifications will not be transferable to other farms or production systems that do not undergo auditing.

Each farm will be evaluated based on its activity. For example, if the farm operates a hatchery, the farm and hatchery will need to comply with the standard related to the amount of phosphorus used to produce a metric ton of tilapia. If the farm does not operate a hatchery, the farm will not be held accountable for the phosphorus loads that are produced at the hatchery where they source their seed.

PROCESS FOR SETTING THE STANDARDS

General Considerations

The process of setting standards is critical, as it largely determines the standards' credibility, viability, practicality and acceptance. In accordance with ISEAL, the process of creating the ISRTA was multi-stakeholder, open to anybody to participate and transparent.

Process for Setting the International Standards for Responsible Tilapia Aquaculture

The ISRTA were developed through four years of transparent, multi-stakeholder meetings with participants of the TAD. The TAD included many of the world's top tilapia producers and buyers, researchers, and representatives from governments, NGOs, development groups and allied businesses. The process, which was coordinated by WWF, included the following steps:

- WWF notified ISEAL of the intent to apply the "Code of Good Practice for Setting Social and Environmental Standards" to the TAD. ISEAL accepted WWF as an associate member on behalf of all of the Aquaculture Dialogues.
- WWF asked key players—including producers, wholesalers, distributors, processors, feed companies, retailers, NGOs, government representatives and scientists—to participate in the TAD.
- TAD participants agreed on the seven key environmental and social impacts associated with tilapia aquaculture.
- TAD participants agreed on the **goals and objectives** for the TAD.
- TAD participants agreed on policies that ensured the TAD meetings encouraged candid discussion (e.g., policies fostering participation rather than endorsement).
- A Steering Committee (SC) was formed. The SC had three NGO and three aquaculture industry representatives. The SC was responsible for managing the TAD process. This involved creating and implementing a TAD process document that, among other things, included **steps for decision-making**.
- **SC members** agreed on a budget for such expenses as meeting room rental, research and the TAD coordinator's time. The SC members also agreed on the roles of different types of TAD stakeholders.
- TAD participants agreed on draft principles, criteria, indicators and standards. The process involved reviewing relevant scientific research related to tilapia aquaculture.
- WWF wrote and disseminated press releases, and developed/updated a TAD website, to keep people informed of upcoming meetings and progress within the TAD.
- Draft principles, criteria, indicators and standards were posted for two 60-day public comment periods. Feedback received during both comment periods was used by the SC to revise and finalize the standards document.
- The SC posted responses to comments received during the public comment periods, with explanations of why standards were or were not altered based on each comment.

Continuous Improvement of the International Standards for Responsible Tilapia Aquaculture

As stated in the ISEAL "Code of Good Practices for Setting Social and Environmental Standards," " . . . standards shall be reviewed on a periodic basis for continued relevance and effectiveness in meeting their stated objectives and, if necessary, revised in a timely manner." It is implicit in the development of the ISRTA that the numerical values, or "tolerance levels," will be raised or lowered over time to reflect new data, improved practices and new technology. These changes will correspond to a lessening of impacts rather than an increase in impacts. Changes to other components of the ISRTA are also recognized as a way to reward better performance and, as science and technology allow for more precise and effective measures, the TAD shall remain open to adopt these new findings within the scope of the ISRTA.

1. PRINCIPLE: OBEY THE LAW AND COMPLY WITH ALL NATIONAL AND LOCAL REGULATIONS

Impact: Farm operations that, intentionally or unintentionally, break the law violate a fundamental benchmark of performance for certified farms.

1.1 Criteria: Evidence of legal compliance

INDICATOR	STANDARD
1.1.1 Presence of documents proving compliance with local and national authorities on land and water use (e.g., permits, evidence of lease, concessions and rights to land and/or water use)	Yes
1.1.2 Presence of documents proving compliance with all tax laws	Yes
1.1.3 Presence of documents proving compliance with all labor laws and regulations	Yes
1.1.4 Presence of documents proving compliance with regulations or permits concerning water quality impacts	Yes

Rationale—Principle 1 reinforces the need for the tilapia aquaculture industry to follow the national and local laws of the region where tilapia aquaculture is taking place. A goal of the ISTRA is to go beyond the law and produce more rigorous standards than those which the law requires, as long as the legal structure of the producing country is respected.

The sovereignty of individual nations to create, develop and enforce laws must be respected in the ISRTA. The TAD developed four key standards, based on broad legal issues, to reinforce the environmental and social significance of all the ISRTA.

2. PRINCIPLE: MANAGE THE FARM SITE TO CONSERVE NATURAL HABITAT AND LOCAL BIODIVERSITY

Impact: Tilapia farms that are improperly sited can disrupt the structure of native fish population, enhance eutrophication in the receiving waters, and cause the loss of sensitive habitat.

2.1 Criteria: Site information

INDICATOR	STANDARD
2.1.1 Site location, history and stewardship activities matrix located in Appendix 1, Table 1 is completed and validated	Yes

Rationale—The information required in Appendix I, Table 1 provides the historical context of a particular site where the tilapia aquaculture activity is being conducted. There is a functional need for the specific location and surrounding site description so the physical conditions of the farm in relation to the greater environmental context can be taken into consideration during the assessment process.

The collective unit of certification (whether a single farm or a group of farms) that is being audited for compliance to the ISRTA must be able to demonstrate the forethought used to determine the potential effects of the farming operation on the surrounding environment. These effects are best acknowledged via a thorough environmental impact assessment. Because the environmental impacts of a farm are not static over a given timeframe, any expansion of the farm seeking to be certified will also require the potential impacts of the proposed, broader activity to be assessed.

The purpose of the ISRTA is to identify and acknowledge producers that go above and beyond the baseline legal frameworks in their respective countries and regions of production. This stewardship of the surrounding environment is sometimes difficult to quantify or embody in a standard, but should be known and acknowledged. The requirement to provide the activities that the farm undertakes to promote the broader responsible use of the natural resources that are depended on by many is another indication of a responsible producer.

2.2 Criteria: Presence of natural or established tilapia species

INDICATOR	STANDARD
2.2.1 Demonstration that the tilapia species cultured is established[2] and naturally reproducing in the receiving waters[3,4] of the operation on or before 1 January 2008	Yes
2.2.2 In Africa, demonstration that the tilapia species and strain cultured is established and naturally reproducing in the receiving waters of the operation or before 1 January 2008	Yes

Rationale—The issue of tilapia species being present in the receiving waters in which the culture activity takes place relates to whether tilapia species are either not present, present naturally, not naturally present but have previously become established in the water body, or present only in culturing facilities. The principle aim of the ISTRA with regard to introductions of non-native species is to discourage introductions of tilapia into receiving waters where tilapia species are not native or previously established. Furthermore, where tilapia species are native (e.g., regions of Africa), the loss of the biodiversity of the native species and strains from introduced farm stock has been identified as impacts that must be prevented. Thus, the ISTRA calls for the cultured strain to be native or established in the receiving waters on or before 1 January 2008.

Escapes or release of tilapia can occur with any system, whether it is an escape on the farm or that which occurs once the tilapia are transported off the farm. These risks of escapes are minimized on the farm to the greatest extent when no-discharge systems are utilized. Therefore, in regions where tilapia do not exist or could not exist for climatic reasons, farms that do not discharge effluent (thus having no receiving waters, as defined by the ISRTA) into a receiving water body can meet standards 2.2.1 and 2.2.2.

It is important to note that the escape of tilapia in regions where the culture species is already established and not native is of a lower threat with regard to the out-competition of already non-native tilapia. This presents a paradox. Nevertheless, escaped tilapia may have negative effects on other species in the receiving waters. Therefore, escape prevention is an important aspect of the ISRTA (see Principle 4).

[2] "A non-indigenous species is considered established if it has a reproducing population within the basin, as inferred from multiple discoveries of adult and juvenile life stages over at least two consecutive years. Given that successful establishment may require multiple introductions, species are excluded if their records of discoveries are based on only one or a few non-reproducing individuals whose occurrence may reflect merely transient species or unsuccessful invasions." (National Oceanic and Atmospheric Administration)

[3] "Receiving water" is defined as all distinct bodies of water that receive runoff or waste discharges, such as streams, rivers, ponds, lakes and estuaries (adapted from *World Health Organization*). This does not include farm-constructed water courses, impoundments or treatment facilities.

[4] Where there are no-discharge systems, or no discharge to receiving waters, standards 2.2.1 and 2.2.2 are not applicable.

2.3 Criteria: The effects of eutrophication

INDICATOR	STANDARD
2.3.1 The percent change in diurnal dissolved oxygen of receiving waters relative to dissolved oxygen at saturation for the water's specific salinity and temperature	≤ 65%

Rationale—The TAD chose the diurnal dissolved oxygen fluctuation as a practical parameter for limiting the effects of eutrophication on a particular water body.

Oxygen levels in water fluctuate over a 24-hour cycle in relation to the level of photosynthesis and respiration. As nutrients are added to a water body, primary productivity increases. This increase causes more oxygen to be released into the water body as a byproduct of photosynthesis during daylight hours. Concurrently, during the day, oxygen is consumed by primary producers and other aquatic life forms as they respire. In the absence of light, however, photosynthesis ceases but respiration continues. Thus, during the night, oxygen is consumed, resulting in a decrease in dissolved oxygen. The larger the primary producer population, the more oxygen is consumed. The level or effects of eutrophication can thereby be expressed in the difference between peak daytime oxygen levels and the reduced oxygen levels during the night. Minimizing excessive fluctuations between daytime and nighttime dissolved oxygen levels is of critical importance to aquaculture operations to maintain fish health and productivity.

2.4 Criteria: Water quality in oligotrophic receiving waters

INDICATOR	STANDARD
2.4.1 Secchi disk visibility[5] limit above which production is not certifiable	10 meters
2.4.2 Compliance with standards 2.4.3. & 2.4.4. when Secchi disk visibility[5] ≤ 5.0 meters	Yes
2.4.3 Total phosphorus concentration limit in receiving waters[5]	≤ 20 µg/L
2.4.4 Chlorophyll a concentration limit in receiving waters[5]	≤ 4.0 µg/L

Rationale—The TAD considered it necessary to go beyond oxygen parameters (see Criteria 2.3) to protect waters that have low nutrient concentrations and where the diurnal dissolved oxygen fluctuations are minimal; i.e., oligotrophic systems. To avoid the excessive loading of nutrient-poor systems, a limit on the total phosphorus concentration in these receiving waters has been imposed. Additionally, a limit on the concentration of chlorophyll a has been established in an attempt to restrain the primary productivity in these water bodies.

Secchi disk visibility measures the amount of turbidity in a water column. When this method is used on systems that are not turbid via suspended sediment (note: the distinction will be made during audits between turbidity from plankton versus turbidity from suspended sediments), a strong correlation exists between low primary productivity and high Secchi disk visibility. Thus, Secchi disk visibility is a useful tool to understand key

[5] Measurements shall be taken at the Receiving Water Farm Afar (RWFA) sampling station. See Appendix II for RWFA definition.

characteristics of water bodies. In the context of the ISRTA, oligotrophic receiving waters are characterized as those that have a Secchi disk visibility equal to or greater than 5.0 meters.

Producers utilizing oligotrophic water bodies as receiving waters for tilapia operations shall be required to maintain Secchi disk visibility within a prescribed range to reduce effects of nutrient loading. Water bodies with an average annual Secchi disk visibility at or above 10 meters are not permitted to be used as receiving waters under the ISRTA because of their ecological uniqueness and rarity. Producers utilizing receiving waters with Secchi disk visibilities ranging between 5.0 and 10.0 meters will be kept to the strict limits of chlorophyll a and total phosphorus cited above if the average annual Secchi disk visibility of the receiving waters (recorded at reference point RWFA in Table 2, Appendix II) declines to and falls below 5.0 meters.

2.5 Criteria: Receiving water monitoring

INDICATOR	STANDARD
2.5.1 Receiving water quality monitoring matrix completed and validated (Appendix II)	Yes (6 months data, pre-audit, required)

Rationale—When water bodies are used directly for tilapia aquaculture, or to receive water discharge from farms, it is important to understand the effect a particular farming activity has on the environment. Nutrient loading from aquaculture into receiving waters (for cages, this is the body of water that is used as the culture medium) must be evaluated with respect to the receiving water body's ability to tolerate more nutrients.

Monitoring the quality of receiving waters is a means for demonstrating due diligence and good stewardship. It shows that producers understand the dynamics of the receiving waters where farms discharge and potentially where they source their water for the culture activity. Trends in key variables are pertinent and cost-effective tools allowing producers to adjust their activities based on a greater understanding of the surrounding environment. An inherent component and intent of the receiving water quality matrix is to identify correlating factors that may be able to predict changes in diurnal oxygen fluctuation prior to the change occurring in the receiving waters. These correlations and the data collected in 2.5.1, will be analyzed overtime, and will be evaluated at the first standards revision to determine potential effectiveness for the creation of new metrics.

2.6 Criteria: Wetland conservation

INDICATOR	STANDARD
2.6.1 Hectares of allowable wetland[6] conversion since 1999[7]	0 ha

Rationale—The TAD acknowledged the importance that wetlands can have in assimilating a portion of the increasing anthropogenic pollution that is discharged into watersheds and, ultimately, the oceans. Given that the bulk of the world's tilapia production has some form of waste discharge, the ISRTA seek to conserve wetlands and the important ecological functions they provide.

Responsible tilapia aquaculture shall not result in the loss of any wetland habitat. Although it may be difficult to restore severely damaged wetlands without considerable expertise, there is potential for the revitalization of these critical habitats. Thus, wetland conversion of any type following the year 1999 will not be allowed by any producers seeking certification against the ISRTA[8].

[6] "Wetland is defined as lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface." (United States Environmental Protection Agency)

[7] The year Ramsar contracting parties adopted strategic framework for the development of the Ramsar List

[8] Note: WWF (a member of the TAD Steering Committee) is an International Organization Partner with Ramsar. WWF is one of four global non-governmental organizations (NGOs) that have been associated with the Ramsar Convention since its inception as "an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources." (http://www.ramsar.org/)

3. PRINCIPLE: CONSERVE WATER RESOURCES

Impact: Tilapia aquaculture can compromise water quality, especially when supplied nutrients are not captured in the tilapia biomass. Whether the culture method utilizes fertilizers, manufactured feed or both, the ability to utilize inputs efficiently aids in the conservation of receiving waters where farms discharge effluent.

3.1 Criteria: Nutrient utilization efficiency

INDICATOR	STANDARD
3.1.1 The total amount of phosphorus added to the culture system per metric ton of fish produced per year. Use equations from Appendix III.	≤ 27 kg
3.1.2 The total amount of phosphorus released from the culture system per metric ton of fish produced per year. Phosphorus loading will be either calculated using equations from Appendix III or measured in effluent if there is post-culture treatment.	≤ 20 kg
3.1.3 Calculation and verification of the total amount of nitrogen applied to the culture system. Use equations from Appendix III.	Measured in kg nitrogen/mt fish/year
3.1.4 Calculation and verification of the total amount of nitrogen released from the farming activity. Use equations from Appendix III.	Measured in kg nitrogen/mt fish/year

Rationale—The TAD determined that the efficient use of nutrients is a common denominator for all open and closed culture systems. Thus, the ISRTA water resources standards focus on the efficiency of two key nutrients: phosphorus and nitrogen. Therefore, the amount of phosphorus used (i.e., the quantity of phosphorus input to the culture system in the form of feed and/or fertilizer), and the amount of unassimilated phosphorus that is released to the aquatic environment as waste in the culture system shall be quantified and limited. In all cases, consideration shall be given for remedial measures that exist or steps that have been taken to reduce loading on the environment. These could include, but not be limited to, in situ physical or biological processes that naturally reduce the nutrient load in the receiving waters, purpose built treatment systems interfacing the culture facility and the natural receiving waters, or the recycling of aquaculture effluents in other biologic systems (e.g., agricultural crop lands adjoining the culture facility).

The determination of the tolerance level for phosphorus input into culture systems began during the TAD process with an understanding of the ranges of phosphorus inputs required for the production of tilapia. In some instances where fertilization of pond water is required for tilapia culture, 50 kg of phosphorus/mt fish produced/year is added. When feed is used, less phosphorus is required and can range from 20 to 40 kg of phosphorus/mt fish produced/year. The TAD made the phosphorus input efficiency a priority in the development of the ISRTA. The input of phosphorus is desired to be set at the lowest level possible. Production facilities shall continue to develop methodologies to reduce their phosphorus demand.

Nitrogen is also identified as a potential limiting factor for freshwater ecosystems and, more so, brackish receiving waters. Identifying a valid numerical limit for nitrogen use efficiency proved to be more complex than for phosphorus limits. The difficulty stemmed from the multiple sources and amounts of protein used in tilapia

feeds, the volatility of nitrogen in the environment and the reactions of nitrogen with other constituents in the water column. Nevertheless, the role nitrogen has on the acceleration of eutrophication was a concern that TAD stakeholders wanted acknowledged and addressed. Without proper justification for setting a standard, however, the TAD sought to account for the amount of nitrogen used so that producers are aware of this and recognize that, in the future, a functionally quantitative standard will be necessary in the ISRTA.

3.2 Criteria: Groundwater salinization

INDICATOR	STANDARD
3.2.1 Percent change in specific conductance of freshwater from a drilled well at the time of drilling and the time of audit. This is required when freshwater wells are used in combination with brackish surface water for the culture of tilapia. Freshwater aquifers are defined as having a specific conductance less than 1,300 µS/cm.	≤ 10 %

Rationale—When groundwater is used directly or mixed with brackish water for tilapia aquaculture, the salinization of freshwater aquifers can occur. Over-pumping can lower the head in the freshwater aquifer and saline water can enter and mix with freshwater. The ISRTA recognize that the responsible operation of a tilapia aquaculture facility shall not lead to the salinization of freshwater aquifers.

4. PRINCIPLE: CONSERVE SPECIES DIVERSITY AND WILD POPULATIONS

Impact: Tilapia escaping from aquaculture facilities may function as vectors of disease in the receiving water environment, or may out-compete native fish species or native tilapia strains. The manipulation or transference of genes from one species to another (transgenics) can produce a more robust and vigorous tilapia strain. However, this vigor may increase the tilapia's ability to out-compete native fish.

4.1 Criteria: Escapes from aquaculture facilities

INDICATOR	STANDARD
4.1.1 Presence of net mesh or grills/screens, barriers on inlets and outlets of culture vessels (e.g., tanks, ponds and raceways), and mesh on all netted confinement units (e.g., cages and impoundments), appropriately sized to retain the stocked fish	Yes
4.1.2 Presence of net mesh, or grills/screens and permanent barrier inspection register recording dates, findings and actions taken, including mitigation or fish containment structure repairs	Yes
4.1.3 Presence of trapping devices[9] placed in effluent/drainage canals or in between cages to sample for escapees, and a record of findings and actions taken	Yes
4.1.4 In cage culture systems, the minimum distance between the bottom of the cage and the bottom of the receiving waters where the cage is placed	≥ 3.0 m
4.1.5 The minimum percentage of males or sterile fish in a culture unit	95%

Rationale—The ISRTA are intended to achieve biodiversity conservation. That is why Principle 2 prohibits the introduction of tilapia for culture where tilapia is not native or established in farm's receiving water. The standards under Principle 4 focus on managing the genetic impacts of tilapia aquaculture and associated potential biological pollution.

Escapes at tilapia facilities fall into two general categories: fry escaping through screens or meshes as a result of breeding in culture systems, and stocked fish escaping via damaged containment devices, such as screens or cages. The ISRTA address these aspects with a suite of specific standards to minimize escapes from containment structures and enhance biosecurity. The standards go further and mandate the culture of all male or sterile hybrid tilapia to minimize the escape of fry.

[9] These devices should not injure or compromise fish health, e.g. gill nets.

4.2 Criteria: Transporting live tilapia

INDICATOR	STANDARD
4.2.1 Presence and evidence of use of fish transport containers that have no escape path for fish	Yes

Rationale—Escapes of tilapia are not necessarily limited to on-farm escapes incidences. There is also the potential for the unintentional release of tilapia from fish transport containers. Thus, whether the transfer of fish fry to the farm or the transfer of harvested size fish to markets or processing facilities, a risk is present and must be minimized. In an attempt to minimize this risk, producers are mandated to utilize sealed transport containers with no escape route for fish.

4.3 Criteria: Transgenic fish

INDICATOR	STANDARD
4.3.1 Allowance for the culture of transgenic tilapia	No

Rationale—Tilapia are some of the hardiest fish reared through aquaculture. They are fast-growing and can survive under extreme environmental conditions. Methods to enhance the performance of cultured tilapia through selective breeding have allowed for significant improvement, but presently the potential for an enhanced ability to out-compete native fish species provides sufficient justification to exclude transgenic manipulation of culture species within the ISRTA. Thus, transgenic fish are prohibited from being reared.

4.4 Criteria: Predator control

INDICATOR	STANDARD
4.4.1 Use of lethal[10] predator control	No
4.4.2 Mortality of IUCN red listed species	0

Rationale—The killing of animals that may prey on cultured tilapia is not permitted under the ISRTA unless it becomes necessary to euthanize an animal trapped in netting. However, euthanizing International Union for Conservation of Nature (IUCN) Red List species, whether passive or otherwise, is prohibited. The use of lethal control was determined to be an ineffective measure to control predation and against the spirit of environmental stewardship within the ISRTA.

[10] The use of lethal predator control is prohibited, unless a predator becomes impinged in netting and is required to be euthanized.

5. PRINCIPLE: USE RESOURCES RESPONSIBLY

Impact: The utilization of resources for the production of tilapia can have a negative impact on the environment. Wild fish sourced for feed ingredients in the form of fish meal and/or oil can originate from fish stocks that are being depleted or are unhealthy. Additionally, other feed ingredient sources and their impacts are becoming more broadly understood in the aquaculture sector and require attention. Last, energy consumption (which often is central to evaluating a producer's carbon footprint) can contribute to forms of pollution and climate change.

5.1 Criteria: Use of wild fish for feed (fishmeal and oil)

INDICATOR	STANDARD
5.1.1 Feed Fish Equivalence Ratio (FFER).See Appendix IV for feed calculations.	≤ 0.8
5.1.2 Allowance for the use of fishmeal and fish oil in tilapia feed containing products from fisheries that are listed on the IUCN's Red List or the species list maintained by the Convention on the International Trade of Endangered Species of Wild Fauna and Flora	None
5.1.3 Timeframe for producers to source feed containing fishmeal or fish oil originating from fisheries deemed sustainable by an ISEAL member's accredited certification scheme	5 years following the date of ISRTA publication
5.1.4 Prior to achievement of 5.1.3, the average FishSource score characterizing the fishery(ies) from which the fishmeal or fish oil is derived. See Appendix V for explanation of FishSource scoring.	≥ 6.0 with no individual score < 6.0 or an N/A in the stock assessment category

Rationale—The dependency on wild harvest fish for aquaculture production was important to the TAD. The use of the Feed Fish Equivalency Ratio (FFER) is a means to quantify the impact of tilapia production on wild fish stocks that are used as an ingredient in tilapia feed. The FFER calculation (see Appendix IV) takes into account the efficiency of feed used and the inclusion rates of fishmeal and fish oil in feed. The FFER calculation does not include fishmeal sourced from the rendering of seafood processing by-products (a.k.a., trimmings) as this material is not fished or targeted for aquaculture.

Feed Conversion Ratios for tilapia can range from 0 to 2, depending on the culture system, feed type (if any), and the desired size of the fish at harvest. Smaller, harvest-size fish will have a lower FFER, but markets are demanding a larger fish. Therefore, limits on FFER are being utilized to reduce the excessive use of wild fish for feed.

The sourcing of fishmeal and fish oil was a serious concern for TAD participants. This is largely because wild fish are extracted from the oceans to be converted to fishmeal for tilapia, and certain wild harvest fish species are in question with respect to the health of their stocks. The final development of indicators for this issue must await completion of the characterization of all wild harvest fish stocks targeted for fishmeal production by a widely recognized authority, such as the Marine Stewardship Council, with respect to their sustainable harvest

status. Ultimately, any standards effort for wild harvest fish sources that has been accredited by the ISEAL Alliance could qualify. The stakeholders in the TAD are nevertheless anxious to include some sustainability criteria for wild harvest fisheries in the standards. Therefore, in the interim the TAD proposes to restrict fisheries currently known to have the poorest status from being used for fishmeal and oil. This restriction will be placed on threatened or endangered species of fish listed on the IUCN's Red List or on the CITES Species list. Further, the scoring of fisheries in the FishSource database (www.fishsource.org) is employed to add an additional layer of protection by restricting the use of fisheries that score below an average of 6 in their assessment scheme (see Appendix for further information on FishSource scoring).

5.2 Criteria: Preference for better feed manufacturers

INDICATOR	STANDARD
5.2.1 Timeframe for producers to provide evidence of preferential sourcing of feed products from feed manufacturers that have a sustainable sourcing policy for feed ingredients, and traceability of feed ingredients	2 years following the date that the ISRTA are published

Rationale—Feed ingredients that are sourced from areas where significant ecological damage has occurred, whether because of the production of these ingredients or not, was of concern to the TAD. Currently, there is no direct verification mechanism for feed ingredients exclusive of the fishmeal and oil sourcing discussed in 5.1. Thus, the ISRTA requires producers to provide evidence that they are sourcing feed products from feed manufacturers who have a sustainable sourcing policy for feed ingredients within two years of the publication of the ISRTA. The validation of these origins will require feed ingredient traceability, and the ISRTA initiates this validation by requiring producers to demonstrate that they can trace the specific ingredients in the feed they purchase. Once traceability is in place, the tilapia producers and auditors will be able to determine the conditions of the environment where these ingredients are sourced. This will enable future requirements within the ISRTA to limit the sourcing of ingredients to areas where the production of these ingredients is causing the least damage. Although a sustainability policy cannot be validated for all aspects of feed production by tilapia producers, it provides a layer of accountability for tilapia producers and enables them to use their purchasing preferences to improve, where necessary, the practices of their feed suppliers.

5.3 Criteria: Energy use

INDICATOR	STANDARD
5.3.1 Identification of the energy sources and calculation and verification of total energy used at the culture facility	Measured in kilojoules/mt fish/year

Rationale—Energy consumption in the course of food production is a major concern within the general public, particularly with respect to carbon-based energy sources. Data on energy consumption and sources in tilapia aquaculture are lacking, and although the TAD was not in a position to mandate standards on the amount and type of energy that are allowable in the various tilapia production systems, the ISRTA does state that on-farm energy consumption and sources shall be monitored on a continual basis, and production facilities shall develop means to reduce consumption of energy resources, particularly those that are limited or carbon-based.

6. PRINCIPLE: MANAGE FISH HEALTH AND WELFARE IN AN ENVIRONMENTALLY RESPONSIBLE MANNER

Impact: The culture of tilapia under stressful conditions can lead to the transfer of novel fish diseases or the amplification of diseases in the receiving waters. Additionally, heavy reliance on the use of therapeutic chemicals at tilapia aquaculture facilities not only results in pollution from chemical residues, but also can stimulate and/ or introduce antibiotic resistant bacteria in the receiving waters, which can potentially have a negative effect on the local ecosystem.

6.1 Criteria: Stocked tilapia recovery

INDICATOR	STANDARD
6.1.1 Percent recovery of fish stocked in production stages after they have attained a size of 100 grams	≥ 65

Rationale—Consensus within the TAD was that fish welfare fundamentally relates to the management of the health of the fish. The most telling indicator of fish health management is the rate of mortality in the culture system. Actual mortality is difficult to determine and isolate because there are several factors that can be attributed to mortality, such as predation, theft, escapes and disease. Health management does not necessarily take into account the predation and theft, per se. However, a measure of fish recovery offers a more comprehensive determination of all of these factors. Thus, the percent recovery of fish stocked was chosen to be one of the key indicators to assess overall tilapia health and welfare management. There are other aspects of production that can be taken into account when measuring percent recovery, but stakeholders agree that this measure promotes positive management practices across all farm activities. Recovery of stocked[11] fish over the entire culture cycle once the average individual fish size is greater than 100 grams is set at 65 percent.

Experts within the TAD noted that recovery rates of wild-caught tilapia (from spawn to full grown adult fish) are typically less than 5 percent. In comparing wild tilapia stock recovery to farmed fish stock recovery, the results are very different because of the controls that can be exerted on stressors of fish in a farm environment. Food is provided for fish to eat so there is no lack of nutrition in the diet. Energy expended to reach that food is also low compared to that required in the wild. Additionally, there are attempts to control predators so fish are not as prone to predation as in the wild, which helps to further reduce stress on the farmed fish.

The TAD agreed that fish welfare is reflected by several other factors, in addition to survival. That is why the ISRTA attempts to ensure that sufficient oxygen is available in the receiving waters of an operation. This, in effect, will help improve the quality of the culture water by maintaining a threshold that cannot be changed in the receiving waters. Having a health professional or veterinarian diagnose any illnesses and prescribe treatment is an attempt to properly reduce the threat of disease outbreaks. Daily removal of mortalities is also a critical procedure for assuring fish welfare. Finally, mandating a fish health management plan be established on a farm further assures the maintenance of welfare in all its details.

[11] Recovery does not include recruitment of tilapia resulting from reproduction within the culture system.

6.2 Criteria: Chemicals

INDICATOR	STANDARD
6.2.1 Allowance for the use of chemicals and therapeutants for disease and pest control that are banned in the importing or producing country	None
6.2.2 Allowance for the prophylactic use of antibiotics, prior to any evidence of a disease problem	None
6.2.3 Minimum hold time required before any water in which fish have been fed with feed containing methyl or ethyl testosterone can be released	≥ 48 hours
6.2.4 Health records proving all therapeutants were used or are being used as prescribed by a veterinary or accredited fish health professional	Yes
6.2.5 Calculation and verification of the total amount of each antibiotic (active ingredient) used per mt fish produced per year.	Measured in kilograms of active ingredient of individual antibiotic/mt of fish produced/year

Rationale—Therapeutants are sometimes required to assist in fish health management. The ISRTA do not support the prophylactic use of antibiotics. When fish do require treatment, however, these therapeutants must be prescribed by a veterinarian or accredited health professional. Furthermore, the only therapeutants allowed for use will be those that are not banned from use in the importing country or the exporting country. The usage and amounts of specific therapeutants and chemicals also must be provided at inspection.

6.3 Criteria: Mortalities

INDICATOR	STANDARD
6.3.1 Presence of records demonstrating that fish mortalities are removed consistently on a minimum daily basis	Yes
6.3.2 Evidence proving acceptable disposal of dead fish, (i.e., landfill receiving receipts, sales receipts, permits or approvals for onsite burial, and assurance if converted to animal meals not destined for the culture of tilapia)	Yes

Rationale—Mortality removal is a necessary step to reduce the decomposition of fish in culture systems or in the exposed environment. There is a need for the appropriate disposal of dead fish to prevent the spread of disease and to help minimize additional predation. Removing mortalities daily and disposing of them in an acceptable manner is required in the ISRTA. Ideally, dead fish should be utilized for rendering into tilapia fishmeal if rendering facilities are available and the fish are collected in a suitable condition.

6.4 Criteria: Fish health management

INDICATOR	STANDARD
6.4.1 Presence and evidence of implementation of a fish health plan that is site-specific and contains effective methods for 1) Protecting the farm from introduction of pathogens, 2) Preventing the spread of pathogens within the farm and to the receiving waters and 3) Reducing the potential for development of disease resistance by ensuring responsible therapeutant use	Yes

Rationale—When fish health is severely compromised, the effects of the culture fish can be transferred to fish or other organisms in receiving waters and detrimentally affect the environment. Although most pathogens of tilapia aquaculture are received via interaction with the natural environment, the amplification of these pathogenic organisms can be realized if appropriate attention is not directed toward fish health.

The culture systems used for tilapia aquaculture are varied and no one fish health management plan suits every facility. Therefore, producers are to demonstrate the applicability of their fish health management plan at the particular site being utilized.

7. PRINCIPLE: BE SOCIALLY RESPONSIBLE

Impact: Aquaculture is a labor-intensive industry and often is the backbone of communities where seafood farms are located. Therefore, it is irresponsible to address environmental sustainability without addressing such social issues as workers' safety and public access to land.

The ISRTA break these social standards (and their related criteria/indicators) into two categories: labor and community. Many countries have national laws that address labor issues rigorously and intensively, however this is not consistent in a global context. Addressing these key issues in tilapia aquaculture is critical, given the important human rights implications and proven societal benefits of labor standards related to poverty, sustainable economic growth, good governance and political stability. The labor standards in this document are based on the core principles of the International Labor Organization (ILO): freedom of association, the right to collective bargaining, prohibition on forced labor, prohibition on child labor, and freedom from discrimination. The ILO principles are recognized globally as the most credible codes of conduct and internal company guidelines on labor. Social Accountability International (SAI), an international and renowned social/labor NGO, worked with the Dialogues to adapt the ILO standards so they are applicable to aquaculture. SAI's work included site visits to several tilapia and pangasius farms in order to ground the standards in the reality of aquaculture[12].

7.1 Criteria: Child labor

INDICATOR	STANDARD
7.1.1 Number of incidences of child[13] labor[14]	0

Rationale—Adherence to the child labor codes and definitions included in this section indicates alignment with what the ILO and international conventions generally recognize as the key areas for the protection of child and young workers[15]. Children are particularly vulnerable to economic exploitation, due to their inherent age-related limitations in physical development, knowledge and experience. Children need adequate time for education, development and play and, therefore, shall never be exposed to work or working hours that are hazardous[16] to their physical or mental well-being. To this end, the standards related to what constitutes child labor are designed to protect the interests of children and young workers in certified aquaculture operations.

[12] A farm does not have to adopt the Dialogue's labor standards if it already is in compliance with SA 8000 (an SAI labor certification program) or an equivalent labor certification scheme that is approved by the International Social and Environmental Accreditation and Labeling Alliance.

[13] A "child" is defined as any person less than 15 years of age. A higher age would apply if the minimum age law stipulates a higher age for work or mandatory schooling. If, however, the local minimum age law is set at 14, in accordance with developing country exceptions under ILO Convention 138, the lower age will apply.

[14] "Child labor" is defined as any work by a child younger than the age specified in the definition of a child, except for light work as provided for by ILO Convention 138, article 7.

[15] A "young worker" is defined as any worker between the age of child, as defined above, and under the age of 18.

[16] "Hazardous work" is defined as work that, by its nature or circumstances in which it is carried out, is likely to harm the health or safety of workers.

7.2 Criteria: Forced, bonded, compulsory labor

INDICATOR	STANDARD
7.2.1 Number of incidences of forced[17], bonded[18] or compulsory labor	0

Rationale—Forced labor—such as slavery, debt bondage and human trafficking—is a serious concern in many industries and regions of the world. Ensuring that contracts are clearly articulated and understood by employees is critical to determining that labor is not forced. The inability of a worker to freely leave the workplace and/or an employer withholding original identity documents of workers are indicators that employment may not be at-will. Employees shall always be permitted to leave the workplace and manage their own time. Employers are never permitted to withhold original worker identity documents. Adherence to these policies shall indicate an aquaculture operation is not using forced, bonded, or compulsory labor forces.

7.3 Criteria: Discrimination in the work environment

INDICATOR	STANDARD
7.3.1 Number of incidences of discrimination[19]	0
7.3.2 Evidence of proactive anti-discrimination practice	Yes

Rationale—Unequal treatment of employees, based on certain characteristics (such as sex or race), is a violation of a workers' human rights. Additionally, widespread discrimination in the working environment can negatively affect overall poverty and economic development rates. Discrimination occurs in many work environments and takes many forms. In order to ensure that discrimination does not occur at certified aquaculture farms, employers must prove their commitment to equality with an official anti-discrimination policy, a policy of equal pay for equal work, as well as clearly outlined procedures to raise/ file and respond to a discrimination complaint in an effective manner. Evidence, including worker testimony, of adherence to these policies and procedures will indicate minimization of discrimination.

[17] "Forced (compulsory) labor" is defined as all work or service that is extracted from any person under the menace of any penalty for which a person has not offered him/ herself voluntarily or for which such work or service is demanded as a repayment of debt. "Penalty" can imply monetary sanctions, physical punishment, or the loss of rights and privileges or restriction of movement (e.g., withholding of identity documents).

[18] "Bonded labor" is defined as when a person is forced by the employer or creditor to work to repay a financial debt to the crediting agency.

[19] "Discrimination" is defined as any distinction, exclusion, or preferences, which has the effect of nullifying or impairing equality of opportunity or treatment. Not all distinction, exclusion, or preference constitutes discrimination. For instance, a merit- or performance-based pay increase or bonus is not by itself discriminatory. Positive discrimination in favor of people from certain underrepresented groups may be legal in some countries.

7.4 Criteria: Health and safety of workers

INDICATOR	STANDARD
7.4.1 Percentage of workers trained in health and safety practices/ procedures/ policies	100%
7.4.2 Percentage of health- and safety-related accidents and violations recorded and mitigated through corrective actions	100%
7.4.3 Employer responsibility and proof of insurance (accident/ injury) for employee costs in a job-related accident or injury when not covered under national law	100%

Rationale—A safe and healthy working environment is essential for protecting workers from harm. It is critical for a responsible aquaculture operation to minimize these risks. Some of the key risks to employees include hazards resulting from accidents and injury. Consistent and effective employee training in health and safety practices is an important preventative measure. When an accident, injury or violation occurs, the company must record it and take corrective action to identify the root causes of the incident, remediate, and take steps to prevent future occurrences of similar incidents. This addresses violations and also the long-term health and safety risks. Finally, while many national laws require that employers assume responsibility for job-related accidents and injuries, not all countries require this and not all employees (e.g., in some cases, migrant and other workers) will be covered under such laws. When not covered under national law, employers must prove they are insured to cover 100% of employee costs in a job-related accident or injury.

7.5 Criteria: Wages, overtime and working hours

INDICATOR	STANDARD
7.5.1 The percentage of employees who are paid fair and decent wages	100%
7.5.2 Incidences of abuse of working hours and/or overtime laws	0

Rationale—Workers shall be paid fair and equitable wages that, at a minimum, meet the legal and industry-standard minimum basic needs[20] of workers as well as provide some discretionary income. Unfairly compensated workers can be subject to a life of sustained poverty. Certified aquaculture operations shall also demonstrate their commitment to fair and equitable wages by having and sharing a clear and transparent mechanism for wage-setting and a labor conflict resolution policy that tracks wage-related complaints and responses. Company policies and practice shall also prohibit deductions in pay for disciplinary actions, and payments shall be made in a manner convenient to workers. Having these policies outlined in a clear and transparent manner is designed to empower the workers to negotiate effectively for fair and equitable wages that

[20] "Basic needs" includes essential expenses (e.g., food, clean water, clothes, shelter, transportation and education), a discretionary income, and legally mandated social benefits (e.g., health care, medical insurance, unemployment insurance and retirement). A "basic needs" wage enables workers to support the average- size family above the poverty line, based on local prices near the workplace.

will, at a minimum, satisfy basic needs. Revolving labor contract schemes designed to deny long-time workers full access to fair and equitable remuneration and other benefits are prohibited.

Abuse of overtime working hours is a widespread issue in many industries and regions. Workers subject to extensive overtime can suffer consequences in their work/life balance and are subject to higher fatigue-related accident rates. In accordance with better practices, employees in certified aquaculture operations are permitted to work—within defined guidelines—beyond normal work week hours but must be compensated at premium rates[21]. Requirements for time off, working hours and compensation rates as described shall reduce the impacts of overtime.

7.6 Criteria: Freedom of association and right to collective bargaining

INDICATOR	STANDARD
7.6.1 Incidences of employees denied freedom to associate, ability to bargain collectively[22] or have access to representative(s) chosen by workers	0

Rationale—Having the freedom to associate and bargain collectively is a critical right of workers because it allows workers to have a more balanced power relationship with employers when doing such things as negotiating fair compensation. Although this does not mean all workers of a certified aquaculture operation must be in a trade union or similar organization, workers must not be prohibited from accessing such organizations when they exist. If they do not exist or are illegal, companies must make it clear that they are willing to engage in a collective dialogue through a representative structure freely elected by the workers.

7.7 Criteria: Disciplinary Actions

INDICATOR	STANDARD
7.7.1 Incidences of abusive disciplinary actions	0
7.7.2 Evidence of non-abusive disciplinary policies and procedures	Yes

Rationale—The rationale for discipline in the workplace is to correct improper actions and maintain effective levels of employee conduct and performance. However, abusive disciplinary actions can violate workers' human rights. The focus of disciplinary practices shall always be on the improvement of the worker. A certified aquaculture operation shall never employ threatening, humiliating or punishing disciplinary practices that negatively impact a worker's physical and mental[23] health or dignity. Employers that support non-abusive disciplinary practices as described in the accompanying guidance as well as evidence from worker testimony shall indicate that a certified aquaculture operation is not employing abusive disciplinary practices.

[21] "Premium rate" is a rate of pay higher than the regular work week rate that is in compliance with national laws/ regulations and/or industry standards.

[22] "Bargain collectively" is defined as a voluntary negotiation between employers and organizations of workers in order to establish the terms and conditions of employment by means of collective (written) agreements.

[23] Mental abuse is characterized by the intentional use of power, including verbal abuse, isolation, sexual or racial harassment, intimidation, or threat of physical force.

7.8 Criteria: Action response plans/policies

INDICATOR	STANDARD
7.8.1 Evidence of implementation of a corrective action plan (updated annually) that addresses unintended problems associated with labor relations and internal monitoring of labor activities	Yes
7.8.2 Evidence of implementation of an emergency action plan and annual (or more frequent) internal monitoring activities	Yes
7.8.3 Evidence of implementation of a verifiable conflict resolution policy for conflicts and complaints tracked transparently, and proof that conflicts and complaints from employees are responded to within three months after being received	Yes

Rationale—Preparedness, whether for disasters, emergencies or unforeseen incidences is indicative of a responsible tilapia farming operation. Corrective action plans assist in farm management to identify and respond to risks and incidences that are unintended. These plans are required to be updated based upon experiences and incidences.

Emergencies that occur at tilapia farming operations should be prepared for via an emergency action plan. As emerging issues and incidences occur that require an emergency response, producers are required to update and adjust emergency action plans accordingly.

Conflicts will occur on farms amongst various individuals within the company and farm management is required to implement, maintain and update a conflict resolution policy to address conflicts that have occurred or may occur at the operation. Rapid action is indicative of a responsible farm and the ISRTA mandate that farm managers respond to conflicts raised by employees within three months of the notification of a conflict.

7.9 Criteria: Living conditions for employees (if workers are housed on site)

INDICATOR	STANDARD
7.9.1 Evidence that living conditions are clean, sanitary and safe for habitation	Yes

Rationale—The protection of workers that reside or live on the farm's property is an additional liability and benefit for farm operations. To maintain the health and function of workers, farms will provide clean, sanitary and safe living quarters with access to clean water and nutritious meals.

7.10 Criteria: Community relations and interaction

INDICATOR	STANDARD
7.10.1 Evidence that farms are not inhibiting or restricting local community access to public land, freshwater resources or public fishing grounds	Yes
7.10.2 Evidence of implementation of a verifiable conflict resolution policy for conflicts and complaints tracked transparently, and proof that conflicts and complaints from communities are responded to within three months after being received	Yes

Rationale—The siting of farms requires appropriate consultation with communities to understand and address concerns that relate to the blocking of access to either natural or physical assets in the environment where the farm is operating. This is an issue for small-scale farms, as well as large-scale farms, particularly when small-scale farms operating in clusters impede access to assets required for community vitality.

Other conflicts may also occur between producers and surrounding communities. These conflicts shall be addressed through a verifiable conflict resolution policy in which complaints from communities are responded to and addressed in a timely manner. Community rights and interactions with farmers, groups of farmers and corporate farms are complex and often dynamic. The intent of these standards is to enable communities to have a clear and transparent way of interacting with producers and for producers to have frameworks to interact with communities.

8. APPENDIX I: SITE AND RECEIVING WATER CHECKLIST

Table 1. Receiving Water Information Checklist and Evaluation (Standard 2.1.1).

Information	Validation	Present/Absent (√ or X)
Dates of farm establishment and expansion	dd/mm/yyyy	
Size of farm operation being audited (hectares)	ha	
GPS Coordinates of farm being audited	List coordinates	
Satellite imagery of farm	Attach satellite images	
Schematic of farm with specific locations of all water inlets and outfalls	Attach schematic	
Receiving water system type (riverine, estuarine, etc.)	Specify	
Official national government certification that the tilapia species being cultured was established on or before 1 January 2008. In Africa, in the native range of tilapia species, cultured species must be shown to have been recruited from the same population as that existing in the receiving waters on or before 1 January 2008.	List and attach copies of these studies or evidence	
Major characterization studies (excluding EIAs, see below) conducted pertaining to the receiving waters or specific activities conducted on the receiving watershed, if any (published or non published)	List and attach copies of these studies	
Description of the major activities (beyond your operation) impinging on the receiving watershed.	List and attach copies explaining activities	
Environmental Impact Assessment(s) for initial farm siting and for expansion	Attach documents	
Other pertinent information regarding the receiving waters and any effect of farm activities	Attach documents	
Stewardship activities to protect the receiving watershed from pollution	List or attach copies explaining in detail stewardship activities	

9. APPENDIX II: RECEIVING WATER MONITORING

Table 2. Monthly Sampling Regime for Receiving Water Quality Monitoring (Standard 2.5.1). All water samples to be taken from a representative mixture of a 1-meter-depth column of water. All sampling locations will be identified with GPS coordinates on a schematic outline of the farm operations and on available satellite imagery. One sample must be taken within each of the three receiving water categories, but multiple sampling to understand receiving water dynamics is encouraged.

	Receiving Water—Reference point (RWRP#)[2]	Receiving Water—Farm outfall or mixing zone (RWFO#)[3]	Receiving Water—Farm afar (RWFA#)[4]
Receiving Water System (Estuary, lake, etc.)	Specify	Specify	Specify
Monthly Sampling Date/Time[1]	dd/mm/yyyy hh:mm	dd/mm/yyyy and hh:mm	dd/mm/yyyy and hh:mm
Dissolved oxygen(mg/L)	mg/L	mg/L	mg/L
Discharge volume[5]	n/a	m^3/year	n/a
Turbidity(NTU)	NTU	NTU	NTU
Specific conductance(µS/cm)	µS/cm	µS/cm	µS/cm
Chlorophyll a (ug/L)	ug/L	ug/L	ug/L
Secchi disk visibility (cm)	cm	cm	cm
Phosphate-phosphorus (ug/L)	ug/L	ug/L	ug/L
Ammonia-nitrogen(ug/L)	ug/L	ug/L	ug/L

[1]in estuaries and other highly dynamic hydrologic systems, monthly sampling times will be alternated to represent events such as wet and dry seasons, high and low tides, and moon phases (spring and neap tides).

[2]RWRP# is a reference or source point that ideally is not influenced by the farming operation, or is least influenced by the farm. Farms discharging in riverine systems, or cages positioned in riverine systems shall identify a point upstream of farm discharge or activity to serve as the reference point. Cage culture operations in lakes and reservoirs will identify a point in the receiving water that is at the maximum distance from the influence from the farming activities. Estuarine-based farms will select a reference point that is characteristic of the furthest point from the effluent but provides a characterization of the estuarine system.

[3]RWFO# is a point where the farm culture water meets the receiving waters. Because the water inside a cage is a component of the receiving waters, cage operators will sample inside cages. In more point-source pollution oriented operations, this point will be in the mixing zone of farm effluent.

[4]RWFA# is a point where the farm effluent has an influence in the receiving waters but is not in the immediate outfall/mixing zone. This location would be downstream in a river, or down the prevailing current pattern in a lake, reservoir or estuary. # denotes the number of representative samples for a given category, should more than one sample be collected.

[5]In the case of cage culture in lakes or reservoirs, residence time and total water volume are required.

10. APPENDIX III: WATER RESOURCE CALCULATIONS

OXYGEN

Diurnal difference in dissolved oxygen (mg/L) (DDDO): Annual Average Maximum dissolved oxygen (mg/L) in receiving waters—Annual Average Minimum dissolved oxygen (mg/L) in receiving waters during each [24] hour period.

The use of the diurnal fluctuation of dissolved oxygen is a unique measure developed by the TAD. Diurnal oxygen fluctuation will be determined by measuring the surface dissolved oxygen of the receiving waters or culture water (for cages). The annual average difference between daily minimum and daily maximum dissolved oxygen measurements will not be more than 65% of the tabulated dissolved oxygen at saturation for the specific temperature and salinity[24] where the measurements are taken.

Equation 1.

$$DDDO = \left[\frac{\text{maximum dissolved oxygen (mg/L)}}{\text{tabulated dissolved oxygen at saturation}_{max}\text{ (mg/L)}} \times 100\right] - \left[\frac{\text{minimum dissolved oxygen (mg/L)}}{\text{tabulated dissolved oxygen at saturation}_{min}\text{ (mg/L)}} \times 100\right]$$

The percentage fluctuation of diurnal dissolved oxygen relative to saturation (DDDO) will be equal to or less than 65%, according to ISRTA.

PHOSPHORUS

Total phosphorus (P) inputs per metric ton (mt) of fish produced: the amount of phosphorus introduced to the culture environment per mt of fish produced per year. This would include phosphorus added primarily in the form of feed and fertilizer.

Phosphorus inputs per mt of fish produced can be calculated by determining the percent fraction of phosphorus in the input material and multiplying by total amount of input material added to the system per mt fish produced.

The total phosphorus output per metric ton of fish produced is the amount of phosphorus released into the natural environment per mt of fish produced. The main output from tilapia farms would be effluent. However, quantifying the amount of phosphorus in effluents is complicated as a result of various feeding times, different times for drain harvests of ponds, precipitation of phosphorus for particular waters, dissolution of phosphorus for specific waters, specific soil phosphorus absorption conditions and the fact that there is no point-source of effluent from cage operations. Thus, phosphorus not included in fish at harvest would be considered the amount of phosphorus released into the environment. An average P content in tilapia is assumed to be 0.75%[25]. Thus, total phosphorus output can be calculated as follows:

Equation 2. Total P Input/mt – 7.5 kg/mt = kg P/mt

[24] Benson, B.B. and D. Krause Jr. 1984. The concentration and isotopic fractionation of oxygen dissolved in freshwater and seawater in equilibrium with the atmosphere. Limnology and Oceanography. Vol. 29, no. 3, pp. 620-632.

[25] Boyd, C. E., and B. Green. 1998 Dry matter, ash, and elemental composition of pond-cultured tilapia (*Oreochromis aureus and O.* niloticus). *J. World Aquacult. Soc*., 29: 125–128.

NITROGEN

Total nitrogen (N) inputs per metric ton (mt) of fish produced: the amount of nitrogen introduced to the culture environment per mt of fish produced per year. This would include nitrogen added primarily in the form of feed and fertilizer.

Nitrogen inputs per mt of fish produced can be calculated by determining the percent fraction of nitrogen in the input material and multiplying by total amount of input material added to the system per mt fish produced.

The total nitrogen output per metric ton of fish produced is the amount of nitrogen released into the natural environment per mt of fish produced. The main output from tilapia farms would be effluent. However, quantifying the amount of nitrogen in effluents is complicated as a result of various feeding times, different times for drain harvests of ponds, volitalization of nitrogen for particular waters, organic matter decomposition rates and the fact that there is no point-source of effluent from cage operations. Thus, nitrogen not included in fish at harvest would be considered the amount of nitrogen released into the environment. An average N content in tilapia is assumed to be 2.12%[26]. Thus, total nitrogen output can be calculated as follows:

Equation 3. Total N Input/mt – 21.2 kg/mt = kg N/mt

[26] Boyd, C. E., and B. Green. Dry matter, ash, and elemental composition of pond-cultured tilapia (*Oreochromis aureus and O.* niloticus). *J. World Aquacult. Soc*., 29: 125–128 (1998).

11. APPENDIX IV: FEED RESOURCE CALCULATIONS

Economic Feed Conversion Ratio (eFCR): the quantity of feed used to produce the quantity of fish harvested.

Equation 4.

$$\text{eFCR} = \frac{\text{Feed, kg or mt}}{\text{Net aquacultural production, kg or mt (wet weight)}}$$

Feed Fish Equivalency Ratio (FFER): the quantity of wild fish used per quantity of cultured fish produced. This measure can be weighted for fish meal or fish oil, whichever component creates a larger burden of wild fish in feed. In the case of tilapia at current status, the fish meal will be the determining factor for the FFER, thus FFERm is the equation used in the ISRTA.

Equation 5.

$$\text{FFER}_m = \frac{(\%\ \text{fish meal in feed}) \times (\text{eFCR})}{22.2}$$

$$\text{FFER}_o = \frac{(\%\ \text{Fish oil in feed}) \times (\text{eFCR})}{5.0}$$

12. APPENDIX V: EXPLANATION OF FISHSOURCE SCORING

- FishSource (FS) scores capture only some aspects from the fisheries through the lenses of Marine Stewardship Council (MSC); the majority of those aspects that can be measured quantitatively. Other important features of sustainability are addressed elsewhere on FishSource (i.e., on each of the 12 sections that make a fishery profile).
- The key relation between Marine Stewardship Council scoring system and FishSource scores is "80<->8". i.e., a FishSource score of 8 or above would mean an unconditioned passing at that particular aspect on the Marine Stewardship Council system. Sustainable Fisheries Partnership devised scores in a way that, departing from 8, a score of 6 relates to a score of 60, and below 6, an MSC "below 60", "no-pass" condition. Please note however that the MSC criteria have been interpreted through time (former assessment tree) with a substantial degree of variability among fisheries and unfortunately this uncertainty might propagate to our scores on specific cases.
- The MSC system states that "if any PI [lower level criterion – roughly at the FS scores' level] fails to reach 60 *the fishery will be ineligible for certification*." Thus, this might be used as an analogy for FishSource scores below 6.
- Whenever a FishSource score is "na", which denotes the unavailability of information, it should be determined whether this is because of official non disclosure of the information. FishSource staff will work to overcome the data gap and provide a numerical score.
- If a fishery has a score lower than 6 or if the fishery has no score, and in order to help feed source fisheries to improve and become certified, farms should:
    - Communicate in writing to the feed supplier the need for improvements and/or certification in the fishery. Seek written confirmation from the feed supplier about the improvement and/or certification actions that are being taken.
    - The move towards certification can be clearly demonstrated, for instance, by undertaking an MSC pre-assessment, or the formation of a client group to undertake an MSC full-assessment.
    - Assess the improvement progress by confirming whether or not the FishSource Scores are rising, and/or whether certification is announced.


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