Aquaculture Facility Certification

Tilapia Farms

Best Aquaculture Practices
Certification Standards, Guidelines,
Sample Application/Audit

Community • Environment • Food Safety • Traceability

Tilapia Farms
Certification Application/Audit

INSPECTION INFORMATION – Download Electronic Form to Apply

The following questions comprise both the application form and audit for farms that apply for Best Aquaculture Practices certification. They are provided to help facilities prepare for the application process and subsequent site inspection.
To apply for certification, download and return the electronic Application Form at www.aquaculturecertification.org.

ANSWER ALL OF THE QUESTIONS. See scoring system below to perform a self-audit on the right side of the form. Following your facility's site inspection, the BAP evaluator will determine a final score based on three categories of questions:

- **Critical questions** (indicated by "C" mark) are mandatory for certification and graded as pass or fail during the inspection and review process.
- **Scored questions** (indicated by "S" mark) are assigned 0 to 3 points with the following values: 0 = Unsatisfactory, 1 = Needs major improvement, 2 = Needs minor improvement, 3 = Satisfactory.
- **Informational questions** (indicated by "I" mark) provide required data, but no score is assigned.

To be certified, applicants must comply with all (100%) of the critical inspection requirements, score at least 70% (80 of 114 points) on the scored inspection requirements and maintain specified production records for traceability for at least three months. If a facility fails any critical elements, it will not be certified, regardless of its score otherwise. After five years, certified facilities shall comply with all critical requirements and score 80% or better on the scored requirements.

Score	
Critical (P/F)	Scored (0-3)

1. Property Rights and Regulatory Compliance

C 1.1: Are current documents available to prove legal land and water use by your facility? _____ Yes _____ No

I 1.1.1: List the documents you will present. (Confirmed during inspection.)

____

____

C 1.2: Are current documents available to prove all business and operating licenses have been acquired by your facility? _____ Yes _____ No

I 1.2.1: List the documents you will present. (Confirmed during inspection.)

____

____

C 1.3: Are current documents available to prove compliance with applicable environmental regulations for construction and operation? _____ Yes _____ No

I 1.3.1: List the documents you will present. (Confirmed during inspection.)

____

____

2. Community Relations

C 2.1: Does your facility accommodate local inhabitants by not blocking traditional access routes to fishing grounds, wetland areas and other public resources? (Prepare to provide area map showing property lines, fences, canals, ditches and other barriers. Evaluator may interview members of local community.) _____ Yes _____ No

S 2.2: Does your facility manage its water usage to avoid restricting the amount of water available to other users? _____ Yes _____ No

Subtotal	Subtotal

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Rev. 9/09

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Score	
Critical (P/F)	Scored (0-3)

S 2.3: List meetings, committees, correspondence, service projects or other activities that show your facility is committed to regular interaction with the local community to avoid or resolve conflicts.

____

____

3. Worker Safety and Employee Relations

I 3.1: What is the minimum wage rate, including benefits, required by local and national labor laws?

Rate and currency ____________________ per time period ____________________
(e.g., hour, day, week, month)

C 3.2: Does your facility meet or exceed these wage and benefit requirements? (Present documentation during inspection.) _____ Yes _____ No

C 3.3: Does your facility comply with national labor laws? (Present documentation during inspection.) _____ Yes _____ No

S 3.4: Does your facility provide employee housing that meets local and national standards (e.g., water-tight structures, adequate space, heating/cooling)? (Confirmed during inspection.) _____ Yes _____ No _____ Does Not Apply

S 3.5: Is safe drinking water readily available to employees? (Confirmed during inspection.) _____ Yes _____ No

S 3.6: Are running water, toilet and shower facilities readily available to employees? (Confirmed during inspection.) _____ Yes _____ No

S 3.7: Are living areas free of accumulated trash and garbage? (Confirmed during inspection.) _____ Yes _____ No

S 3.8: Briefly describe the basic medical care provided by your facility, including access to or communication with medical authorities in case of emergencies or accidents. (Confirmed during inspection.)

____

____

S 3.9: Is an emergency response plan prepared for serious illnesses or accidents? (Confirmed during inspection.) _____ Yes _____ No

S 3.10: Briefly describe what training in general health, safety, first aid, contamination risks and proper disposal of potentially dangerous compounds is provided to employees. (Confirmed duinrg inspection.)

____

____

S 3.11: List the protective gear and equipment provided for employees (e.g., eye protection for welding, gloves for shop work, boots for wet areas). (Confirmed during inspection.)

____

____

S 3.12: Is a first aid kit readily available to employees? (Confirmed during inspection.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

4. Wetland Conservation and Biodiversity Protection

I 4.1: Has net loss of sensitive wetland habitat occurred on facility property since 1999? _____ Yes _____ No
(If no, do not answer questions 4.1.1 and 4.1.2. Evaluator will adjust final score.)

C 4.1.1: Were the wetlands removed for allowable purposes? _____ Yes _____ No

C 4.1.2: Was the removal mitigated by restoring an area three times as large or donation to restoration? _____ Yes _____ No

I 4.1.2.1: Removal was mitigated by creating or replanting a viable wetland area of __________ square meters on or near farm

I 4.1.2.2: Removal was mitigated by contribution of U.S. $ _____________ to Restoration Program ______________________________

S 4.2: Has your facility practiced unrequired wetland creation or restoration in abandoned production areas or elsewhere? (Documentation required.) _____ Yes _____ No

I 4.2.1: How was the stewardship demonstrated? (Documentation required.)

I 4.2.1.1: Wetland creation or restoration of __________ square meters on or near farm

I 4.2.1.2: Contribution of U.S. $ _______________ to Restoration Program ______________________________

C 4.3: Has your farm avoided dredge and fill activities aimed at increasing the area available for pond construction? (Documentation required.) _____ Yes _____ No

C 4.4: Are screens installed on both water inlet and water outlet pumps or pipes? (Confirmed during inspection.) _____ Yes _____ No

S 4.5: Does your facility use humane, nonlethal methods of predator control? _____ Yes _____ No

C 4.6: Does your farm obey laws related to the destruction of birds and other predators? _____ Yes _____ No

S 4.7: Are measures taken to control erosion and other impacts caused by outfalls? (Confirmed during inspection.) _____ Yes _____ No

S 4.8: Does your facility adequately monitor the impacts of discharges on benthic biodiversity, using routine sampling and comparison with control sites? (Documentation required.) _____ Yes _____ No _____ Does Not Apply

S 4.8:1: If negative impacts are detected, are measures taken to allow benthic communities to recover (e.g., fallowing at cage sites, movement of outfalls for raceways, effluent treatment)? _____ Yes _____ No _____ Does Not Apply

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

5. Effluent Management

I 5.1: Does your facility operate within an irrigation system such that effluent water, or the water that flushes cages or net pens, is exclusively destined to irrigate agricultural crops? (Confirmed during insection.) If yes, Standard 5 does not apply — proceed to Standard 6. If no, answer the Standard 5 questions below for your facility's type of culture system. _____ Yes _____ No

I 5.2: Does your facility avoid all regular or temporary discharges of effluents into natural water bodies, for example, by reusing all water? (Confirmed during insection.) If yes, Standard 5 does not apply — proceed to Standard 6. If no, answer the Standard 5 questions below for your facility's type of culture system. _____ Yes _____ No

Land-Based Farms

(Including cages and net pens in privately owned ponds that discharge into public waters)

C 5.3: Are records on intake water and effluent monitoring maintained and available? (Confirmed during inspection.) _____ Yes _____ No

C 5.4: Do effluent water quality concentrations comply with BAP water quality criteria, or if it was not possible to comply with BAP criteria because of high concentrations in the intake water, do concentrations reflect no increase between intake and discharge? (Confirmed during inspection.) _____ Yes _____ No

Note: Water quality measurements taken during certification inspection must meet BAP's initial criteria as outlined in the Guidelines for Standards — except as excluded above — and those of applicable government permits. Farms must continue compliance with these criteria to maintain certification and comply with BAP's final criteria within five years.

I 5.5: If effluent data is available for less than a full year, how long was this period? ______________________
(* Minimum three months data required for initial inspection.)

I 5.6: What was your facility's estimated annual water use during the last calendar year? (cubic meters) ______________________

I 5.7: What were the average annual concentrations for each variable for effluents that entered natural bodies of water at your facility during the last calendar year? (Confirmed during inspection.)

		Evaluator Sample
I 5.7.1: pH (standard units)	____________	____________
I 5.7.2: Total suspended solids (mg/L)	____________	____________
I 5.7.3: Soluble phosphorus (mg/L)	____________	____________
I 5.7.4: Total ammonia nitrogen (mg/L)	____________	____________
I 5.7.5: 5-day biochemical oxygen demand (mg/L)	____________	____________
I 5.7.6: Dissolved oxygen (mg/L)	____________	____________
I 5.7.7: Chloride (mg/L)	____________	____________

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

5.8: **(For Evaluator Only)** What volume of effluent water was discharged on the day the readings to right were taken? ________________

5.9: **(For Evaluator Only)** What were the concentrations for each variable for the source water that entered the farm on the day of the inspection?

		Evaluator Sample
5.9.1: pH (standard units)	________________	________________
5.9.2: Total suspended solids (mg/L)	________________	________________
5.9.3: Soluble phosphorus (mg/L)	________________	________________
5.9.4: Total ammonia nitrogen (mg/L)	________________	________________
5.9.5: 5-day biochemical oxygen demand (mg/L)	________________	________________
5.9.6: Dissolved oxygen (mg/L)	________________	________________
5.9.7: Chloride (mg/L)	________________	________________

5.10: **(For Evaluator Only)** What volume of source water entered the farm for processing on the day the readings to right were taken? ________________

Cages, Net Pens — Lakes, Reservoirs

C 5.11: Does the water quality of the lake or reservoir, including its discharge point, meet the BAP effluent water quality criteria? (Confirmed during inspection) _____ Yes _____ No

I 5.12: What is the approximate hydraulic retention time of the lake or reservoir? ________________

I 5.13: Is your facility located in an embayment within the lake or reservoir? (Confirmed during inspection.) _____ Yes _____ No

C 5.14: Does the facility maintain accurate records of daily feed inputs that reflect compliance with the BAP maximum allowable daily feed Input levels? (Confirmed during inspection.) _____ Yes _____ No

I 5.15: Do cage or net pen facilities other than yours operate in the lake or reservoir? _____ Yes _____ No

I 5.15.1: List the other operations and indicate their scale (mt/yr) and estimated mean feeding rates (kg/ha/day).

____

____

C 5.15.2: Is it true that the total feed input for all culture operations on the lake or reservoir does not exceed the BAP maximum allowable daily feed input? _____ Yes _____ No

C 5.16: Are water quality-monitoring records available as specified? (Documentation required.) _____ Yes _____ No

C 5.17: Do water quality variables meet the BAP effluent water quality criteria at the specified sampling stations and the water body's discharge point? (Confirmed during inspection.) _____ Yes _____ No

C 5.18: Are water quality-monitoring records applied in the management of feeding rates when dissolved-oxygen levels are consistently below 5 mg/L in the early morning? (Documentation required.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

C 5.19: Are water quality-monitoring records applied in the management of feeding rates when mean annual Secchi disk visibility decreases by 25% since initial certification? (Documentation required.) _____ Yes _____ No

C 5.20: Are water quality-monitoring records applied in the management of feeding rates when blue-green algae comprise more than 60% of total phytoplankton? (Documentation required.) _____ Yes _____ No

C 5.21: Are water quality-monitoring records applied in the management of feeding rates when the thermocline becomes 25% shallower since initial certification?? (Documentation required.) _____ Yes _____ No

Cages, Net Pens — Streams

C 5.22: Are monthly records of upstream and downstream total ammonia nitrogen and soluble phosphorus concentrations available? (Documentation required.) _____ Yes _____ No

C 5.23: Are maximum daily feeding rates managed such that downstream concentrations of nutrients do not exceed upstream concentrations by more than 25%? (Confirmed during inspection.) _____ Yes _____ No

Cages, Net Pens — Estuaries

C 5.24: Do feeding records demonstrate that the maximum feeding rate of 7.5 kg/ha/day is not exceeded? (Documentation required.) _____ Yes _____ No

C 5.25: Are water quality-monitoring records maintained as specified, except the requirements for sampling each 2 m to locate the thermocline and to measure chlorophyll a, Secchi disk visibility and phytoplankton? (Documentation required.) _____ Yes _____ No

C 5.26: Do water quality variables meet the BAP effluent water quality criteria at the specified sampling stations? (Confirmed during inspection.) _____ Yes _____ No

6. Fishmeal and Fish Oil Conservation

C 6.1: Does your farm use feed that indicates its content of key nutrients to allow determination of an adjusted marine product inclusion rate? (Confirmed during inspection.) _____ Yes _____ No

I 6.2: What was your facility's average annual feed-conversion ratio during the last calendar year? ______________________

I 6.3: What was your facility's average annual fish-in:fish out ratio during the last calendar year? ______________________

7. Soil and Water Conservation

I 7.1: Are ponds at your facility constructed on permeable soil? (Confirmed during inspection.) _____ Yes _____ No

C 7.1.1: Are measures taken to control seepage and avoid contamination of aquifers, lakes, streams and other natural bodies of freshwater? (Observation of salt-sensitive vegetation, monitoring of on-farm well water, interviews with local community.) _____ Yes _____ No

C 7.2: Does quarterly monitoring of neighboring well and surface water show that chloride levels are not increasing due to farm operations? (Confirmed during inspection.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
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I 7.3: Does your farm use well water in culture systems? (Confirmed during inspection.) _____ Yes _____ No

S 7.3.1: Are water levels in nearby wells monitored by regulatory agencies to establish that aquaculture is not lowering the water table? (Documentation required.) _____ Yes _____ No

S 7.4: Is it true that use of water from wells, lakes, streams, springs or other natural sources has not caused ecological damage or subsidence in surrounding areas? (Confirmed during inspection.) _____ Yes _____ No

S 7.5: Are ponds managed to minimize water use through seine harvesting and other practices that result in major pond draining only at up to seven-year intervals? _____ Yes _____ No

8. Control of Escapes, Use of GMOs

I 8.1: What fish species is/are cultured at your facility?

____

____

I 8.2: Are any of these fish non-native species? _____ Yes _____ No

I 8.2.1: List the non-native species.

____

____

I 8.3: Is governmental approval required for importation or use of the above species? _____ Yes _____ No

C 8.3.1: Does your facility comply with these government regulations? _____ Yes _____ No _____ Does Not Apply

I 8.3.1.1: List the documents you will present. (Confirmed during inspection.)

____

____

C 8.4: Are screens sized to retain the smallest animals present installed on water outlet pumps, pipes or sluices? (Confirmed during inspection.) _____ Yes _____ No

C 8.5: Are all incidents involving fish escapes accurately documented? (Documentation required.) _____ Yes _____ No

9. Storage and Disposal of Farm Supplies

C 9.1: Are fuel, lubricants and agricultural chemicals stored and disposed of in a safe and responsible manner? (Confirmed during inspection.) _____ Yes _____ No

S 9.2: Is it true that fuels, lubricants and agricultural chemicals are not stored near feed, in employee housing or kitchen areas, or near harvest equipment and supplies? (Confirmed during inspection.) _____ Yes _____ No

S 9.3: Are fuel, lubricants and agricultural chemical storage areas marked with warning signs and are precautions taken to prevent spills, fires and explosions? (Confirmed during inspection.) _____ Yes _____ No

S 9.4: Is garbage from housing and food waste retained in water-tight receptacles with covers to protect contents from insects, rodents and other animals? (Confirmed during inspection.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

S 9.5: Briefly describe how garbage and other solid waste is disposed of to comply with local regulations and avoid environmental contamination (e.g., recycling, burning, composting or placing in a landfill). (Confirmed during inspection.)

____

____

S 9.6: Describe the measures taken to prevent infestation by animal and insect vectors and pests. (Confirmed during inspection.)

____

____

S 9.7: Does secondary fuel containment conform to BAP guidelines for fuel storage? (Confirmed during inspection.) _____ Yes _____ No

10. Animal Welfare

C 10.1: Does your facility apply a maximum biomass limit based on tilapia health and survival records? (Confirmed during inspection.) _____ Yes _____ No

I 10.1.1: The maximum biomass is set at ________________ kilograms/cubic meter.

S 10.2: Is feeding managed to avoid stress through underfeeding or overfeeding? (Confirmed during inspection.) _____ Yes _____ No

S 10.3: Does your facility apply maximum periods for fasting, crowding and time out of water? (Confirmed during inspection.) _____ Yes _____ No

I 10.3.1: The maximum fasting period is ________________ hours.

I 10.3.2: The maximum crowding period is _______________ minutes.

I 10.3.3: The maximum time out of water is ______________ seconds.

S 10.4: Are regular inspections of the culture facility, water quality, and behavior and condition of fish performed? (Confirmed during inspection.) _____ Yes _____ No

S 10.5: Are disease outbreaks managed through rapid diagnosis and treatment (including vaccination by trained staff) and, when necessary, humane slaughter? (Confirmed during inspection.) _____ Yes _____ No

S 10.6: When ill, deformed or unmarketable tilapia and unwanted species are removed, are they killed by humane techniques and the carcasses disposed of responsibly? (Confirmed during inspection.) _____ Yes _____ No

11. Drug and Chemical Management

S 11.1: Does the farm have a written health management plan that includes procedures to avoid the introduction of diseases, protocols for water quality management and fish health-monitoring and disease diagnosis techniques? (Documentation required.) _____ Yes _____ No

C 11.2: If used, are drug treatments based on recommendations and authorizations overseen by a fish health specialist only to treat diagnosed diseases in accordance with instructions on product labels and national regulations? _____ Yes _____ No _____ Do Not Use

C 11.3: Is it true that any antibiotics or chemicals banned or unapproved in the producing or importing country are not used in feeds, pond additives or any treatment that could result in residue in fish? (Confirmed during inspection.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)

C 11.4: Is documentation available from feed manufacturers that antibiotics or other drugs are not present in non-medicated feed used at the farm? (Documentation required.) _____ Yes _____ No

I 11.5: Are medicated feeds used at your facility? (Confirmed during inspection.) _____ Yes _____ No

C 11.5.1: Are medicated feeds offered in accordance with product labels? (Documentation required.) _____ Yes _____ No

C 11.6: Is it true that your farm does not use antibiotics or hormones as growth promoters? (Confirmed during inspection.) _____ Yes _____ No

S 11.7: Are all male fry obtained by methods other than the use of methyl testosterone or other hormones? (Confirmed during inspection.) _____ Yes _____ No

C 11.8: Do workers wear protective clothing and masks with air filters when handling hormones? (Confirmed during inspection.) _____ Yes _____ No _____ Do Not Use

S 11.9: Has a survey of chemical use been conducted to identify potential contaminants such as pesticides, PCBs and heavy metals in the surrounding watershed? (Documentation required.) _____ Yes _____ No

12. Microbial Sanitation

I 12.1: Briefly describe how domestic sewage is treated to avoid contamination of surrounding areas (e.g., sewer system, septic system, portable toilet, outhouse). (Confirmed during inspection.)

____

____

C 12.1.1: Is human waste/sewage disposed of responsibly to prevent entry into water canals, ponds or nearby water bodies? (Confirmed during inspection.) _____ Yes _____ No

C 12.2: Is it true that human waste and untreated animal manure are not used to fertilize ponds? (Confirmed during inspection.) _____ Yes _____ No

S 12.3: Is it true that uncooked organisms are not used as feed in growout ponds at your facility? (Confirmed during inspection.) _____ Yes _____ No

13. Harvest and Transport

S 13.1: Are fish harvested and transported in a manner that maintains temperature control and minimizes stress? (Confirmed during inspection.) _____ Yes _____ No

S 13.2: Are equipment and containers used to harvest and transport fish clean and free of lubricants, fuel, metal fragments and other foreign material? (Confirmed during inspection.) _____ Yes _____ No

S 13.3: Is the adequacy of transport methods assessed through documented mortality rates? (Documentation required.) _____ Yes _____ No

S 13.4: Is the duration of live fish transport kept below 12 hours to minimize stress? (Confirmed during inspection.) _____ Yes _____ No

C 13.5: Is it true that nonapproved chemicals are not applied directly or indirectly during transport? (Confirmed during inspection.) _____ Yes _____ No

Subtotal	Subtotal

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Score	
Critical (P/F)	Scored (0-3)
Subtotal	Subtotal

Traceability Requirement

C Are traceability records maintained via the BAP-approved online traceability system for each of the specified parameters for every production unit and every production cycle to allow tracing of fish back to the unit and inputs of origin? (Confirmed during inspection.) _____ Yes _____ No

I What internal system does your facility use to maintain traceability data as defined in the Guidelines for Standards?

____

____

____

Final Scoring — For Offical Use After Inspection

Evaluator:

I have applied the Best Aquaculture Practices guidelines to the best of my ability in completing the site inspection and assign the following score for this facility.

[ ]	**Irrigation System, No Discharge** Passed Critical Questions x 3.449 =	[ ] %	(Must pass all 29 items for 100%.)
[ ]	**Land-Based Farms** Passed Critical Questions x 3.226 =	[ ] %	(Must pass all 31 items for 100%.)
[ ]	**Cages, Net Pens — Lakes, Reservoirs** Passed Critical Questions x 2.632 =	[ ] %	(Must pass all 38 items for 100%.)
[ ]	**Cages, Net Pens — Streams** Passed Critical Questions x 3.226 =	[ ] %	(Must pass all 31 items for 100%.)
[ ]	**Cages, Net Pens — Estuaries** Passed Critical Questions x 3.125 =	[ ] %	(Must pass all 32 items for 100%.)
[ ]	Total Scored Points x 0.877 =	[ ] %	(Must initially score at least 70%, then 80% or more after five years.)

Final Score	
Pass	Fail

ACC Evaluator Signature ______________________________ Date ____________

Farm Representative:

I had the opportunity to participate in the ACC site inspection and understand the score assigned.

Farm Representative Signature ______________________________ Date ____________

Note: Certification is not complete until payment is received for all ACC and evaluator fees.

Evaluator Comments — Attach additional sheets, if needed.

GUIDELINES – TILAPIA FARMS

The following guidelines provide perspective and clarification for the Best Aquaculture Practices farm certification standards referenced in the Certification Application Form. The application form and guidelines were designed to assist program applicants in performing environmental and social impact assessments of their tilapia production facilities and developing management systems for compliance with the certification standards.

The word "shall" is used throughout these guidelines to indicate mandatory provisions. For further information, please refer to the additional resources listed.

Standard 1 – Community
Property Rights and Regulatory Compliance

Farms shall comply with local and national laws and environmental regulations, and provide current documentation that demonstrates legal rights for land use, water use, construction, operation and waste disposal.

Reasons for Standard

Certified farms shall comply with applicable business-related laws and environmental regulations, including those concerning protection of sensitive habitats, effluents, operation of landfills and predator control. These regulations are needed to assure that farms provide pertinent information to governments and pay fees to support relevant programs. The BAP program requires compliance because it recognizes that not all governmental agencies have sufficient resources to effectively enforce laws.

Some tilapia farms have been sited in water bodies or on land to which farm owners do not have legal right. Such farms are usually found in undeveloped areas under government ownership where land use is poorly controlled. This land may be occupied by landless people or used by coastal communities for hunting and gathering. Water bodies in which cages have been installed can be an important fishery for local people. These waters can also have other important uses for domestic water supplies, irrigation, recreation or tourism. Unauthorized installation of farms can displace landless people and interfere with the use of resources by local communities.

Implementation

Regulations regarding the operation and resource use of farms vary significantly from place to place. Among other requirements, such laws can call for:

- business licenses
- aquaculture licenses
- land deeds, leases or concession agreements
- land use taxes
- construction permits
- water use permits (including concessions to install cages or net pens in water bodies)
- effluent permits
- predator control permits
- well operation permits
- protection of wetlands or other sensitive habitats
- environmental impact assessments.

BAP evaluators cannot know all laws that apply to tilapia farming in all nations. Participating farms have the responsibility to obtain all necessary documentation for siting, constructing and operating their facilities.

Assistance in determining these necessary permits and licenses can be sought from governmental agencies responsible for agriculture, environmental protection, fisheries and aquaculture, water management, and transportation, as well as local aquaculture associations. BAP evaluators must also become familiar with the legal requirements within the areas they service.

The BAP program imposes repeated environmental audits on participating facilities. It strengthens existing regulations that may require aquaculture facilities to perform environmental impact assessments before beginning construction and to comply with effluent standards or other regulations during operation.

During the BAP site inspection, the representative of the farm shall present all necessary documents to the evaluator. All documents shall be current, and farms shall be in compliance with the requirements stipulated by the documents. For example, if a farm has an effluent discharge permit with water quality standards, those standards shall be enforced. In cases where governmental agencies have waived one or more permits, proof of these waivers shall be available.

Standard 2 — Community
Community Relations

Farms shall strive for good community relations and not block access to public areas, common land, fishing grounds or other traditional natural resources used by local communities.

Reasons for Standard

Aquaculture farms are often located in rural areas, where some individuals may rely on varied natural resources to supplement their livelihoods. Some local residents benefit from employment or infrastructure improvements associated with large-scale aquaculture development, but others may face limited access to areas used for fishing, hunting, gathering, domestic water supply or recreation.

Implementation

Farm management should accommodate traditional uses of natural resources through a cooperative attitude toward established local interests and environmental stewardship. Farms shall not block traditional access corridors to public spaces and fishing grounds. In some cases, it may be necessary to provide designated access routes across a farm.

To avoid conflicts with local communities, farms are encouraged to communicate with local leaders by telephone, written correspondence, meetings or other means.

During facility inspection, the evaluator may verify compliance with this standard through examination of maps that define public and private zones; on-site inspection of fences, canals and other barriers; and interviews with local people and farm workers. The evaluator should select the individuals for interview, rather than being provided a group of interviewees by farm management.

Standard 3 — Community
Worker Safety and Employee Relations

Farms shall comply with local and national labor laws to assure adequate worker safety, compensation and, where applicable, on-site living conditions.

Reasons for Standard

Farm work is potentially dangerous because of the types of machinery employed, the risks of drowning and electrocution, and the use of potentially hazardous materials. Workers are not always highly educated, and safety instruction may not be adequate.

Much aquaculture takes place in developing nations where pay scales are low and wage or labor laws may not be consistently enforced. Large farms that employ several hundred workers commonly provide on-site living quarters, which must provide decent living conditions.

Implementation

At a minimum, certified farms shall provide legal wages, a safe working environment and adequate living conditions. Evaluators must take into account national regulations and local standards to evaluate this aspect. Efforts should be made to exceed the minimum requirements, because certified farms should be progressive and socially responsible.

Staff should be given initial training, as well as regular refresher training, on safety in all areas of farm operations. Workers should also be trained in the first aid of electrical shock, profuse bleeding, drowning and other possible medical emergencies. Safety equipment such as goggles, gloves, hard hats, life jackets and ear protection, should be provided when appropriate. A plan shall be available for obtaining prompt medical assistance for injured or ill workers.

Living quarters should be well ventilated and not overcrowded or exposed to safety hazards. They should provide adequate shelter and clean shower and toilet facilities. Food services, if provided, should provide wholesome meals for workers, with food stored and prepared in a hygienic manner and served for prices that do not exceed local standards. Trash and garbage should not accumulate in living, food preparation or dining areas (see Standard 9). Opportunities for recreation during off-duty hours should be available.

During facility inspection, the evaluator will evaluate whether conditions comply with labor laws. The evaluator will also interview a random sample of workers to obtain their opinions about wages, safety and living conditions. Any discrepancies will be investigated.

Standard 4 — Environment
Wetland Conservation And Biodiversity Protection

Aquaculture facilities shall not be located in mangrove or other sensitive wetland areas where they displace important natural habitats. Farm operations shall not damage wetlands or reduce the biodiversity of other ecosystems. Wetland area removed for allowable purposes shall be mitigated.

Reasons for Standard

Mangroves and other wetlands are important components of many coastal and inland ecosystems. They represent important breeding and nursery grounds for many aquatic species, and provide habitat for birds and other wildlife. Wetlands have an important role in improving the quality of water runoff before it enters streams, lakes or estuaries. Wetlands, and mangrove areas in particular, protect coastal areas from heavy winds, waves and storm surges. Both coastal and inland wetlands are also an important resource to local people.

Farm operations have the potential to alter aquatic ecosystems and cause a decline in biodiversity through wetland destruction, lethal predator control and eutrophication. Erosion and sedimentation at farm outfalls can have adverse impacts on benthic biodiversity.

Implementation

Farm construction shall take place outside areas with sensitive wetland vegetation. The most reliable way of delineating wetland areas is by the type of vegetation present.

In coastal zones, aquaculture ponds should be located behind mangrove areas on land that is above the average tidal zone and inundated no more than a few times per month by the highest tides. Particular care should be taken to assure that hydrological conditions are not altered in a way that deprives mangroves or other coastal wetland vegetation of contact with seawater or brackish water.

Certified farms shall not discharge effluents into mangrove or wetland areas to effect water treatment unless monitoring at the point of entry shows that total suspended solids concentrations comply with the limits in Standard 5.

Farms shall not dredge or fill in sensitive wetlands or wetland buffers to increase the area available for pond construction. Excessive pond construction on a flood plain can reduce the cross-sectional area of flow and increase flood levels and water velocities. This can result in water overtopping pond embankments, erosion of farm earthwork and damage to other property on the flood plain. The problem usually can be avoided if not more than 40% of the flood plain is blocked by pond embankments.

It is sometimes necessary during construction to remove wetland vegetation to access water supplies and for drainage. This practice is allowed, provided no local regulations prohibit it. However, farms shall mitigate the damage to wetland vegetation. The most reliable procedure is to contribute to wetland restoration programs, for farm operators may not have suitable habitat and expertise for creating wetland areas.

Farms shall obey laws related to the destruction of birds and other predators. Where applicable, permits and records should be available. The BAP program strongly encourages farms to employ humane, nonlethal measures for predator control, even when lethal methods are permitted. Farms should record all predator mortalities (species and numbers). Additionally, all species listed by the World Conservation Union red list or protected by local or national laws are not subject to control by any means.

At land-based farms supplied with water from natural sources, screens shall be installed on the intakes of water pumps to prevent impingement of aquatic animals. Screens shall also be installed on water outlets to minimize the escape of farm animals.

Discharges from cage, net pen and raceway facilities can have adverse impacts on benthic biodiversity. These impacts occur beneath cages, within net pens and at raceway outfalls. Impacts on macrozoobenthos should be routinely assessed according to a benthic monitoring plan for measuring biomass and species diversity within the discharge area and at representative control sites.

Negative benthic impacts often can be mitigated by fallowing. This involves moving the outfall of raceways to a nearby area or moving cages or net pens to another location to allow time for the disturbed benthic communities to recover. If this is not possible or does not remediate the problem, treatment of raceway effluents or reduction in the number of cages or pens per site will be necessary. At sites with multiple operators, prevention of negative benthic impacts may require cooperation among neighboring farms.

During initial inspection, the evaluator will record farm areas occupied by wetland vegetation. If dying wetland vegetation is observed around farms, the evaluator will deterine if the mortality is the result of farm operations. If it is, a warning will be issued and the deficiency shall be corrected for continuation of certification. Wetland removal for unapproved purposes or failure to mitigate allowable removal will result in loss of certification.

Farms formerly constructed in wetland areas are encouraged to demonstrate environmental stewardship by re-establishing wetland vegetation or by contributing to wetland rehabilitation projects. When ponds constructed in former wetland areas are closed, embankments should be breached to restore natural water flow so that wetland vegetation can reestablish.

Prevention of erosion avoids resedimentation of soil material from effluents downstream from farms. Sedimentation can also result from the settling of particles in pond effluents.

The control of erosion from effluent involves reducing the impact energy of discharges upon soil and reducing water velocity in ditches to prevent scouring. Drainpipes should extend at least 1 m beyond embankments at an elevation near the ditch bottom. The pipe outlet area should be protected with a splash shield or riprap to reduce effluent energy. Drainpipes that discharge directly into streams should extend over the stream bank to prevent erosion and be located near the stream's normal water level.

For Additional Information

Environmental Impacts of Tilapia
R. S. V. Pullin et al. — 1997
ICLARM Contribution No. 1350

Standard 5 — Environment

Effluent Management

Farms shall monitor their effluents to confirm compliance with BAP effluent water quality criteria*. In lakes, reservoirs and estuaries, operations shall comply with feeding rate limits.

Water quality measurements taken during certification inspection shall meet both BAP criteria and those of applicable government permits. Facilities shall comply with BAP's final criteria within five years.

BAP Water Quality Criteria — Land-Based Tilapia Farms

Variable (units)	Initial Value	Final Value (after 5 years)	Collection Frequency
pH (standard units)	6.0-9.5	6.0-9.0	Monthly
Total suspended solids (mg/L)	50 or less	25 or less	Quarterly
Soluble phosphorus (mg/L)	0.5 or less	0.3 or less	Monthly
Total ammonia nitrogen (mg/L)	5 or less	3 or less	Monthly
5-day biochemical oxygen demand (mg/L)	50 or less	30 or less	Quarterly
Dissolved oxygen (mg/L)	4 or more	5 or more	Monthly
Chloride Water with less than 1 ppt salinity, specific conductance below 1,500 μmhos/cm or chloride less than 550 mg/L is considered fresh.	No discharge above 800 mg/L chloride into freshwater	No discharge above 550 mg/L chloride into freshwater	Monthly

* **Limited Option:** The source water for aquaculture farms can have higher concentrations of water quality variables than allowed by the initial criteria. In these cases, demonstration that the concentrations of the variables do not increase (or decrease for dissolved oxygen) by more than the final values between the source water and farm effluent is an acceptable alternative to compliance with the criteria. This option does not apply to pH, dissolved oxygen and chloride.

BAP Water Quality Monitoring — Cages and Net Pens in Lakes and Reservoirs

Variable	Sample Depth	Collection Frequency
Temperature	Vertical profile, 2-m intervals	Monthly
Dissolved oxygen	Vertical profile, 2-m intervals	Monthly
pH	Equal to cage middepth	Quarterly
Chorophyll a	Equal to cage middepth	Quarterly
5-day biochemical oxygen demand	Equal to cage middepth	Quarterly
Secchi disk visibility	Not applicable	Weekly
Soluble phosphorus	Equal to cage middepth	Quarterly
Total ammonia nitrogen	Equal to cage middepth	Quarterly
Phytoplankton abundance and species	Equal to cage middepth	Quarterly

Additional Data

After the first year of effluent monitoring, ACC will also use data provided by facilities' application forms to calculate:

- an annual water use index, determined as described below.
- annual load indices for total suspended solids, soluble phosphorus, total ammonia nitrogen and five-day biochemical oxygen demand, determined as described below.

Load indices for nitrogen and phosphorus will be estimated for cage and net pen culture operations in lakes and reservoirs.

Reasons for Standard

Only a portion of the nutrients added to aquaculture facilities to increase production is converted to animal tissue. The remainder becomes waste that can cause increased concentrations of nutrients, organic matter and suspended solids in and around culture systems.

Land-based farms discharge effluents during water exchange or when growout units are cleaned or drained for harvest. Wastes from cages and net pens pass directly into the receiving water bodies. Effluents can contain nitrogen, phosphorus, suspended solids and organic matter at greater than ambient concentrations.

The substances in effluents can contribute to eutrophication, sedimentation and high oxygen demand in receiving water. Effluents with low dissolved oxygen concentrations or high pH can negatively affect aquatic organisms in receiving water bodies.

Implementation

This standard is designed to demonstrate that compliance with other BAP standards through the application of good management practices is effective in reducing the volume and improving the quality of farm effluents. The water quality criteria also assure that effluents from aquaculture facilities have no greater concentrations of pollutants than typically allowed for effluents from other point sources.

Where possible, farms should adopt practices that reduce effluent volume, such as harvesting by seining rather than draining, and maintaining water quality by mechanical aeration rather than pond flushing.

Applicants in the BAP program shall maintain records for effluent data (see sample forms on pages 18-19. To confirm compliance with BAP water quality criteria at farms, the evaluator will sample effluents during the inspection process and have them analyzed by an independent laboratory.

Sampling — Land-Based Farms

- Samples shall be collected near the point where effluents enter natural water bodies or exit the farm property. A water control structure at the sampling site or suitable sampling method should be used to prevent mixing of effluent and water from the receiving body.
- For farms with multiple effluent outfalls, all or several outfalls shall be sampled to prepare a composite sample for analysis. Where there are more than four outfalls, three outfalls shall be selected as sampling locations.
- Water shall be collected directly from the discharge stream of pipes or dipped from the surface of ditches or canals with a clean plastic bottle. The sample will be placed on ice in a closed, insulated chest to prevent exposure to light.
- Samples or direct measurements for temperature, dissolved oxygen and pH shall be obtained between 0500 and 0700 hours, and 1300 and 1500 hours on the same day. The average of the two measurements for each variable will be used for verification of compliance.
- Samples for other variables shall be collected between 0500 and 0700 hours.
- The number of ponds or growout units being drained for harvest at the time of sampling shall be recorded.
- Source water samples shall be collected quarterly directly in front of the pump station or from the pump discharge outlet but before pumped water mixes with the supply canal. These samples enable the calculation of annual loads (Equation 2 below) and establish if the limited option is applicable.

Sampling — Cages, Pens in Lakes, Reservoirs

- A minimum of three sampling stations shall be established. One shall be in the approximate center of the cage farm or net pen area. The other two stations must be at least 200 m and preferably 500 m away from the cages, considering the direction of the predominant wind. The evaluator must approve the locations of the stations.
- Water shall be collected with a Kemmerer or van Dorn water sampler, or by use of a weighted bottle from which the stopper can be removed by jerking the calibrated line. Samples shall be transferred to clean plastic bottles and placed on ice in a closed, insulated chest to avoid exposure to light.

Analyses

- Analysis shall be done by a private or government laboratory following standard methods as published by the American Public Health Association, American Water Works Association and Water Environment Federation — www.standardmethods.org.
- Hach and Merck water analysis equipment is approved for total ammonia nitrogen, soluble phosphorus, and chloride analyses. However, evaluators can reject analytical results if sampling, in situ measurements or lab protocols are deficient.
- Measurements for temperature, dissolved oxygen and pH shall be taken in situ with portable meters. Evaluators must verify the correct application of calibration procedures.

Rules for Compliance

Tilapia are produced in ponds, flow-through systems, water reuse systems, and cages and net pens. Rules for compliance with the effluent discharge standard differ among growout methods.

Land-Based Farms

For land-based farms, at least three months of effluent data are required for initial farm certification. For each variable measured monthly, at least 10 values obtained during a 12-month period shall initially comply with the criteria. After five years, the target is no more than one annual case of noncompliance for each variable. For variables measured quarterly, one noncompliance is initially permitted for each variable during a 12-month period. The target after five years is no more than one case of noncompliance for each variable during a 24-month period. When noncompliances occur, farms should make every effort to correct the problems within 90 days.

Flow-Through Systems

Tilapia culture in most flow-through systems shall be in compliance with BAP effluent criteria. An exception shall be allowed for culture in irrigation systems where effluent is discharged back into the irrigation system and the irrigation water has no use other than application to crops. Such tilapia culture operations shall be exempt from water quality monitoring and effluent limitations.

Water Reuse Systems

Some water reuse systems exchange water between outdoor treatment ponds and culture units. Treatment ponds can overflow during periods of heavy rainfall or when they are drained for renovation.

Effluent samples shall be collected during discharge and comply with BAP effluent criteria. Indoor systems treat water from culture units for reuse by mechanical and biological means, but discharge when dissolved solids concentrations must be reduced by exchange of culture water for fresher water or when parts of the system are cleaned.

Cages, Net Pens
Growout cages and net pens may be installed in lakes, reservoirs, streams, irrigation systems, ponds or estuaries. They do not discharge effluents, but uneaten feed, fish feces and metabolic excretions of fish enter the water bodies that contain the cages or net pens.

Rules for compliance with the BAP effluent standard differ among the types of water bodies in which the cages and pens are installed. Moreover, natural water bodies can already be eutrophic when certification is sought. Sites at which water quality in the water body containing cages or net pens does not comply with BAP effluent guidelines shall not be eligible for certification.

Lakes, Reservoirs
The potential of cage and net pen culture to cause eutrophication of lakes and reservoirs depends primarily upon the location of facilities, the amount of feed input compared with the assimilation capacity of the water body, and the hydraulic retention time (HRT) or flushing rate of the water body.

Cages or net pens placed in areas with restricted water circulation such as narrow embayments can cause localized eutrophication without causing generalized water quality problems in the entire water body. The assimilation capacity is impractical to measure for purposes of aquaculture certification, but major factors governing the ability of a water body to assimilate wastes are its size and especially its volume.

Nutrients and organic matter are removed from water bodies by outflow, and systems with short HRTs are less likely to become eutrophic as a result of aquaculture operations than systems with longer HRTs. Of course, the nutrients and organic matter flushed from lakes and reservoirs enter downstream waters and can have adverse impacts.

Water bodies for cage and net pen culture shall be classified according to HRT as follows:

- Long HRT — Over 3 years
- Moderate HRT — 1-3 years
- Short HRT — Less than 1 year

Applicants for certification may chose to determine HRT by one of the techniques below.

Annual lake discharge is measured and recorded.

HRT = Lake volume (m^3)÷ Lake discharge (m^3/yr)

Stream inflow to lake is measured and recorded.

HRT = Lake volume (m^3)÷ [Stream inflow (m^3/yr) + Direct rainfall (m^3/yr)] — Lake evaporation (m^3/yr)

Where lake evaporation = Pan evaporation (m/yr) x 0.7 x Lake surface area (m^2) and direct rainfall = Annual rainfall (m/yr) x Lake surface area (m^2).

Catchment area is known, but discharge or stream inflow is measured

HRT = Lake volume (m^3)÷ [Catchment runoff (m^3/yr) + Direct rainfall (m^3/yr)] — Lake evaporation (m^3/yr)

Where catchment runoff = Catchment area (m^2) x Annual rainfall (m/yr) x 0.3. See methods for direct rainfall and lake evaporation above.

Otherwise, the evaluator and the applicant seeking certification will agree upon the HRT level according to the following indicators.

Long HRT: Arid climate, catchment area:water surface area ratio of 5 or less, discharge occurs only after periods of heavy rainfall, annual water level fluctuation of 2 m or more.

Moderate HRT: Humid area, catchment area:water surface area ratio 5-15, frequent or continuous discharge, annual water level fluctuation of 2 m or less.

Short HRT: Humid area, catchment area:water surface area ratio more than 15, continuous large discharge, annual water level fluctuation of 0.5 m or less, riverine system. Note: Some riverine lakes and reservoirs in arid climates have short HRTs.

The BAP maximum allowable daily feed input to cages and net pens in lakes and reservoirs shall be based on HRT as follows.

- Long HRT — 2.5 kg/ha/day x water surface area (ha)
- Moderate HRT — 5.0 kg/ha/day x water surface area (ha)
- Short HRT — 7.5 kg/ha/day x water surface area (ha)

If cages or net pens are installed in an embayment with restricted water exchange, the maximum daily feed input shall be reduced by 50%. If there are multiple cage and net pen operations in a water body, the daily feed inputs of all operations must not exceed the maximum allowable daily feed input based on HRT.

Once every three months, a water sample shall be taken and the percentage of blue-green algae assessed (see phytoplankton methods manual at http://products.lwa.gov.au/files/PR990300.pdf). Feed input shall be reduced until water quality improves when:

- Dissolved oxygen concentrations are consistently below 5 mg/L in early morning at any sampling location.
- The average annual Secchi disk visibility decreases by 25% after certification is achieved.
- Blue-green algae comprise more than 60% of the phytoplankton.
- The thermocline becomes 25% shallower after certification is achieved.

Discharges from water bodies containing cages or net pens can cause water pollution downstream. Thus, if the feed input to the water body must be reduced because of signs of increasing eutrophication, the discharge of the lake shall be monitored. Aquaculture operations shall not be eligible for certification unless the discharge is in compliance with BAP effluent criteria.

Ponds
Ponds are privately owned but usually discharge into public waters. Effluents from ponds containing cages or net pens shall comply with BAP effluent criteria.

Streams
Stream flow is variable and too difficult to measure to use as a guide to establish maximum daily feed inputs. Thus, soluble phosphate and total ammonia nitrogen concentrations shall be used as indicators for cage and net pen operations. Soluble phosphate and total ammonia nitrogen shall be measured monthly immediately upstream of cages (50 cm depth) and 200 m downstream of cages at the same depth. The downstream concentrations shall not exceed the upstream concentrations by more than 25%. Feed input shall be adjusted downward when compliance cannot be achieved.

Irrigation Systems
Where water from irrigation systems is used only for crop irrigation, cage and net pen operations shall be exempt from feed input limits and water quality monitoring and effluent limitations. However, if water has other uses, production facilities in irrigations systems shall be treated for BAP certification as facilities installed in streams.

Estuaries
As a general rule, cage and net pen areas in estuaries are well flushed. Thus, daily feed input of 7.5 kg/ha of the surface area of the estuary is allowed. Monitoring shall be the same as for operations in lakes or reservoirs with two exceptions: There is not a thermocline in estuaries as in lakes and reservoirs, and it is not necessary to monitor discharges of estuaries for compliance with BAP effluent criteria.

Annual Effluent Volume

After the first year of effluent monitoring, an estimation of annual effluent volume shall be determined using the following equation:

Equation 1
Effluent = (Water added + Precipitation + Runoff) – (Seepage + Evaporation) + (Farm volume, day 1 – Farm volume, day 365).

The terms of this equation can be estimated as follows:

Water added (m^3) = Pump capacity (m^3/hr) x Pump operation (hr/year) or other appropriate method.

Precipitation (m^3) = Annual precipitation (m) x Farm water surface area (m^2).

Runoff (m^3) = Annual precipitation (m) x Watershed area (m^2) × 0.25.

Seepage (m^3) = Farm water surface area (m^2) × 0.55 m/yr.

Evaporation (m^3) = Class A pan evaporation (m/year) x 0.8 × Farm water surface area (m^2).
Farm volume = [Average depth of ponds (m) – Average distance of water level below overflow structure (m)] x Farm water surface area (m^2).

Annual Effluent Loads

Loads of water quality variables are more indicative of the pollution potential of farm effluents than separate measurements of concentrations of these variables and effluent volume. After the first year of effluent monitoring, annual effluent loads for total suspended solids, soluble phosphorus, total ammonia nitrogen and five-day biochemical oxygen demand shall be calculated as follows:

Equation 2
Load of variable (kg/yr) = Farm discharge (m^3/yr) x [Mean annual concentration in effluent – mean annual concentration in source water (mg/L, same as g/m^3)] x 10^{-3} kg/g

Water Use and Load Indices

It is possible to comply with numerical water quality criteria by increasing the amount of water passing through a farm to dilute the concentrations of tested variables. Compliance with the water use index assures that farms meet water quality criteria through good management rather than diluting effluents before they are released into natural waters. After the first year of effluent monitoring, water use and load indices shall be estimated using the following equations:

Equation 3
Water use index (m^3/kg fish) = Annual effluent volume (m^3) ÷ Annual fish production (kg)

Equation 4
Load index (kg variable/ton fish) = Annual load of variable (kg/yr) ÷ Annual fish production (ton/yr).

Load Indices for Cages, Net Pens

Water use indices cannot be applied to cages and pens. The loads of nitrogen and phosphorus imposed by cages and net pens on receiving water bodies can be estimated as follows:

Equation 5
Nitrogen load (kg/yr) = [Total feed (kg) x Nitrogen (% in feed) ÷ 100] – [Harvested fish (kg) x Nitrogen (% in fish) ÷ 100]

Equation 6
Phosphorus load (kg/yr) = [Total feed (kg) x Phosphorus (% in feed) ÷ 100] – [Harvested fish (kg) x Phosphorus (% in fish) ÷ 100]

Equation 7
Nitrogen load index (kg/ton fish) = Nitrogen load (kg/yr) ÷ Fish production (ton/yr)

Equation 8
Phosphorus load index (kg/ton fish) = Phosphorus load (kg/yr) ÷ Fish production (ton/yr).

The percentage nitrogen in feed is percentage crude protein divided by 6.25. The phosphorus content in tilapia feed is about 1%, but the exact value should be measured or obtained from the feed manufacturer. Live tilapia typically contain 2.2% nitrogen and 0.72% phosphorus.

Sample Effluent Monitoring Form: Dissolved Oxygen and pH

Date (day/month/year)	Dissolved Oxygen (mg/L)			pH (standard units)			Number of Ponds Being Harvested
	Morning	Evening	Average	Morning	Evening	Average	
_____/01/_____							
_____/02/_____							
_____/03/_____							
_____/04/_____							
_____/05/_____							
_____/06/_____							
_____/07/_____							
_____/08/_____							
_____/09/_____							
_____/10/_____							
_____/11/_____							
_____/12/_____							
Annual Average							

Sample Effluent Monitoring Form: Soluble Phosphorus, Total Ammonia Nitrogen, Chloride

Date (day/month/year)	Soluble Phosphorus (mg/L)	Total Ammonia Nitrogen (mg/L)	Chloride (mg/L)	Number of Ponds Being Harvested
_____/01/_____				
_____/02/_____				
_____/03/_____				
_____/04/_____				
_____/05/_____				
_____/06/_____				
_____/07/_____				
_____/08/_____				
_____/09/_____				
_____/10/_____				
_____/11/_____				
_____/12/_____				
Annual Average				

Sample Effluent Monitoring Form: Total Suspended Solids, 5-day Biochemical Oxygen Demand

Quarter	Date (day/month/year)	Total Suspended Solids (mg/L)	5-day Biochemical Oxygen Demand (mg/L)	Number of Ponds Being Harvested
1				
2				
3				
4				
Annual Average				

Example: Water Use, Load Indices For Farm Discharge Estimated By Pond Volume-Water Exchange Method

A farm has 100 ha of ponds that average 1 m deep, with average water exchange of 2.5% pond volume/day. There are 2.3 crops/year, and the average length of each crop is 120 days. The farm effluent contains an average of 35 mg/L total suspended solids (TSS), 0.16 mg/L soluble phosphorus (SP), 0.72 mg/L total ammonia nitrogen (TAN) and 8.1 mg/L biochemical oxygen demand (BOD). Fish production for the past year was 230,000 kg (230 tons).

Calculations:

Pond volume = 100 ha x 10,000 m^2/ha x 1 m = 1,000,000 m^3

Farm discharge = [1,000,000 m^3/crop x 2.3 crops/yr] + [1,000,000 m^3 x 0.025 pond volume/day x 120 days/crop x 2.3 crops/yr] = 9,200,000 m^3/yr

TSS load = (35 g/m^3)(9,200,000 m^3/yr)10^{-3} = 322,000 kg/yr

SP load = (0.16 g/m^3)(9,200,000 m^3/yr)10^{-3} = 1,472 kg/yr

TAN load = (0.72 g/m^3)(9,200,000 m^3/yr)10^{-3} = 6,624 kg/yr

BOD load = (8.12/m^3)(9,200,000 m^3/yr)10^{-3} = 74,520 kg/yr

$$\text{Water use index} = \frac{9{,}200{,}000\ m^3/yr}{230{,}000\ kg\ fish/yr} = 40\ m^3/kg\ fish$$

$$\text{TSS index} = \frac{322{,}000\ kg/yr}{230\ tons\ fish} = 1{,}400\ kg\ TSS/ton\ fish$$

$$\text{SP index} = \frac{322{,}000\ kg/yr}{230\ tons\ fish} = 6.4\ kg\ SP/ton\ fish$$

$$\text{TAN index} = \frac{6{,}624\ kg/yr}{230\ tons\ fish} = 28.8\ kg\ TAN/ton\ fish$$

$$\text{BOD index} = \frac{74{,}520\ kg/yr}{230\ tons\ fish} = 324\ kg\ BOD/ton\ fish$$

Example: Water Use, Load Indices For Farm Discharge Estimated By Pump Operation Method

A farm has two pumps that discharge a combined volume of 136 m^3/min. The pumps operate an average of 8 hr/day. Effluent contains 81 mg/L total suspended solids (TSS), 0.20 mg/L soluble phosphorus (SP), 1.05 mg/L total ammonia nitrogen (TAN) and 11.2 mg/L biochemical oxygen demand (BOD). Fish production during the past year was 378,000 kg (378 tons).

Calculations:

Farm discharge = 136 m^3/min x 60 min/hr x 8 hr/day x 365 days/yr = 23,827,200 m^3/yr

TSS load = (23,827,200 m^3/yr)(81 g/m^3)10^{-3} = 1,930,000 kg

SP load = (23,827,200 m^3/yr)(0.2 g/m^3)10^{-3} = 4,765 kg

TAN load = (23,827,200 m^3/yr)(1.05 g/m^3)10^{-3} = 25,018 kg

BOD load = (23,827,200 m^3/yr)(11.2 g/m^3)10^{-3} = 266,865 kg

$$\text{Water use index} = \frac{23{,}827{,}200\ m^3/yr}{378{,}000\ kg\ fish/yr} = 63.0\ m^3/kg\ fish$$

$$\text{TSS index} = \frac{1{,}930{,}000\ kg/yr}{378\ tons\ fish} = 5{,}106\ kg\ TSS/ton\ fish$$

$$\text{SP index} = \frac{4{,}765\ kg/yr}{378\ tons\ fish} = 12.6\ kg\ SP/ton\ fish$$

$$\text{TAN index} = \frac{25{,}018\ kg/yr}{378\ tons\ fish} = 66.2\ kg\ TAN/ton\ fish$$

$$\text{BOD index} = \frac{266{,}865\ kg/yr}{378\ tons\ fish} = 706\ kg\ BOD/ton\ fish$$

Production Practices

Land-Based Systems

Compliance with the effluent management standard usually require farms to improve their production practices in some areas. These areas can include practices for erosion control, feed management, water and bottom soil quality, and water exchange that can reduce and improve pond effluents.

If adoption of these practices is not sufficient to meet BAP water quality criteria, a settling basin shall be installed to provide water treatment before final discharge. If a settling basin is used, the water quality criteria shall apply to its final outfall.

In cases where source water has high concentrations of suspended solids, a presettling basin to improve water quality before the water reaches production ponds can lessen sediment accumulation in ponds and possibly benefit effluent quality.

In some cases, the use of a natural or constructed “filter strip” can provide effective treatment for effluents before they are discharged into public waters. Effluent water flows in a thin sheet across the strips, which allows the capture of sediment, organic matter and other pollutants by deposition, infiltration, absorption, decomposition and volatilization.

Another approach is the use of retention, evaporation or percolation ponds in areas with highly porous soils. For freshwater effluent, application for irrigation purposes to fields with sustained vegetative cover at less than or equal to agronomic rates is an option.

Cages, Net Pens
The most reliable way of reducing nutrient outputs from cage and net pen culture is to increase feed use efficiency. This can be done mainly by using high-quality feed that contains no more nitrogen and phosphorus than necessary and by assuring that fish consume all of the feed offered. Thus, fish should access feed slowly enough that they consume it before the pellets pass through the cage or pen mesh. Also, feeding rates should be monitored to avoid overfeeding. Observations of fish-feeding activity are enhanced by using floating feed. A diver should perodically go beneath cages to determine if uneaten feed is accumulating on the bottom.

Dead fish should be removed promptly and disposed of on land by responsible procedures. Carcasses should never be discarded in water bodies where cage culture is conducted. Nets of cages and pens often are removed and cleaned on shore. Cleaning waste shall be diverted into a sedimentation pond, sanitary sewer or other treatment system.

It is not feasible to treat wastes from cages and net pens. The main precaution against pollution is to locate culture units in open water areas where water circulation is sufficiently high to transport wastes away from cages and rapid ly mix and dilute wastes. The distance between cage bottoms and the bottoms of water bodies should be at least 1-2 m to promote water movement beneath cages.
High biomass in a particular location can obviously increase the likelihood of pollution. While there are no specific guidelines for the biomass that can be safely sustained at a particular cage site, monitoring shall be used to track the status of water quality.

In bodies of water that stratify thermally, a high biomass can result in severe organic enrichment and dissolved oxygen depletion in the hypolimnion. Subsequent sudden thermal destratification can result in dissolved oxygen depletion throughout the water column. This phenomenon has been responsible for serious fish mortality both inside and outside cages.

Wastes can accumulate beneath cages and cause deterioration of sediment quality. This is environmentally undesirable and can have negative impacts on the fish in cages, as well. Sediment quality in areas with fish cages can be protected by fallowing — periodically moving cages to new sites and allowing the original sites to recover. Observations on sediment quality shall be used to determine when to move cages.

Every effort must be made to assure that fish do not escape from enclosures in water bodies. Cages and net pens should be constructed of sturdy material and maintained in good condition to minimize the likelihood of holes and rips through which fish can escape. It is particularly important to use material that does not corrode, as holes can suddenly appear without warning in nets made of corrodible wire.

Cages and pens should be placed in areas where there is little danger of collisions with boats or floating debris and where heavy waves are not likely to damage them. Placement of cages and pens in navigable waters may need approval from governmental authorities. Divers or underwater cameras must periodically inspect cages for holes, rips and tears.

Cages and pens should also be located as far away as possible from effluent outfalls of industries, municipal treatment plants, urban stormwater runoff collection systems and other potential pollutant sources. The units should also not be located in areas with increased potential for oil spills or other accidental discharges of pollutants.

Standard 6 — Environment
Fishmeal and Fish Oil Conservation

Farms shall accurately monitor feed inputs and minimize the use of fishmeal and fish oil derived from wild fisheries.

Reasons for Standard
The majority of feeds manufactured for use in aquaculture contain fishmeal and fish oil as protein sources. Although fishmeal and fish oil are renewable resources derived primarily from small fish unsuitable for human consumption, there are limits to the amounts of these products the world’s oceans can supply.

The BAP program therefore supports the use of protein feed ingredients derived from terrestrial sources, as well as fishmeal and fish oil produced from fish processing and fishery by-products. Fishery-based ingredients from wild sources should come from sustainable fisheries.

In addition, by improving the efficiency with which feed is converted into fish biomass, farmers can lessen the amount of fishmeal and fish oil protein used. More efficient feed conversion also has a direct beneficial impact on water quality and limits the release of excess nutrients to the environment.

Implementation
Tilapia feed is typically manufactured at commercial facilities and delivered to farms. Farmers shall obtain feed from suppliers that provide reliable information on the crude protein and fishmeal and fish oil content in the feeds. Farmers shall record the charactersistics of all feeds used, the total amounts of each feed used each year and the total annual fish production.

Although a BAP standard for feed conversion has not been established, producers should strive to reduce their facilities’ feed-conversion ratios as low as practicable. Also, certified farms should maintain or lower feed conversion in the years following their initial certification. Harvest size must be considered when assessing the evolution of FCR.

Additional Data

Feed-Conversion Ratio

The feed-conversion ratio is a measure of the amount of feed needed to produce a unit weight of the culture species. Farms shall calculate and record FCR yearly using the following equation:

Equation 1
Feed-conversion ratio = Annual feed use (mt) ÷
Fish harvested (mt).

"Fish In:Fish Out" Ratio

The so-called "fish in:fish out" ratio is one means of measuring the ecological efficiency of an aquaculture system. It compares the amount of fish consumed by the system (usually in the form of fishmeal and fish oil) with the amount of fish produced.

Tilapia producers should strive to obtain the lowest fish in: fish out ratio practicable in order to conserve industrial fish resources. Since tilapia diets typically incorporate only small amounts of fishmeal and fish oil, tilapia farms typically have fish in:fish out ratios of less than 1, indicating that they can actually make a net contribution to global fish supplies.

Farms shall calculate and record a final yearly fish in:fish out ratio using Equation 2 below. In the absence of better, specific data from the feed supplier, the transformation yields for industrial fish to fishmeal and fish oil should be 22% and 8%, respectively.

Equation 2
Fish in:fish out ratio = (FMI + FOI) ÷ (YFM + YFO) x FCR

FMI = Fishmeal inclusion in feed (%)
FOI = Fish oil inclusion in feed (%)
YFM = Yield of fishmeal from industrial fish (%)
YFO = Yield of fish oil from industrial fish (%)
FCR = Feed-conversion ratio

The inclusion rates in Equation 2 should include any meal or oil derived from wild-caught fish, squid, krill, mollusks or any other wild marine animals. However, they should exclude meal or oil derived from fishery by-products such as trimmings, offal and squid liver powder; aquaculture by-products such as shrimp head meal; and marine aquaculture products such as polychaetes.

Additional Information

The State of World Fisheries and Aquaculture
FAO Fisheries and Aquaculture Department — 2006
ftp://ftp.fao.org/docrep/fao/009/a0699e/a0699e.pdf

Standard 7 — Environment
Soil and Water Conservation

Farm construction and operations shall not cause soil and water salinization or deplete groundwater in surrounding areas. Farms shall properly manage and dispose of sediment from ponds, canals and settling basins.

Reasons for Standard

In some locations, freshwater from underground aquifers is used to dilute salinity in brackish water ponds or as the main water supply for freshwater ponds. Farming can cause salinization if saline water from ponds infiltrates freshwater aquifers or is discharged into freshwater lakes or streams. Farms can potentially lower water tables and negatively affect groundwater availability. Where other suitable water sources are available, the use of well water is discouraged.

Sediments that accumulate in canals and ponds can negatively impact water movement and affect pond soil and water conditions, necessitating periodic dredging and removal. Sediments are mostly mineral soil enriched with organic material, but at some farms also contain water-soluble salt from contact with saline water. Improper disposal of salt-laden sediments from ponds can cause salinization of soil and water.

Implementation

Salinization can result from pond culture of tilapia in coastal areas where ponds are filled with brackishwater. Several practices can be adopted to lessen the risk of salinization. One of the most important is to avoid constructing ponds in highly permeable, sandy soil, or to provide clay or plastic liners to minimize seepage. Other useful practices:

- Do not discharge saline water into freshwater areas.
- Avoid excessive pumping of groundwater from freshwater aquifers, and do not use freshwater from wells to dilute salinity in growout ponds.
- Monitor chloride concentration in freshwater wells near farms to determine if salinization is occurring.

In freshwater levee and embankment ponds, use the drop-fill method to capture rainfall and runoff, and reduce the use of water from other sources. Water should not be added to ponds during dry weather until the water level has fallen 15 to 20 cm below the overflow level. Water should then be added to increase the water surface level by not more than 7.5 to 10 cm. This practice provides storage volume sufficient to capture normal rainfall and runoff.

Where freshwater from wells is used to supply ponds or other production facilities, water levels in nearby wells should be monitored to determine if aquaculture use is contributing to a decline in the water table level. Use of water from irrigation systems should be in accordance with regulations, and effluent should be returned to the irrigation system.

Water removal from lakes, streams, springs and other natural sources should not be excessive and cause ecological damage or conflicts with other water users. Where possible, seine harvest fish and not drain ponds for several years. This practice is highly recommended for it conserves water, reduces effluent volume and lessens pumping costs.

Farm ponds should be surrounded by a ditch to intercept seepage. This ditch should be large enough to capture overflow from ponds following rainfall. When ponds are drained for harvest, water should be stored in a reservoir or transferred to other ponds for reuse.

When ponds must be drained into a freshwater stream, the water should be discharged when stream flow is high. The water should be discharged slowly to avoid increases in chloride concentration greater than 250 mg/L in the receiving water body.

A vegetative barrier of salt-sensitive vegetation around farms can help detect movement of salt into adjacent areas. Where freshwater from wells is used to supply ponds or other production facilities, water levels in nearby wells should be monitored by appropriate regulatory agencies to determine if aquaculture use is contributing to a decline in the water table level.

Farms shall manage sediment so that it does not cause salinization or other ecological nuisances in surrounding land or water. Sediment accumulation in ponds and canals should be reduced by implementating proper earthen infrastructure design to lessen erosion and placing aerators to avoid impingement of water currents on embankments. Erosion-prone areas should be reinforced with stone or other lining materials. Bare areas should be covered with gravel or grass.

When sediment is stored, it should be confined within a diked area so that solids suspended by rainfall can be retained. When sediment must be removed, it should ideally be reused to repair pond earthworks or applied as fill material. The sediment can also be spread in a thin layer over the land and vegetative cover established.

For Additional Information

Hydrology and Water Supply for Pond Aquaculture
K. H. Yoo and C. E. Boyd — 1994
Chapman and Hall
New York, New York, USA

U.S. Army Corps of Engineers
Engineering Manual No. 1110-2-5027
"Confined Disposal of Dredged Material"
Department of the Army — 1987
U.S. Army Corps of Engineers
Washington, D.C., USA
Online at http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-5027/toc.htm

Standard 8 — Environment
Control of Escapes, Use of GMOs

Certified farms shall take measures to minimize escapes of farm stock and comply with governmental regulations regarding the use of native and non-native species, and genetically modified organisms.

Reasons for Standard

The escape of non-native culture species could lead through interbreeding to the alteration of the gene pools of local fish populations. Escapes of non-native species could also lead to competition with native species and possibly have other detrimental ecological consequences. Diseases can also be transmitted from escapees to wild fish.

Most nations allow the importation of native species, and some allow specified non-native imports. Among other factors, regulation is required because diseases can be transferred between countries and species by importations of eggs, fry and broodstock. Regulations usually require health certificates and quarantine.

Genetically modified organisms (GMOs) are defined as organisms whose genomes have been modified by the introduction or deletion of specific genetic material. Sex-reversed organisms and their offspring, and organisms created by hybidization and polyploidy are not GMOs.

Should genetically modified tilapia be commercialized in the future, producers shall comply with all regulations regarding such organisms. Some consumers do not desire genetically modified foods and should be provided with reliable information to enable informed food choices.

Implementation

Participating farms shall keep records of their sources and purchases of stocking material, and record the number stocked in each culture unit for each crop. A sample Pond-Level Traceability Form that records this data is provided in the Traceability section. In the future, farms that use GMO fish must also note this information. All incidents involving animal escapes shall be accurately documented. Farms should demonstrate reductions in escapes over time.

All holding, transport and culture systems shall be designed, operated and maintained to minimize the escape of eggs, larval forms, juveniles and adult animals. Ponds and other culture systems shall have intact screens on water inlets and outlets. Filter screens or devices shall be sized to retain the smallest life stage present. Acceptable filter devices include a series of mesh screens capable of screening all water, dry-bed filters constructed with gravel and sand, microscreen solids filters, and pond traps with screened discharge.

Production facilities should be constructed to prevent overtopping by storm surges, waves or flood water. When heavy rainfall is expected, pond water levels should be drawn down to prevent the rain from raising water levels and overtopping embankments.

Cages, nets and pens shall be tagged and maintained in good condition, and records of repairs shall be kept. Periodic inspections of mooring lines shall be documented. Jump nets that extend above the water line should surround the perimeters of net cages for tilapia.

During site inspection, documentation of compliance with government regulations relating to the import of fry shall be available. Even if imported fry were purchased from an intermediary, pertinent documents shall be provided.

Regulations differ by country, and the certification body cannot maintain complete records of the requirements in every country. Evaluators should become familiar with relevant regulations in countries that they serve.

For Additional Information

FAO Fisheries Technical Paper No. 402
Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals and the Beijing Consensus and Implementation Strategy
FAO/NACA — 2000
Rome, Italy

Standard 9 — Environment
Storage and Disposal of Farm Supplies

Fuel, lubricants and agricultural chemicals shall be stored and disposed of in a safe and responsible manner. Paper and plastic refuse shall be disposed of in a sanitary and responsible way.

Reasons for Standard

Farms use fuel, oil and grease to power and lubricate vehicles, pumps, aerators and other mechanical devices. The main agricultural chemicals used in tilapia farming include fertilizers, liming materials and zeolite. Some farms use insecticides, herbicides, parasiticides and algicides. Other products employed include preservatives, paints, disinfectants, detergents, and antifoulants.

Fuels and some fertilizers are highly flammable and/or explosive, and pesticides, herbicides and algicides are toxic. They shall therefore be considered potential hazards to workers.

Spills or careless disposal of petroleum products and agricultural chemicals can also affect aquatic organisms and other wildlife in the immediate vicinity, and result in water pollution over a wider area.

Farms generate considerable waste that can cause pollution, odors and human health hazards on the farm and in surrounding areas when not disposed of properly. Human food scraps, out-of-date feed and other organic waste can attract scavengers. Runoff from refuse piles can cause pollution and contaminate ground water.

Empty plastic bags and other containers used for feed, fertilizer and liming materials do not decompose quickly. They can be a hazard to animals that become entangled in them. Cage culture and net pen operations may despose of old frames and netting in staging areas and create a nuisance.

Implementation

Fuel, lubricants and agricultural chemicals shall be labeled and stored in a manner to prevent fires, explosions and spills. Used lubricants and unwanted or out-of-date chemicals shall be disposed of in a responsible manner.

Secondary containment shall be provided for individual fuel storage tanks over 2,500 liters in volume and multiple tanks with combined storage of over 5,000 liters. The containment volume should be equivalent to 110% of individual tanks or 110% of the largest tank in a multiple-tank storage system. “Flammable Material” and “No Smoking” warning signs shall be installed at fuel storage sites.

Oil leaks from tractors, trucks and other equipment should be prevented through good maintenance. Oil changes and refueling should avoid spills, with used oil sent to a recycling center. Out-of-date chemicals and wastes collected after chemical spills shall be confined in sturdy plastic containers, labeled and sent to a hazardous waste disposal site.

Chemicals such as insecticides, herbicides, algicides, antifoulants and detergents shall be stored in locked, well-ventilated, water-tight buildings. The buildings’ concrete floors should slope to a center basin for containing spills. Warning signs shall be posted.

Fertilizers, liming materials, salt and other less hazardous agricultural chemicals should be stored under a roof, where rainfall will not wash them into surface water. Particular care shall be taken with nitrate fertilizers, which are strong oxidants that are particularly explosive when contaminated with diesel fuel or other oils. Nitrate fertilizers shall be protected from contact with petroleum products and open sparks.

Procedures should be developed for managing spills of oil, fuel, chemicals, feed, fertilizers and other products. The equipment and supplies needed for managing and cleaning up these spills shall be readily available and accessible. Workers should be trained to properly use the equipment and handle the contained waste.

Trash, garbage and other farm wastes shall not be dumped in mangrove areas, wetlands or other vacant land. Waste shall be burned, composted or put in a landfill in accordance with local laws. Composting shall be done by a procedure that does not create an odor problem or attract wild animals.

A plan should be made for prompt and responsible disposal of massive mortalities of culture animals by incineration, burial, composting or removal by a competent contractor.

Paper and plastic should be recycled if possible. Collection of wastes for recycling requires readily accessible waste containers that are serviced at regular intervals. All containers must be appropiately labelled with risk indicators (poisonous/explosive, etc)

For Additional Information

USDA NRCS AL Guide Sheet No. AL 701
Spill Prevention Control and Countermeasures
Available online at http://www.al.nrcs.usda.gov/SOsections/Engineering/BMPindex.html

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Standard 10 — Environment
Animal Welfare

Producers shall demostrate that all operations on farms that involve fish are designed and operated with animal welfare in mind. Employees shall be trained to provide appropriate levels of husbandry.

Reasons for Standard

Since society seeks to avoid needless animal suffering, numerous regulations address animal welfare. Although few such regulations address fish, many consumers would like to know that farmed fish were produced by humane techniques.

When farmed fish are exposed to continuing stress, their feed consumption and grow rate can decline. Stressed animals are also less resistant to diseases, and mortality usually increases. Animal suffering can be prevented and production efficiency enhanced by applying good husbandry techniques to avoid stressful culture conditions.

Implementation

This standard seeks to assure a high level of welfare for aquaculture species. The following good aquatic animal husbandry practices should therefore be applied.

Farms must provide well-designed facilities for holding and rearing fish with adequate space and shade. The chemical composition of culture water should be appropriately maintained, and changes in water quality should be made slowly so the fish can adjust to the changes. Adequate levels of dissolved oxygen must be maintained.

High-quality feed should be offered at regular intervals that do not overfeed or underfeed the fish. Although fasting periods are often needed to enable harvesting in hygienic conditions, they should be minimized.

Farms should minimize stressful situations during handling by limiting crowding to two hours and time out of water to 15 seconds. Culture management should also avoid stress, injury or disease through rapid diagnosis and treatment of disease and by humane slaughter. When used, vaccination procedures should be executed by trained staff to prevent physical damage and minimize stress.

Dead animals must be documented, removed from ponds at least daily and disposed of properly in accordance with applicable local and state regulations. Ill fish and unwanted animals in the pond environment must be eliminated in a humane fashion by breaking their necks or a blow to the head and disposed of in accordance with applicable regulations. Procedures should be recorded in a health management plan or operating manual.

Farm staff should make regular inspections of the culture facility, noting water quality as well as the appearance and behavor of the fish. Swift action should be taken to correct deficiences or symptoms.

Reliable scientific data on the effects of stocking density on fish welfare is limited, and many factors influence this relationship. Through detailed health records, farms shall demonstrate that suitable stocking densities are being employed. Maximum stocking densities shall be set with respect to fish biomass per water volume.

For Additional Information

Farm Animal Welfare Council
http://www.fawc.org.uk/freedoms.htm

Standard 11 — Food Safety
Drug and Chemical Management

Banned antibiotics, drugs and other chemical compounds shall not be used. Other therapeutic agents shall be used as directed on product labels for control of diagnosed diseases or required pond management, not prophylactic purposes.

Critical Points:

- Chloramphenicol and nitrofuran antibiotics are banned for use in food production in all countries. Other drugs and chemicals, such as antiobiotics, malachite green, heavy metals, parasiticides and hormones, may be banned in specific countries.
- The use of antibiotics to treat a diagnosed disease should be authorized and conducted by a veterinarian or fish health specialist.
- When antibiotics are used for therapeutic purposes, antibiotic residues test should be carried out after the withdrawal period.
- For exported products, drugs and chemicals approved for use in producing countries may only be used if they are not banned in importing countries and residues in fish products do not exceed limits set by importing nations.
- The use of methyl testosterone for sex reversal of fry is permissible provided it is not banned by the importing country.
- Records for disease diagnoses should support the use of therapeutants.
- Required records for every application of drugs and other chemicals shall include the date. compound used, reason(s) for use, dose and harvest date for treated ponds.
- Statements from feed, fry and and fingerling suppliers that declare no prohibited drugs or other chemicals were applied to feed or seed are required.
- Vaccines and anaesthetics, where employed, shall be approved and used only according to manufacturers' instructions.
- Neither hormones nor antibiotics shall be used as growth promoters.
- Hormones should not be administered to animals intended for human consumption.
- Use of antifoulants shall be approved and discharge consents shall be obtained.

Reasons for Standard

Residues of some therapeutic agents can accumulate in fish tissue and present a potential health hazard to humans. Therefore, certain compounds have been banned, and residue limits mandated for others. Apart from compromising food safety, failure to comply with such regulations can have serious ecomomic consequences to all involved in the food supply chain.

Improper use of chemicals can harm other organsisms that live around farms. Moreover, prolonged use of antibiotics can lead to antibiotic resistance in disease organisms that affect tilapia and other aquaculture species.

Some farms are built on land previously used for agricultural or other purposes. Pesticides, heavy metals and other chemicals applied during these previous uses can remain in the land's soil and water in small amounts and be taken up by fish in production ponds. Such compounds pose a potential health risk to some elements of the human population.

Implementation

When considering site locations for new pond construction, soil samples should be taken in areas of high-risk contamination, such as low areas where runoff collects, previously used pesticide storage or disposal sites, and washing and loading sites for spray applicators and agricultural aircraft.

Good health management focuses on the prevention of disease rather than disease treatment with chemical compounds. The best ways of controlling disease are to avoid stocking diseased tilapia, adopt fallowing and "all in, all out" stocking procedures at cage and net pen sites, and avoid environmental stress by maintaining good water quality in culture systems. In pond culture, limiting water exchange lessens the risk of disease spreading from one farm to another.

Farms should develop health management plans that indicate procedures to avoid the introduction of disease, protocols to maintain water and soil quality in ponds, and fish health-monitoring and disease diagnosis techniques. Plans should also explain the steps to be taken when a diagnosed disease will be treated with approved chemicals. Lists of approved chemicals can usually be obtained from processing plants, agricultural agencies, or university fisheries research and extension programs.

Analyses of tilapia fillets have shown that the use of methyl testosterone or related hormones for producing all-male fry has not resulted in residues of testosterone higher than those naturally found in control fish. Nevertheless, where practical, producers are encouraged to use other methods of obtaining all-male fry. When used, records of hormone application shall be maintained. Workers shall be instructed to wear protective clothing and masks with air filters when working with methyl testosterone.

During inspections, evaluators shall have access to full records as described above for all applications of drugs, antibiotics and hormones. A sample Pond-Level Traceability Form that records this data is provided in the Traceability section.

Farms should conduct a survey of chemical use in the surrounding watershed to evaluate potential sources of contamination. Certified facilities should also routinely monitor changes in land use practices in the surrounding area that might affect chemical residue levels in farmed fish.

For Additional Information

Guide to Drug, Vaccine, and Pesticide Use in Aquaculture
Federal Joint Subcommittee on Aquaculture — 1994
Texas Agricultural Extension Service College Station
Texas, USA
April 2007 revision — http://www.aquanic.org/jsa/wgqaap/drugguide/drugguide.htm

Food Safety Issues Associated With Products From Aquaculture
Report of a Joint FAO/NACA/WHO Study Group
World Health Organization — 1999
Geneva, Switzerland

Responsible Use of Antimicrobials in Fish Production.
http://www.ruma.org.uk

Standard 12 — Food Safety
Microbial Sanitation

Human waste and untreated animal manure shall be prevented from contaminating pond waters. Domestic sewage shall be treated and not contaminate surrounding areas.

Reasons for Standard

Sewage contains microorganisms that can be harmful to humans. It can also pollute the water into which it is discharged.

There is a possibility of health hazards to humans who consume inadequately cooked fish grown in waters that receive human waste, untreated animal manure or organic fertilizers containing *Salmonella* or other food-poisoning organisms. Farms should not use uncooked organisms and their by-products or trash fish as feed in fish ponds, as this encourages the spread of fish diseases. Also, this raw food has a high oxygen demand that can deteriorate pond water quality.

Implementation

Housing for owners or workers sometimes is located near fish ponds. Sewage from bathrooms, kitchens and other facilities shall be treated in septic tanks. Waste oxidation lagoons are also an acceptable treatment method on large farms. In all cases, raw sewage shall not be discharged into fish ponds, farm canals or natural waters. Runoff from barns and other facilities for holding livestock shall not enter ponds.

Domestic animals other than family pets or watch dogs shall not circulate freely within farms. Livestock is permitted in pastures that serve as pond watersheds, but fences must be installed to prevent the animals from drinking or wading in ponds.

In the unlikely case that culture water is drawn from water bodies that could receive untreated human waste in the immediate vicinity of the farm, water holding or pretreatment is recommended.

At cage farms, workers often spend long hours on the floating cage platforms. Portable toilets shall be provided and sanitary procedures for disposal of the wastes onshore shall be established.

It is in the best interest of the tilapia culture industry to use chemical fertilizers, properly treated organic manure and pelleted feed in ponds. Certified farms shall not use any untreated manure or uncooked organisms in growout ponds. The use of beneficial bacteria is highly recomended to reduce the need for antibiotic treatments.

For Additional Information

Pond Aquaculture Water Quality Management
C. E. Boyd and C. S. Tucker — 1998
Kluwer Academic Publishers
Boston, Massachusetts, USA

Food Safety Issues Associated With Products From Aquaculture
Report of a Joint FAO/NACA/WHO Study Group
World Health Organization — 1999
Geneva, Switzerland

Environmental Engineering
P. A. Vesilind, J. J. Peirce and R. F. Weiner — 1994
Butterworth-Heinemann
Boston, Massachusetts, USA

Standard 13 — Food Safety
Harvest and Transport

Fish shall be harvested and transported to processing plants or other markets in a manner that maintains temperature control and minimizes stress, physical damage and contamination.

Reasons for Standard
The crowding and handling of fish during harvesting and transport are potentially stressful, so measures should be taken to prevent unnecessary animal suffering. Unclean water and transport containers can cause contamination of fish during transit from ponds to plants or markets.

Implementation
Tilapia that are accidentally dropped on the ground during harvest shall not be left out of water to suffocate. Equipment and containers used to harvest and transport tilapia shall be clean to avoid contamination of harvested fish by lubricants, fuel, metal fragments or other foreign materials.

Live transport of tilapia in trucks should not take longer than 12 hours, and adequate water quality should be maintained during transport to minimize stress. This usually requires the application of mechanical aeration or oxygenation in the transport containers. Temperature control may also be necessary.

The adequacy of transport methods should be assessed by documented mortality rates. Nonapproved chemicals shall not be applied directly or indirectly to fish during transport.

For Additional Information

USFDA Center for Food Safety & Applied Nutrition
Fish and Fisheries Products Hazards and Controls
Guidance: Third Edition, June 2001
Appendix 4: Bacterial Pathogen Growth and Inactivation
Available online at http://www.cfsan.fda.gov/~comm/haccp4x4.html

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Traceability
Record-Keeping Requirement

To establish product traceability, the following data shall be recorded for each culture unit and each production cycle:

- culture unit identification number
- unit area or volume
- stocking date
- quantity of fingerlings stocked
- source of fingerlings (hatchery)
- antibiotic and drug use
- herbicide, algicide and other pesticide use
- manufacturer and lot number for each feed used
- harvest date
- harvest quantity
- processing plant or purchaser.

Reasons for Requirement
Product traceability is a crucial component of the BAP certification program. It interconnects links in the fish production chain and allows each processed lot to be traced back to the culture unit and inputs of origin. Results of food quality and safety analyses by accredited laboratories can also be included. Traceability ultimately assures the purchaser that all steps in the production process were taken in compliance with environmental, social and food safety standards.

Implementation
Farms can maintain paper records of the required data in notebooks or files (sample form follows). If possible, the information should also be transferred to computer database files, with the original files kept to allow verification of the electronic data.

Some of this information shall also be added via the Internet to the BAP online traceability system developed by Trace Register. To participate in the traceability system, the farm shall pay a basic annual fee.

This information and other pond-related records needed for BAP certification can be captured on the sample Pond-Level Product Traceability Form on page 29.

The record-keeping process requires a high degree of care and organization. On large farms, pond managers could collect initial data for those fish for which they are responsible. A single clerk could then be given the task of collecting the data from pond managers and transferring it to a computer database. Farm management shall of course review the effort at intervals to verify it satisfies BAP requirements.

Sample Pond-Level Product Traceability Form

Farm Name		Pond Number	Pond Area (ha)
FINGERLINGS Stocking Date		**FEED** Feed Type	
Stocking Quantity		Manufacturer	
Hatchery	BAP No.	Lot Number(s)	
"No Banned Chemical Use" Statement Available? Y N		"No Banned Chemical Use" Statement Available? Y N	
THERAPEUTIC DRUG USE Compound 1		**PESTICIDE USE** Compound 1	
Disease Treated		Condition Treated	
Application Rate		Application Rate	
Application Period		Application Period	
Compound 2		Compound 2	
Disease Treated		Condition Treated	
Application Rate		Application Rate	
Application Period		Application Period	
HARVEST Harvest Date		Harvest Purchaser Name/ Address	
Harvest Quantity (kg)			