# Aquaculture Facility Certification

## Finfish, Crustacean and Mollusk Hatcheries and Nurseries

### Best Aquaculture Practices Certification Standards, Guidelines


**Community • Environment • Animal Welfare • Food Safety • Traceability**

# BEST AQUACULTURE PRACTICES CERTIFICATION

The following Best Aquaculture Practices standards apply to all aquaculture facilities that produce eggs and/or juvenile aquatic animals for live transfer to other aquaculture facilities and to all species for which BAP farm standards are available. Production facilities can be ponds or tanks on land with directed inflows and outflows of water, trays located intertidally on the foreshore, or rafts or cages (net pens) floating in a body of water. For the purposes of these BAP standards, the generic term used to describe these facilities is "hatchery."

Processes within the general scope of hatchery operations include:

- broodstock collection, production, selection and management
- mollusk spawning and larvae setting
- egg collection and fertilization
- egg incubation and hatching
- feeds and feeding practices until the time juvenile animals are moved to facilities that only produce aquatic animals for harvest and slaughter for human consumption
- a nursery phase or intermediate juvenile production phase before final growout that may itself consist of one or more stages
- treatment of animals to induce sterility, manipulate gender or achieve protective immunity against pathogens, or to treat or protect against disease.

Except in the case of certain mollusk species, the collection and rearing of eggs or juveniles from the wild are not included or permitted under these standards.

These processes may be carried out in sequence at one location or in two or more locations with live aquatic products transferred between or among them. For BAP certification, each location shall be considered a separate facility.

Some requirements are system-specific, applying, for example, only to earthen ponds, facilities that produce effluents, or facilities using cages. Each section of the standards and guidelines identifies which standards apply to the different production systems. Please reference the chart on the following page.

The BAP standards are achievable, science-based and continuously improved global performance standards for the aquaculture supply chain that assure healthful foods produced through environmentally and socially responsible means. They are designed to assist program applicants in performing self-assessments of the environmental and social impacts, and food safety controls of their facilities, and to lead to third-party certification of compliance, thereby eliminating the most significant negative impacts. For further information, please refer to the additional resources listed throughout this document.

BAP standards demand compliance with local regulations as the first step toward certification. However, not all regulations are equally rigorous. For this reason, BAP standards set out requirements for documentation and procedures that must be in facility management plans, whether they are prescribed by local regulations or not. By so doing, they seek, where possible, to impose consistency in performance among facilities in different producing regions and to engage the industry as a whole in a process of continuous improvement.

In common with ISO usage, these standards use the words "shall" to mean compliance is required and "should" to mean compliance is recommended. Auditable points are "shall" statements listed at the end of each section.

To obtain BAP certification, applicants shall be audited by an independent, BAP-approved certification body. To apply for certification, contact:

**Best Aquaculture Practices Management**
P. O. Box 2530 – Crystal River, Florida 34423 USA
Telephone: +1-352-563-0565 – Fax: +1-425-650-3001
Web: www.bestaquaculturepractices.org – E-mail: info@aquaculturecertification.org, aquacert@tampabay.rr.com

**The audit consists of an opening meeting, a site assessment, the collection of necessary samples, a review of management records and procedures, and a closing meeting. All points in the standards shall be addressed. Any non-conformity raised during the evaluation is recorded by the auditor in the formal report as:**

**Critical** – When there is a failure to comply with a critical food safety or legal issue, or a risk to the integrity of the program, the auditor immediately informs the certification body, which then informs BAP Management. Pending clarifications, failure to certify or immediate temporary suspension can ensue.

**Major** – When there is a substantial failure to meet the requirements of a standard but no food safety risk or immediate risk to the integrity of the program, the auditor notifies the certification body and records this in the report. Verification of the implementation of corrective actions shall be submitted to the certification body within 28 days of the evaluation. (Major non-conformities typically reflect issues with general policies.)

**Minor –** When full compliance with the intent of the standards has not been demonstrated, the auditor notifies the certification body and records this in the report. Verification of the implementation of corrective actions shall be submitted to the certification body within 28 days of the evaluation. (Minor non-conformities typically reflect general housekeeping issues.)

BAP standards are developed by committees of technical experts following a process aligned to the FAO Technical Guidelines on Aquaculture Certification. See www.gaalliance.org/bap/standardsdevelopment.php.

## BAP Standards Compliance Requirements

| BAP Standard | Applies To |
|---|---|
| 1. Community: Property Rights and Regulatory Compliance | All production systems |
| 2. Community: Community Relations | All production systems |
| 3. Community: Worker Safety and Employee Relations | All production systems |
| 4. Environment: Protection of Ecologically Sensitive Areas | Land-based systems only |
| 5. Environment: Metabolic Wastes and Uneaten Feed | All production systems<br>5i – Land-based systems<br>5ii – Cages in fresh- or brackish water below 25-ppt salinity<br>5iii – Cages in marine water above 25-ppt salinity |
| 6. Environment: Soil and Water Conservation | Land-based systems only |
| 7. Environment: Feed Biosecurity, Fishmeal and Fish Oil Conservation | All production systems |
| 8. Environment: Stocking Sources and GMOs | All production systems |
| 9. Environment: Control of Escapes | All production systems, several standards for cages only |
| 10. Environment: Wildlife Interactions | All production systems, several standards for cages only |
| 11. Environment: Storage, Disposal of Supplies and Wastes | All production systems |
| 12. Animal Welfare: Animal Welfare | All production systems |
| 13. Food Safety: Chemical and Drug Management | All production systems |
| 14. Biosecurity: Disease Control | All production systems |
| 15. Traceability: Record-Keeping Requirement | All production systems |

## Abbreviations

AAHP – Aquatic animal health professional
AMA – Area Management Agreement
AWS – Animal Welfare Section (of the Health Management Plan)
BAP – Best Aquaculture Practices
BOD – Biochemical oxygen demand
ESA – Ecologically sensitive area
FIFO – Fish in:fish out ratio
GIP – Genetic Improvement Plan
HMP – Health Management Plan
ILO – International Labor Organization
HMP – Health Management Plan
mt – Metric tons
ppt – Parts per thousand
RAS – Recirculating aquaculture system
SCP – Stock Containment Plan
WIP – Wildlife Interaction Plan

## Definitions

Brackish water – Water that is on average below 25-ppt salinity.

Cage – A net or mesh-covered container in which aquatic animals are held. Sometimes these are also called net pens. The term cage is used throughout in these standards.

Ecologically sensitive areas – Places that have special environmental attributes worthy of retention or special care. These areas are critical to the maintenance of productive and diverse plant and wildlife populations. (See http://www.env.gov.bc.ca/wld/documents/bmp/urban_ebmp/EBMP%20PDF%204.pdf)

GMO – Genetically modified organism – An animal that has been genetically modified by artificial transfer of genetic material from another species.

Marine water – Water that is on average above 25-ppt salinity.

Point source effluents – Effluents discharged from a pipe or canal as a single stream, in contrast to effluents discharged from cages, which “leak” out through the net mesh.

Proactively prohibited therapeutants – Compounds that are specifically identified and banned for use, including extra-label use, in aquatic animals in producing or importing countries. (See http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=530.41.)

Therapeutants – Antibiotics, drugs and chemicals used in the treatment of aquatic animal diseases.

# 1. Community (All Production Systems)

## Property Rights and Regulatory Compliance

**Hatcheries 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

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

Some hatcheries may be sited in water bodies or on coastal land to which hatchery owners do not have legal right. Such facilities 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, fishing 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.

### Implementation

Regulations regarding the operation and resource use of hatcheries 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
- protection of sensitive habitats
- effluent permits
- therapeutics use permits
- permits related to non-native species
- predator control permits
- well operation permits
- landfill operation permits
- environmental impact assessments.

Individual auditors cannot know all laws that apply to hatcheries in all nations. Participating hatcheries 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, aquaculture, water management and transportation, as well as local aquaculture associations. Auditors shall also become familiar with the legal requirements within the areas they service.

During the BAP site inspection, the representative of the hatchery shall present all necessary documents to the auditor. Hatcheries shall be in compliance with the requirements stipulated by the documents. For example, if a hatchery 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.

### Standards

1.1: Current documents shall be available to prove legal land and water use by the applicant.

1.2: Current documents shall be available to prove all business and operating licenses have been acquired.

1.3: Current documents shall be available to prove compliance with applicable environmental regulations for construction and operation.

## 2. Community (All Production Systems)

### Community Relations

**Hatcheries 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 facilities 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 reduced access to areas used for fishing, hunting, gathering, domestic water supply or recreation.

### Implementation

Hatchery management shall attempt to accommodate traditional uses of coastal resources through a cooperative attitude toward established local interests and environmental stewardship. Facilities shall not block legal traditional access corridors to public mangrove areas and fishing grounds. In some cases, it may be necessary to provide a designated access route across the facility.

Hatcheries shall maintain a neat and attractive appearance to avoid becoming an eyesore to local residents. Sanitary measures shall be employed to prevent odors from affecting nearby neighbors. (See Section 11.) Machinery shall be maintained in good repair to avoid unnecessary noises that may disturb neighbors.

During facility inspection, the auditor shall 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 facility workers. The auditor shall select the individuals for interview.

### Standards

2.1: The applicant shall accommodate local inhabitants by not blocking traditional access routes to fishing grounds, wetland areas and other public resources.

2.2: The applicant shall manage water usage to avoid restricting the amount of water available to other users.

2.3: The applicant shall demonstrate interaction with the local community to avoid or resolve conflicts through meetings, committees, correspondence, service projects or other activities performed annually or more often.

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## 3. Community (All Production Systems)

### Worker Safety and Employee Relations

**Hatcheries shall comply with local and national labor laws, including those related to young and/or underage workers, to assure adequate worker safety, compensation and, where applicable, on-site living conditions.**

### Reasons for Standard

Work at aquaculture facilities is potentially dangerous because of the types of machinery employed, the risks of drowning and electrocution, and the use of hazardous materials. Workers may not fully appreciate the risks at such facilities, and sometimes safety instruction may not be adequate.

Both local and foreign workers may be employed at hatcheries. Instances of employment of illegal foreign workers have been reported in some countries. Therefore, BAP certification requires proof of legal foreign worker documentation.

Much aquaculture takes place in developing nations where pay scales are low, and labor laws may not be consistently enforced. Hatcheries that provide on-site living quarters shall provide clean living conditions with adequate space.

### Implementation

At a minimum, certified hatcheries shall provide legal wages, a safe working environment and adequate living conditions, if these are provided. Auditors shall take into account national regulations and local standards to evaluate this aspect. Efforts should be made to exceed the minimum requirements, because certified hatcheries should be progressive and socially responsible. When hiring foreign workers, hatcheries shall require documentation of legal status.

Safety equipment such as goggles, gloves, hard hats, life jackets and ear protection shall be provided when appropriate. Machinery shall have protective guards or covers, where appropriate, and electrical devices shall be correctly and safely wired. Tractors and forklifts should have roll bars, shields over power take-offs and other appropriate safety devices.

Staff and workers shall be given initial training as well as refresher training on safety in all areas of hatchery operation. Workers shall also be trained in first aid for electrical shock, profuse bleeding, drowning and other possible medical emergencies, including those related to the mishandling of chemicals. A plan shall be available for obtaining medical assistance for injured or ill workers.

Living quarters shall be well ventilated and have adequate shower and toilet facilities. Food services, where provided, shall provide wholesome meals for workers, with food storage and preparation done in a responsible manner. Trash and garbage shall not accumulate in living, food preparation or dining areas. (See Section 11.)

Hatcheries that use divers to perform underwater tasks shall develop a written plan to assure safety and require directly employed or contracted divers to follow the plan. The plan shall require specialized diver safety training, maintenance records for diving equipment and procedures for diving emergencies.

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

## Standards

3.1: The applicant shall meet or exceed the minimum wage rate, including benefits, required by local and national labor laws.

3.2: The applicant shall not engage in or support the use of child labor. The applicant shall comply with national child labor laws regarding minimum working age or ILO Minimum Age Convention 138, whichever is higher. ILO Minimum Age Convention 138 states the minimum age shall be 15, unless local law in developing nations is set at 14 – in accordance with developing nations exceptions under this convention.

3.3: The employment of young workers above the minimum age but under 18 years old shall be in compliance with local laws, including required access to compulsory school attendance and any restrictions on hours and time of day.

3.4: Young workers above the minimum age but under 18 years old shall not be subjected to hazardous work that can compromise their health and safety.

3.5: All work, including overtime, must be voluntary. The facility shall not engage in any form of forced or bonded labor. This includes human trafficking, the holding of original identity papers, prohibiting workers from leaving the premises after their shifts or other coercion intended to force anyone to work. Where the holding of original identity papers is required by national law, such papers must be immediately returned to employees upon request and be readily available to them at all times.

3.6: The applicant shall abide by the national mandated work week where applicable.

3.7: The applicant shall comply with national labor laws for pay, overtime and holiday compensation for hours worked beyond the regular work day or week.

3.8: The facility shall not require the payment of deposits, deductions from wages or withholding of pay that is not part of a legal contractual agreement with the employee and/or that is not provided for or permitted by national law.

3.9: The facility shall not make deductions from wages as part of a disciplinary process.

3.10: The applicant shall only employ legally documented workers, whether nationals or migrants.

3.11: The facility shall maintain all relevant documents that verify any contracted/subcontracted workers, whether contracted through a labor service or otherwise, are paid in compliance with all local wage, hour and overtime laws.

3.12: All labor, recruiting or employment services used by the facility must be licensed to operate by the local or national government as a labor provider.

3.13: The facility shall maintain all relevant documents that verify piece workers (those paid a fixed “piece rate” for each unit produced or action performed regardless of time) are paid in compliance with local law, including regulations regarding equivalence to or exceeding minimum requirements for wages, hours, overtime and holiday pay.

3.14: The facility shall provide to all workers, whether hourly, salaried, piece-rate, temporary, seasonal or otherwise prior to hire and during employment, written and understandable information regarding the terms of employment, worker rights, benefits, compensation, hours expected, details of wages for each pay period and facility policies regarding disciplinary actions, grievance procedures, authorized deductions from pay and similar labor-related issues. This information must be provided in the prevalent language of the majority of employees.

3.15: Where contracted/subcontracted or temporary workers are hired through a labor or employment service, the facility shall ensure that the labor or employment service provides the above information prior to and during hire, in appropriate languages, to ensure workers are aware of their rights and conditions of employment as described above.

3.16: Workers shall have the right to terminate their employment after reasonable notice.

3.17: The facility shall appoint a management person responsible for ensuring worker health, safety and training.

3.18: The facility shall identify and eliminate or minimize any workplace health and safety hazards by conducting a thorough risk assessment. This includes a requirement for accident investigation.

3.19: Workers shall have the right to collective bargaining, or at least one employee shall be elected by the workers to represent them to management.

3.20: There shall be a written worker grievance process, made available to all workers, that allows for the anonymous reporting of grievances to management without fear of retaliation.

3.21: The facility shall provide for equal opportunity with respect to recruitment, compensation, access to training, promotion, termination or retirement.

3.22: The facility shall treat workers with respect and not engage in or permit physical, verbal or sexual abuse, bullying or harassment.

3.23: If provided, employee housing shall meet local and national standards (e.g., water-tight structures, adequate space, heating/ventilation/cooling), and shall be free of accumulated trash and garbage, as well as equipment and inputs.

3.24: Safe drinking water shall be readily available to employees. If meals are provided, they shall be wholesome and commensurate with local eating customs.

3.25: Running water, toilets and hand-washing facilities shall be readily available to employees.

3.26: In the event of accidents or emergencies, the applicant shall provide basic medical care, including access to or communication with medical authorities. Additionally, first aid kits shall be readily available to employees, and any expired content shall be replaced.

3.27: The applicant shall provide training in general health, personal hygiene and safety (including aquatic safety and the use of boats and associated equipment), first aid and contamination risks to all employees within eight weeks after hiring. Safety documents must be available in a language understood by the workforce.

3.28: Employees shall be appropriately licensed to drive or use equipment for which public licenses are required, and a list of such licensed employees and copies of their licenses shall be available for inspection.

3.29: An emergency response plan shall be prepared for serious illnesses or accidents.

3.30: Select workers shall be made familiar with details in emergency response plans and trained in the first aid of electrical shock, profuse bleeding, drowning and other possible medical emergencies.

3.31: Protective gear and equipment in good working order shall be provided for employees (e.g., eye protection for welding, gloves for shop work and boots for wet areas). Auditor to verify deployment.

3.32: Electrical pumps and aerators shall be wired according to standard safe procedures. Machinery shall have proper driveshaft and/or drive belt safety guards.

3.33: The applicant shall comply with laws that govern diving on aquaculture facilities and develop a written dive safety plan that requires diver training and the maintenance of logs that document procedures, safety-related incidents and equipment maintenance.

# 4. Environment

(Land-Based Systems Only)

### Protection of Ecologically Sensitive Areas

**Hatcheries shall protect and conserve ecologically sensitive areas with environmental attributes worthy of retention or special care. Wetland areas removed for allowed purposes shall be mitigated.**

### Reasons for Standard

Hatcheries are typically operated in coastal or freshwater environments in tropical or temperate locations. Such locations can include ecologically sensitive areas (ESAs) that have special environmental attributes worthy of retention or special care. These areas, which can include but are not limited to mangrove and wetland areas and sensitive shoreline habitat, are critical to the maintenance of productive and diverse plant and wildlife populations.

Hatcheries use different rearing methods and can be built in ecologically sensitive areas adjacent to natural water bodies. This can potentially harm sensitive areas in various ways.

### Implementation

These BAP standards seek to prevent damage, if possible, or mitigate damage where prevention is not possible. In all cases, hatcheries shall employ appropriate construction methods and methods of operation to protect the natural resources they use.

- Ecologically sensitive areas shall be identified and protected during construction.
- Facilities shall be designed and operated to prevent erosion or sedimentation due to effluent discharge, water flow or flooding.
- If hatchery operation requires access to water across an ecologically sensitive area, this shall only be allowed for the installation of inlet and outlet canals, pump stations and docks.
- ESAs damaged by construction or operations since 1999 shall be mitigated by restoration of an area of similar habitat three times the size of the area damaged or by a donation of equivalent value to other restoration projects. This practice is only allowable if local regulations permit it.
- In cases where ESAs were damaged before 1999, the facility shall be the subject of a five-year restoration or mitigation plan. To be considered for a possible exemption, the hatchery shall explain the extenuating circumstances regarding the damage.

### Standards

#### Land-Based Systems

4.1: Where the site plan shows that an ESA has been damaged by facility construction and/or operation since 1999, the loss shall have been only for allowable purposes.

4.2: If net loss of ecologically sensitive area occurred on facility property since 1999, the loss shall have been mitigated by restoring an area three times as large or by an equivalent donation to restoration projects.

4.3: For facilities constructed before 1999 and where an ESA was damaged but not restored, the applicant shall propose a plan, subject to local regulations, that within five years from the date of initial BAP certification shall restore the damaged area, mitigate the damage by restoring an equal area of similar habitat or make a donation of equivalent value to other restoration projects. Alternatively, the applicant shall provide an explanation of the extenuating circumstances regarding the damage for consideration of exemption from this standard.

4.4: Operation of the facility shall not lead to erosion or beach deterioration, or cause other ecosystem damage that will not recover within the natural life cycle of the major fauna or flora damaged.

4.5: Unless specific permits apply, hatchery activities shall not alter the hydrological conditions of the surrounding watershed, and the normal flow of brackish water to mangroves or freshwater to wetlands shall not be altered.

## 5. Environment (All Production Systems)

### Metabolic Wastes and Uneaten Feed

**Hatcheries shall monitor the concentrations and/or impacts of the metabolic wastes and uneaten feed discharged from their facilities and comply with BAP effluent quality criteria, unless exempted. Where applicable, hatcheries shall also meet conditions for discharge as specified in their operating permits.**

Different monitoring procedures and standards apply for different hatchery systems as described below.

### 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.

Sea-based, mollusk nursery facilities where the animals feed only on naturally growing food are exempt from the effluent-monitoring requirements of this standard.

## 5i. Land-Based Systems

### Implementation

Applicants shall monitor their effluents and meet the initial BAP effluent water quality criteria, and apply the methods for sampling and analysis given in Appendix A. Within five years, they shall meet the final criteria shown in Appendix A. Water quality records shall be documented according to the effluent data sample forms in Appendix B.

To confirm compliance with the BAP effluent criteria, the auditor shall during the inspection process witness effluent sampling and preparation for analysis by an independent laboratory. The samples collected during the audit shall be analyzed by a private or government laboratory following generally accepted analytical methods.

#### Limited Option: Allowable Deviation From Standard Water Quality Criteria

The source water for hatcheries can have higher concentrations of water quality variables than allowed by the BAP initial criteria. In these cases, demonstration that the concentrations of the variables do not increase (or decrease for dissolved oxygen) between the source water and hatchery effluent is an acceptable alternative to compliance with the criteria. This option does not apply to pH and chloride.

To qualify for the Limited Option, hatcheries must collect samples of both influent and effluent water according to the frequencies stated in Appendix A.

#### Exemptions From Effluent-Monitoring Requirements

The following land-based hatchery facilities are exempt from the effluent-monitoring requirements:

- Hatcheries that release no effluent to natural water bodies, e.g., those where effluent is used for irrigation, or where percolation ponds are used.
- Hatcheries that avoid regular discharges of effluents into natural water bodies such that less than 1% of the system volume is exchanged daily on an annual basis – for example, by reusing all water or practicing infrequent, limited exchange of water. Hatcheries qualifying for this exemption shall report an annual effluent discharge volume, water use and nutrient load as described in Appendix C.
- Hatcheries that produce less than 3 mt of live aquatic products yearly.

### Standards

#### Land-Based Systems

5.1: If the facility is claiming the Limited Option as a justification for deviating from standard water quality criteria, it shall collect the requisite influent and effluent water quality data, and concentrations shall reflect no deterioration between intake and discharge.

5.2: If the applicant's facility is claiming exemption because the facility releases no effluent, or its effluent is exclusively destined to irrigate agricultural crops, an explanation of how this is achieved shall be provided, and these Section 5 standards do not apply. Must be verified by auditor.

5.3 If the applicant is claiming exemption because daily water exchange rates on an annual basis are less than 1% of system volume, data for annual effluent discharge volumes, water use and nutrient loads shall be provided.

5.4: If the applicant is claiming exemption because the facility produces less than 3 mt of live aquatic products per year, an explanation of how this is met shall be provided.

5.5: Records on intake water and effluent monitoring shall be maintained and available.

5.6: Effluent water quality concentrations shall comply with BAP water quality criteria or applicable regulations, if they are equivalent or more rigorous.

5.7: Hatcheries shall continue compliance with these criteria to maintain certification and comply with BAP's final criteria within five years.

5.8: The hatchery shall provide the auditor with an estimated annual water use during the last calendar year, as illustrated in Appendix C, and the input data shall also be available for review.

## 5ii. Cages in Fresh- or Brackish Water

### Implementation

Cages do not discharge point-source effluents, but uneaten feed, feces and metabolic excretions enter the water bodies that contain the cages or net pens.

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 criteria (Appendix A) shall not be eligible for certification. However, this does not apply to mollusk nursery facilities, where filter-feeding mollusks may improve water quality.

Hatcheries that use cages in freshwater or brackish water and that annually produce more than 20 mt of animals or use more than 20 mt of feed (dry weight basis) shall monitor and maintain records of water quality according to the schedule and procedures in Appendix D. 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.

Cages can be installed in lakes, reservoirs, streams, irrigation systems, ponds or estuarine water embayments. Rules for compliance with the BAP effluent management standards differ among the types of water bodies in which the cages and pens are installed. Guidance on improving production practices in cages is provided in Appendix E.

#### Cages in Lakes, Reservoirs

In addition to water quality monitoring, hatcheries that use cages in lakes and reservoirs shall comply with feeding rate limits based on the calculated hydraulic retention time of the water bodies (Appendix F).

#### Cages in Ponds

Ponds are mostly privately owned but usually discharge into public waters. Effluents from ponds containing cages shall comply with the BAP effluent criteria (Appendix A).

#### Cages in Streams, Irrigation Systems

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 operations in streams.

Soluble phosphate and total ammonia nitrogen levels shall be measured monthly immediately upstream of cages at a depth of 50 cm and 200 m downstream 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.

#### Cages in Brackish Water

As a general rule, cage areas with brackish water with mean salinity below 25 ppt are well flushed. Thus, daily feed input of 7.5 kg/ha of the surface area of the water body is allowed unless results from monitoring indicate non-compliance, in which case feeding rates shall be reduced until compliance is achieved.

Monitoring shall be the same as for operations in lakes or reservoirs with two exceptions: Brackish water locations do not experience thermoclines, as found in lakes and reservoirs, and it is not necessary to monitor discharges from them for compliance with BAP effluent criteria.

### Standards

#### Cages in Lakes, Reservoirs

5.9: The water quality of the water body, including its discharge point if applicable, shall meet the BAP effluent water quality criteria, with sampling conducted following the procedures in Appendix D.

5.10: Facilities shall maintain accurate records of daily feed inputs that reflect compliance with the BAP maximum allowable daily feed input levels.

5.11: Water quality-monitoring records shall be applied in the management of feeding rates (Appendix E) when dissolved-oxygen levels are consistently below 5 mg/L in the early morning, when mean annual Secchi disk visibility decreases by 25% since initial certification, when blue-green algae comprise more than 60% of total phytoplankton or when the thermocline becomes 25% shallower since initial certification. Water quality and feeding records shall be available to substantiate compliance.

#### Cages in Streams, Irrigation Systems

5.12: Monthly records of upstream and downstream total ammonia nitrogen and soluble phosphorus concentrations shall be available.

5.13: Maximum daily feeding rates shall be managed such that concentrations of nutrients at 50-cm depth and 200 m downstream of the cages do not exceed upstream concentrations by more than 25%.

#### Cages in Brackish Water

5.14: Feeding records shall demonstrate that the maximum daily feeding rate of 7.5 kg/ha of the water body surface area is not exceeded and that feeding levels were reduced when BAP water quality criteria were exceeded.

5.15: Water quality-monitoring records shall be maintained as specified.

## 5iii. Cages in Marine Water Above 25-ppt Salinity

### Implementation

Sediment monitoring is the most practical means of detecting the environmental impacts of hatcheries that use marine cages. Such facilities shall be located and operated so that they minimize negative impacts on sediment quality outside a defined sediment impact zone.

Cage facilities are usually located following hydrographic, biological and physical studies of the sites to determine that operations will not have significant negative impacts on animal populations that comprise the benthos under or near the cages. Then "allowable" benthic impacts are set as conditions in the operating permits for the facilities, which are defined in terms of one or more of several chemical properties of the sediments. Sometimes these are then correlated with species density and diversity determinations, which are based on prior knowledge of local sediment biology or analysis of sediment reference samples collected from the facility locations.

Production cycles and fallowing shall be coordinated with other neighboring BAP applicants or BAP-certified facilities, or with members of an established Area Management Agreement (AMA). Neighboring facilities, defined as facilities within an area twice the regulatory minimum separation distance to an upper limit of a 5-km radius, should participate in the creation and implementation of Area Management Agreements to address cumulative impacts associated with multiple aquaculture facilities.

BAP-certified hatcheries that operate in isolation should have statements of intent to enter AMAs, should other operations move into their areas.

Cage facility permits and/or local regulations usually define an allowed "sediment impact zone," "allowable zone of effect" or "footprint of deposition," and prescribe monitoring protocols to check it. Because biological sampling of sediments requires special expertise and is time-consuming and expensive, chemical sediment properties are usually used as leading indicators of sediment condition. Biological sampling is only required in some jurisdictions when an indicator trigger point is exceeded.

Chemical indicators used for this purpose include oxygen concentration in the sediment, sulfide, REDOX potential, total organic carbon or total volatile solids, or visual inspection with documentation by video. The specific environmental conditions dictate which method is most suitable.

For example, sulfide determination works well in silt or clay sediments containing up to 50% sand, as does determination of total organic carbon. Above this level of sand, an indicator such as total organic carbon works better. On hard bottoms with over 10% gravel, visual recording by video is best, because grab sampling is impossible, and many such sea bottoms are erosional in nature, not depositional.

Since different methods or combinations of methods may be required in different jurisdictions based on local hydrographic or benthic conditions, no preferred method is specified in these standards, only that whatever method is used shall be undertaken using standard methods of sampling and analysis that conform to generally accepted international standards.

In situations where sediment monitoring is a statutory requirement, and allowed sediment impact zones are defined, the following shall apply to all applicants for BAP certification.

- Hatcheries shall provide documents that describe local standards for benthic impacts under cage facilities.
- Existing facilities shall provide at least three years of monitoring data to show that they meet or exceed benthic standards required by operating permits at current production levels.
- Each new facility shall have completed a baseline study, with review by an independent expert, that describes hydrographic and benthic conditions at the site. The expert's opinion (given without liability) must indicate the facility can meet or exceed the benthic standards required by its operating permits at current or proposed production levels. This opinion shall be verified by reference to sampling results at the next audit.
- Hatcheries shall provide documents to show that sediment quality was determined using generally accepted sample collection and analytical methods.

In countries or regions where sediment monitoring is not required as described above, and/or an allowed sediment impact zone is not defined, applicants that produce more than 20 mt of animals or use more than 20 mt of feed (dry weight basis) yearly shall write and implement a monitoring plan that requires them to:

- Nominate an independent individual or company with demonstrated expertise in sediment sampling and analysis to design a sediment sampling and analysis program appropriate to the facility conditions and to conduct sediment monitoring as required below.
- Chart an allowable sediment impact zone that shall not exceed the total area of the facility plus a boundary zone of 40 m around it. The footprint may be shifted in any direction to account for normally occurring uneven current patterns, as long as the total area remains the same.
- Monitor the organic build-up on the seabed within this zone by the method deemed best for the type of sediment that exists there. The choice of method shall be justified by prior documentation of the type of sediments over which the facility is located.
- Conduct sediment sampling to coincide with the period of peak feeding during each crop cycle. Samples shall be taken along at least two transects that pass directly through the facility and align with the dominant flow of water at the site. One sample with three replicates shall be taken at the edge of the facility, and another shall be taken at the 40-m boundary.
- Take five replicate samples from at least two reference stations within 1 km of the facility that have depth and sediment characteristics similar to those that occur at the facility and where there is no production.
- Demonstrate by statistical analysis of the results that there is no organic build-up due to facility activity at the boundary of the allowable sediment impact zone in comparison to the reference station, as determined by the monitoring method chosen.

## Additional Information

**Finfish Aquaculture License**
**Under the Pacific Aquaculture Regulations**
Fisheries and Oceans Canada
http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar-eng.pdf

**Guide to the Assessment of Sediment Condition at Marine Finfish Farms in Tasmania**
C. Macleod and S. Forbes (editors)
Tasmanian Aquaculture and Fisheries Institute
University of Tasmania
Hobart, Tasmania, Australia
http://www.imas.utas.edu.au/__data/assets/pdf_file/0011/68384/AquafinCRC_ProjectNo4.1.pdf

**Norwegian Standard N. S. 9410.E**
Environmental Monitoring of Marine Fish Farms

**Code of Good Practice for Scottish Finfish Culture**
Scottish Salmon Producers' Organisation
http://www.thecodeofgoodpractice.co.uk

**Washington State Legislature, WAC 173-204-420**
Sediment Impact Zone Maximum Criteria
http://apps.leg.wa.gov/WAC/default.aspx?cite=173-204-200

**FAO Fisheries and Aquaculture Technical Paper No. 527**
Environmental Impact Assessment and Monitoring in Aquaculture, pp. 455–535
A. Wilson, S. Magill, K. D. Black – 2009
FAO. Rome, Italy

## Standards

### Cages in Marine Water

5.16: The applicant shall provide documents that describe local standards for benthic impacts under cage facilities, which shall include the benthic indicator "trigger level" above which the facility would not be in full compliance with the local standard, where this is clearly defined, or with its intent where it is not clearly defined.

5.17: For established facilities, the applicant shall provide three years of monitoring data to show that the facility meets or exceeds sediment quality criteria specified in its operating permits and/or its own monitoring plan at current operating levels.

5.18: For newly established facilities or those that have expanded and do not yet have enough monitoring data, the applicant shall provide an independent study that characterizes the hydrographic and benthic characteristics of the area and provides a consultant's opinion (without liability) that the facility can meet or exceed sediment and water quality criteria if operated correctly. This opinion shall be verified by reference to sampling results at the next audit.

5.19: Monitoring of sediment conditions shall be undertaken at the time of peak feeding during the production cycle and shall be conducted according to the requirements of the facility's operating permits or its own plan in countries or regions where sediment monitoring is not required, and as specified in the implementation guidelines.

5.20: Sediment sampling and analysis performed as part of the monitoring program shall apply generally accepted international methods and be adapted to the local hydrographic or benthic conditions.

5.21: The results of sediment monitoring shall be reported to and reviewed and accepted by the appropriate regulators. Where regulatory approval is conditional upon implementing a program of remedial action, this shall have been implemented and completed.

5.22: Production cycles and fallowing shall be coordinated with other neighboring BAP applicants or BAP-certified facilities, or with members of an established Area Management Agreement.

5.23: Where an AMA has not been established, applicants shall nevertheless demonstrate cooperation on matters of stocking, fallowing, animal health and biosecurity with BAP-certified facilities within an area twice the regulatory minimum separation distance to an upper limit of a 5-km radius.

# 6. Environment

## (Land-Based Systems Only)

## Soil and Water Conservation

**Hatchery construction and operations shall not cause soil and water salinization or deplete groundwater in surrounding areas. Land-based hatcheries shall properly manage and dispose of sediment from ponds, raceways, tanks, canals and settling basins.**

### Reasons for Standard

In some hatcheries, freshwater from underground aquifers is used as a source of process water. If saline water used elsewhere in the facility is allowed to infiltrate freshwater aquifers or is discharged into nearby freshwater lakes or streams, it can cause salinization of the groundwater. Excessive use of groundwater can also potentially lower water tables and negatively affect groundwater availability, or cause subsidence or salinization.

Solid waste (mostly feces and uneaten food) from hatchery operations can add to biochemical oxygen demand and cause the build-up of sediment at the point or points of discharge. It should therefore be treated before release.

### Implementation

#### Salinization

Salinization can result from hatchery operation in coastal areas where saltwater or brackish water is used in ponds for production or is discharged into ponds for settlement prior to discharge. The risk of salinization can be reduced by not constructing settling or treatment ponds in highly permeable, sandy soil, or by providing clay or plastic liners to minimize seepage. Discharging into ponds where the groundwater is already saline is another approach. Other best practices include:

- Do not discharge saline water into freshwater areas.
- Avoid pumping of groundwater from freshwater aquifers that significantly lowers the water table in neighboring wells.
- Monitor chloride concentration in freshwater wells near hatcheries to determine if salinization is occurring.

Use of water from irrigation systems shall be in accordance with regulations, and effluents shall be returned to the irrigation system.

#### Sediment Management

Aquaculture ponds have high hydraulic retention times and function as sedimentation basins, but negative environmental impacts can arise when sediments are resuspended during harvest or when sediment is pumped from ponds during the culture period and discharged as a highly fluid sludge. The sludge contains organic material from feces and uneaten feed, and often comprises mineral particles that enter the ponds in source water from a river.

Hatcheries must incorporate suitably sized settling basins or other engineered solutions that assure the collection and removal from the effluent stream of the majority of settleable solids. An example of how the volume of such a settlement facility should be calculated is given in Appendix G. Accumulated solids must then be pumped periodically to offline sludge basins, where they can be dewatered before being disposed of responsibly.

Settlement facilities must be designed to limit or prevent erosion or scouring caused by the influent water flow. 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.

### Standards

**Land-Based Systems**

6.1: If ponds with saline water are constructed on permeable soil, measures such as the use of pond liners shall be taken to control seepage and avoid contamination of aquifers, lakes, streams and other natural bodies of freshwater.

6.2: For inland brackish ponds, quarterly monitoring of neighboring well and surface water shall show that chloride levels are not increasing due to hatchery operations.

6.3: Data on water levels in neighboring wells shall be requested from the well owners, and where available shall show that the water table is not adversely affected by the facility's use of water for hatchery processes.

6.4: Use of water from wells, lakes, streams, springs or other natural sources shall not restrict the amount of water available to other users or cause damage to ecologically sensitive areas or subsidence in surrounding areas.

6.5: The facility shall process all sludge/sediment in sedimentation basins or by other proven sediment concentration methods, such as filters and presses, and shall not dump material in ecologically sensitive areas.

6.6: If the applicant's facility uses tanks, raceways or similar systems with short retention times, sedimentation basin capacity shall be provided to handle the associated sludge/sediment, and documents shall be available to show how the capacity was calculated.

6.7: Any accumulated sludge removed from ponds, reservoirs or sedimentation basins shall be confined within the facility property until it is disposed of harmlessly.

6.8: Removed sediment shall be properly contained and located to prevent the salinization of soil and groundwater, and shall not be placed in mangrove areas or other sensitive habitats.

6.9: The applicant shall take measures to control erosion and other impacts caused by outfalls.

## 7. Environment (All Production Systems)

### Feed Biosecurity

### Fishmeal and Fish Oil Conservation

**Hatcheries shall accurately monitor feed inputs and take steps to minimize risks of contamination or spoilage. Hatcheries that produce juveniles with average live weights over 50 g and use more than 500 mt of dry feed yearly shall minimize the use of fishmeal and fish oil from wild fisheries.**

### Reasons for Standard

Hatcheries use live, fresh, frozen or dry feeds depending on the species grown and the stage of animal development. Live, fresh and frozen feeds can contain microorganisms that pose a biosecurity risk, while there is a risk of spoilage or the presence of toxic preservatives in some fresh and frozen feeds if they have not been handled correctly.

Dry feeds purchased from trustworthy suppliers should not pose such risks and, since most hatcheries use dry feeds in only small quantities, the amounts of fishmeal and fish oil from wild fisheries they contain are not considered an issue for BAP certification.

However, in some cases, much larger volumes of dry feed can be used. This occurs especially at hatcheries that grow fish to an intermediate size in facilities that are often referred to as "nurseries" before transfer to the final growout farm. Where feed volumes used in such nurseries exceed 500 mt of dry feed yearly, and juveniles are grown to an average live weight greater than 50 g, assurance is required regarding the responsible sourcing of fishmeal and fish oil from wild fisheries, as well as demonstration of efforts to minimize their use.

Sea-based, mollusk nursery facilities where the animals graze on naturally produced phytoplankton are exempt from compliance with these standards.

### Implementation

Hatcheries shall keep accurate records of all feed brought into and used at the facilities, and shall take all reasonable measures to ensure the feed is wholesome and stored under conditions where it will not deteriorate. Biosecurity issues related to live, fresh or frozen feeds brought into the facility and/or produced at the facility shall be the subject of measures outlined in the site-specific Health Management Plan. (See Section 14.)

Hatcheries that use more than 500 mt of dry feeds yearly and produce juveniles of over 50 g average live weight shall maintain records that enable fish in:fish out ratios to be calculated as described in Appendix H.

To promote the responsible sourcing of marine ingredients, the applicant shall obtain feed from a BAP-certified feed mill or a feed mill that declares and documents compliance with BAP feed mill standards 3.1 and 3.3. These standards address sourcing policies on marine ingredients, covering traceability for species and origin, and the exclusion of any species designated on the IUCN Redlist as endangered or critically endangered.

The BAP feed mill standards require that after June 2015, for fishmeal and fish oil derived from reduction fisheries, at least 50% (calculation based on mass balance) shall come from sources that are certified by either the Marine Stewardship Council (MSC) or to the International Fishmeal and Fish Oil Organization Responsible Supply standards (IFFO RS). Alternatively, where MSC- or IFFO RS-certified fishmeal and fish oil are not produced nationally, the above minimum percentage can comprise material from active approved improvers programs as verified by IFFO (http://www.iffo.net/node/493), the Sustainable Fisheries Partnership (SFP, http://fisheryimprovementprojects.org/view-fips/) or World Wildlife Fund (WWF, https://sites.google.com/site/fisheryimprovementprojects/home). This 50% target will be periodically reassessed with the ultimate goal that all fishmeal and fish oil are derived from certified sources.

### Standards

#### All Production Systems

7.1: Accurate records shall be kept of all feeds used, their sources and any tests undertaken for the presence of contaminants or toxicants.

7.2: Live, fresh or frozen feed brought into the hatchery from an outside source shall be accompanied by a certificate from the supplier warranting that the feed is fresh or was frozen when fresh, and has not been treated with toxic preservatives such as formalin.

7.3: All feed shall be stored under cover with temperature control (as needed) and enough space from the walls to allow ventilation and movement for inspection.

7.4: Feeds and feed additives (premixes) shall be protected from moisture and pests, and stored away from fuels, chemicals and other potential contaminants.

7.5: Biosecurity provisions for feeds brought into or produced at the facility shall be followed as described in the Health Management Plan. (See Section 14.) Records shall be available to demonstrate this.

7.6: No feeds that contain material derived from the flesh or carcasses of the same species that is reared in the facility shall be used, even if such materials have supposedly been disinfected by cooking or other treatment.

#### Hatcheries Using Over 500 mt Dry Feed/Year

7.7: The applicant's facility shall use feed for which the manufacturer has provided data on the wild-harvested fishmeal and fish oil content or feed fish inclusion factor.

7.8: The facility shall record the characteristics of all feeds used, the total amounts of each feed used each year and the total annual production.

7.9: The facility shall calculate and record a feed-conversion ratio for each completed production cycle.

7.10: The facility shall calculate and record a fish in:fish out ratio for each completed production cycle.

7.11: The fish in:fish out ratio shall not exceed 1.5.

7.12: The applicant shall obtain feed from a BAP-certified feed mill or a feed mill that declares and documents compliance with standards 3.1 and 3.3 of the BAP feed mill standards, as below.

Feed mill standard 3.1: The applicant shall obtain declarations from suppliers on the species and fishery origins of each batch of fishmeal and fish oil.
Feed mill standard 3.3: The applicant shall develop and implement a clear, written plan of action defining policies for responsibly sourcing fishmeal and fish oil.

## 8. Environment (All Production Systems)

### Stocking Sources and GMOs

**Certified hatcheries shall comply with government regulations regarding the use of native and non-native species, genetically modified aquaculture species and wild-caught broodstock. Except for certain molluscan shellfish, wild-caught juveniles shall not be stocked.**

### Reasons for Standard

The introduction of domesticated, non-native or genetically modified stocks to a country or region carries with it the risk of adverse interactions with native stocks should escapes occur. Therefore, procedures must be followed to minimize such risks.

### Implementation

Hatcheries shall keep records of their sources and purchases of stocking material, and record an estimated count of the number stocked in each culture unit for each crop. A sample traceability form that records these data is provided in Appendix I.

Introductions of species to countries where such species are not native, not feral or not already approved for farming shall be subject to the provisions of the 2005 ICES Code of Prac-

tice on the Introductions and Transfers of Marine Organisms or, in the case of freshwater species, the United Nations Food and Agriculture Organization's 1988 Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms.

Hatcheries that engage in genetic improvement of stock through selective breeding shall have a written Genetic Improvement Plan that describes improvement goals and how genetic fitness will be maintained as these goals are pursued. Guidance on the development of such a plan is available through FAO. (See Additional Information.)

### Genetically Modified Organisms

Genetically modified organisms (GMOs) are defined as organisms that have been genetically modified by artificial transfer of genetic material from another species or altered in a way that does not occur naturally. Sterile or sex-reversed organisms and their offspring created by hybridization or polyploidy are not GMOs. Should GMOs be permitted by governments for use in aquaculture in the future, producers shall, at a minimum, comply with all regulations in producing and consuming countries.

### Additional Information

**Code of Practice on Introductions and Transfers of Marine Organisms, 2005**
International Council for the Exploration of the Sea
http://www.ices.dk/publications/Documents/Miscellaneous%20pubs/ICES%20Code%20of

**FAO Technical Guidelines for Responsible Fisheries 5, Supplement 3**
Aquaculture Development, Genetic Resource Management
ftp://ftp.fao.org/docrep/fao/011/i0283e/i0283e01.pdf

**Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms**
European Inland Fisheries Advisories Commission
Food and Agriculture Organization of the United Nations
Rome – 1988
ftp://ftp.fao.org/docrep/fao/009/ae989e/ae989e.pdf

### Standards

8.1: The facility shall maintain accurate records of the species produced and, where relevant, any significant stock characteristics, including but not limited to non-native, specific pathogen-free, specific pathogen-resistant, sterile, hybrid, triploid, sex-reversed or genetically modified status. Records shall also include documentation to support the stock characteristic claims made.

8.2: If government regulations control the use or importation of any of the species or stocks produced, relevant permits shall be made available for inspection, even if imported eggs, juveniles or fry were purchased from an intermediary.

8.3: The facility shall keep records of sources and purchases of stocking material, and record the number stocked in each culture unit for each production lot. Numbers shall be determined either by physical count or by estimation using batch weight and average individual animal weight, with records available that also provide an estimated margin of error.

8.4: The facility shall comply with all government regulations regarding importation of native and non-native gametes, juveniles and/or broodstock, where applicable.

8.5: Wild juveniles shall not be deliberately stocked. (This standard does not apply to the collection of seed of certain wild mollusks, which when practiced, must comply with applicable regulations.)

8.6: If wild-caught broodstock are used, documents from the appropriate government agency shall be available to show their capture was approved, and the broodstock were caught from regulated and sustainable fisheries, where such information is available.

8.7: Where the species produced is neither native nor already approved for farming, further documents shall be provided to demonstrate that approval for farming is based on the 2005 ICES Codes of Practice on the Introductions and Transfers of Marine Organisms or, for freshwater species, the United Nations Food and Agriculture Organization's 1988 Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms.

8.8: Hatcheries that engage in genetic improvement of stock through selective breeding shall have a written Genetic Improvement Plan that describes improvement goals and how genetic fitness will be maintained as these goals are pursued.

## 9. Environment (All Production Systems, Several Standards for Cages Only)

### Control of Escapes

**Certified hatcheries shall take measures to minimize escapes and unintended releases of the facilities' stocks.**

### Reasons for Standard

The escape of domesticated and/or non-native culture species or the unintended release of their eggs or larvae can have adverse ecological effects through interbreeding with local populations of the same species, competition with native species or transmission of disease.

## Implementation

All systems shall be designed and maintained to minimize the escape of culture animals, and all incidents involving escapes of animals shall be accurately documented. Hatcheries should demonstrate reductions in such escapes over time.

### Provisions for Cages

Cages are used by some hatcheries for holding broodstock or as nursery facilities where juvenile stock are grown to an intermediate size before being transferred to the final growout facilities from which they will eventually be harvested. Cages are especially susceptible to the occurrence of escapes. Each hatchery that operates cages shall therefore have a written Stock Containment Plan that describes procedures for preventing escapes or explains why in some cases, such as certain mollusk-rearing facilities, such procedures are unnecessary.

## Additional Information

**British Columbia Net Cage Strength-Testing Procedure, 2002**
http://www.agf.gov.bc.ca/fisheries/aqua_report/2004-5/Appendix3.pdf

## Standards

### All Production Systems

9.1: A site risk analysis, updated at least annually, shall be conducted that identifies the potential and actual causes of escapes, determines the relative likelihood of their occurrence or recurrence, and identifies critical control points for effective escape risk monitoring, reduction and response.

9.2: Employees shall be trained in the findings of the risk analysis, and the efficacy of procedures to monitor and reduce escape risks, and effectively respond to escape events shall be documented through the year.

9.3: All holding, transport and culture systems shall be designed, operated and maintained to minimize the unintended release of eggs, larval forms, juveniles and adult animals.

9.4: Screens, nets or other controls sized to retain the smallest live aquatic animals present shall be installed on water outlet pumps, pipes or sluices.

9.5: Screens, nets or other controls shall be installed on or near pump intakes to minimize the introduction of local aquatic fauna.

9.6: All screens shall be well maintained and checked for damage at least daily. Effluents shall be monitored for the presence of live organisms, with records kept to demonstrate compliance.

### Cages

9.7: The applicant shall provide documents that show the facility's moorings were installed according to the manufacturer's and/or marine engineer's specifications.

9.8: Based on the escape risk analysis, the applicant shall have a Stock Containment Plan that describes how cage system integrity is assured and maintained. Unless it can be demonstrated by engineering specifications, operational considerations and/or government regulations that alternative procedures provide equal or better safeguards against escapes or are unnecessary, the procedures outlined in standards 9.9 to 9.14 shall be followed.

9.9: The main surface components of the cage system shall be inspected at least annually and repaired or replaced as needed. The subsurface components shall be inspected at least every two years and replaced as needed.

9.10: The ages of all nets at the facility shall be tracked, and strength tests shall be conducted on them every two years using a recognized net strength-testing method. (See Additional Information for an example.) Nets shall be retired when their strength is below 60% of the strength of new nets.

9.11: All operational nets shall be surface checked for holes at least weekly and checked subsurface with an underwater camera or by a diver at least every four weeks. Nets and cage superstructure shall be checked for holes and other indications of structural damage after risk events such as storms or big tides.

9.12: Boats shall have guards on propellers, and staff members who drive boats shall be trained to avoid contact between boats and cage nets.

9.13: At marine sites, procedures and equipment consistent with local Coast Guard rules shall be in place to warn marine traffic of the facility's presence.

9.14: The facility shall maintain equipment for the recapture of escapees and have written procedures for its use. The procedures must enable rapid response, subject to legal constraints on the types of equipment used.

9.15: The applicant shall be able to verify that all staff have been trained in all aspects of the Stock Containment Plan.

# 10. Environment

## (All Production Systems, Several Standards for Cages Only)

### Wildlife Interactions

**Facilities shall manage physical interactions with wildlife to avoid adverse outcomes and employ humane, non-lethal measures for predator control where possible.**

### Reasons for Standard

The presence and operation of hatcheries can lead to adverse interactions with wildlife through encroachment on their habitat and/or measures taken by the facility to deter predation.

### Implementation

Applicants shall obey laws related to the destruction of birds and other predators and pests. Where applicable, permits and records of predator deterrence actions taken shall be available.

The BAP program strongly encourages hatcheries to employ humane, non-lethal measures for predator and pest control, even when lethal methods are permitted. Additionally, all species listed as "endangered" and "critically endangered" by the International Union for Conservation of Nature Red List or protected by local or national laws shall be subjected to passive deterrence methods only, and no active or lethal means shall be used except under exceptional circumstances, such as risk to human life.

### Provisions for Cages

Cages are used by some hatcheries for holding broodstock or as nursery facilities where juvenile stock are grown to an intermediate size before being transferred to the final growout facilities from which they will eventually be harvested. Cages are especially susceptible to the occurrence of adverse interactions with wildlife. Hatcheries that operate cages should therefore have a written Wildlife Interaction Plan that describes how to deal with potential predators.

### Standards

#### All Production Systems

10.1: The facility shall use humane methods of predator deterrence and actively favor non-lethal control methods. Where applicable, government permits for predator control shall be made available for review.

10.2: The facility shall maintain a list of species that occur within the vicinity of the hatchery that are classified as endangered or threatened under regional laws and/or the IUCN Red List.

10.3: Except in exceptional circumstances, such as the risk to human life, no controls other than non-lethal exclusion shall be applied to predator species listed as endangered or critically endangered on the IUCN Red List or that are protected by local or national laws.

10.4: The facility shall record the species and numbers of all avian, mammalian and reptilian mortalities resulting from predator control actions and shall report them as required by local authorities.

10.5: Specific members of staff designated to carry out lethal control measures shall be trained in humane slaughter methods.

#### Cages

10.6: The applicant shall provide a list of relevant local laws and specific conditions of operating permits that apply to wildlife management and protection.

10.7: Marine sites shall maintain maps that identify officially designated "critical" and/or "sensitive" marine and coastal habitat in the region. If a facility is in an area so designated, a list shall be included of the classified or endangered sedentary species within a 2-km radius of the facility and of mobile coastal species within the region. The list shall be updated where necessary to show wildlife established after the facility began operations.

10.8: Documents shall be available that describe the passive measures in place to deter the entry into cages of would-be predators and procedures for the routine inspection and maintenance of the measures.

10.9: Documents shall be available to show that any active but non-lethal deterrent measures used are approved by regulators through a review of environmental impacts with specific reference to endangered, protected or cetacean species in the area. Such devices shall not be deployed if the review shows they can adversely affect these species.

# 11. Environment (All Production Systems)

## Storage, Disposal of Supplies and Wastes

**Fuel, lubricants and chemicals shall be stored and disposed of in a safe and responsible manner. Paper and plastic refuse shall be disposed of in a prompt, sanitary and responsible way. Excessive accumulation of waste and/or discarded hatchery supplies and equipment shall be removed and disposed of responsibly.**

### Reasons for Standard

Hatcheries use fuel, oil and grease to power and lubricate vehicles, pumps, aerators and other mechanical devices. Chemicals used in hatcheries and nurseries can include fertilizer, liming materials, insecticides, herbicides, parasiticides and algicides. Preservatives, paints, disinfectants, detergents and antifoulants are also used.

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 chemicals can also affect aquatic organisms and other wildlife in the immediate vicinity, and result in water pollution over a wider area.

Hatcheries generate waste that can cause pollution, odors and human health hazards at the facilities and in surrounding areas when not disposed of properly. Human food scraps, out-of-date feed, other organic waste, and discarded equipment or supplies can attract pests and scavengers. Runoff from refuse piles can cause pollution and contaminate groundwater.

Empty plastic bags and other containers used for feed, fertilizer and liming materials do not decompose quickly and can be a hazard to animals.

### Implementation

Fuel, lubricants and chemicals shall be labeled and safely stored. Material Safety Data Sheets shall be available for inspection. Used chemicals shall be disposed of in a responsible manner.

Secondary containment shall be provided for individual or multiple fuel storage tanks. The containment volume shall be equivalent to the total stored volume plus 10%.

Oil leaks from generators, trucks and other equipment shall be prevented through good maintenance. Oil changes and refueling shall avoid spills, with used oil sent to a recycling center or otherwise properly disposed of.

Chemicals such as insecticides, herbicides, algicides and detergents shall be stored in locked, well-ventilated, watertight buildings. The buildings' concrete floors should slope to a center basin for containing spills. Warning signs indicating the presence of such materials shall be posted. Chemicals used for hatchery operations shall be neutralized or diluted before discharge into natural bodies of water.

Fertilizers, liming materials, salt and other less hazardous agricultural chemicals shall be stored under a roof or in rainproof containers, where rainfall will not wash them into surface water. Particular care shall be taken with nitrate fertilizers, which are strong oxidants that are particularly hazardous when contaminated with diesel fuel or other oils.

Procedures shall be developed for managing spills of chemicals and other products, and the supplies needed for cleaning up spills shall be readily available. Workers shall be trained to properly use the equipment and handle the contained waste.

Trash, garbage and other waste, including discarded machinery and equipment, shall not be dumped in mangrove areas, wetlands or vacant land, or allowed to accumulate on facility property. Such waste shall be disposed of responsibly. Composting shall be done by a procedure that does not create an odor problem or attract wild animals.

Paper and plastic should be recycled, if possible. Waste collection for recycling requires readily accessible waste containers that are serviced at regular intervals. All containers must be appropriately labeled with risk indicators (poisonous/explosive, etc.).

Housing for owners or workers sometimes is located near production facilities. Sewage from bathrooms, kitchens and other facilities shall be treated in septic tanks.

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

### Standards

11.1: Fuel, lubricants, feed and chemicals used at the facility shall be labeled, stored, used and disposed of in a safe and responsible manner. A list of such materials together with Material Safety Data Sheets for them shall be maintained and made available to the auditor.

11.2: Chemicals used for hatchery operations shall be neutralized or diluted before discharge into natural bodies of water.

11.3: Fuel, lubricants and agricultural chemicals shall not be stored near feed, in employee housing or kitchen areas, or near harvest equipment and supplies.

11.4: Fuel, lubricants and chemical storage areas shall be marked with warning signs.

11.5: Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or leaks. Designated staff shall be trained to manage such spills and leaks.

11.6: Garbage from housing and food waste shall be retained in water-tight receptacles with covers to protect contents from insects, rodents and other animals.

11.7: Garbage and other solid waste shall be disposed of to comply with local regulations and avoid environmental contamination and odor problems (e.g., recycling, burning, composting or placing in a legal landfill).

11.8: Household trash and other facility wastes shall not be dumped in mangrove areas, wetlands or other vacant land, and shall be removed regularly and properly to avoid accumulation.

11.9: Discarded hatchery supplies and equipment (e.g., tires, pallets, bags, barrels, aeration paddles or engines) shall be stored tidily, not dumped in mangrove areas, wetlands or other vacant land and removed properly to avoid excessive accumulation.

11.10: Measures shall be taken to prevent infestation by animal and insect vectors and pests.

11.11: Secondary fuel containment shall conform to BAP guidelines for fuel storage.

11.12: Domestic sewage shall be treated and properly disposed of to avoid contamination of surrounding areas (e.g., sewer system, septic system, portable toilet or outhouse).

# 12. Animal Welfare

## (All Production Systems)

### Animal Welfare

**Hatcheries shall demonstrate that all facility operations are designed and operated with animal welfare in mind, and maximum survival and seed quality shall be sought. Employees shall be trained to provide appropriate levels of husbandry.**

### Reasons for Standard

When farmed animals are exposed to continuing stress, their feed consumption and growth rates can decline. Stressed animals are also less resistant to diseases and produce lower-quality seed. Stress usually increases mortality, as well. Animal suffering can be prevented, and production efficiency can be enhanced by applying good husbandry techniques that avoid creating stressful culture conditions.

Also, an increasing number of regulations specifically address animal welfare and the humane treatment of farmed animals. Although few such regulations address fish, crustaceans and mollusks, similar principles should be applied to ensure that farmed aquatic animals are produced using humane techniques.

### Implementation

Since a high level of welfare is a prerequisite for good animal health, good aquatic animal husbandry practices must be an integral part of the facility's written Health Management Plan. (See Section 14.) An Animal Welfare Section (AWS) of the HMP shall describe procedures the facility follows to assure that animal welfare issues are addressed. Its implementation shall be overseen by a qualified aquatic animal health professional (AAHP) and/or member of facility management, one of whom shall be available at audit to present the plan and answer questions.

The AWS shall specifically include details of how brood animals are to be treated. Where this includes interventions to induce maturation or spawning, such as eyestalk ablation in shrimp, hormone injection in fish, manual extraction of eggs and sperm and/or sacrifice of brood animals of any species, procedures shall be designed to minimize animal suffering.

These procedures may include sedation of live animals before handling, use of sterile instruments if the intervention is surgical, and handling techniques that minimize animal stress. Invasive procedures shall only be used if viable, non-invasive alternatives are not available.

### Standards

12.1: The facility shall include within its Health Management Plan an Animal Welfare Section (AWS), and all facility personnel shall receive training in its provisions.

12.2: The AWS shall be written and/or approved by a qualified aquatic animal health professional (AAHP), and overseen by a member of facility management or the AAHP, one of whom shall be available at audit to answer questions.

12.3: The AWS shall include procedures for the humane treatment of brood animals during spawning and/or taking of eggs and sperm (whether induced or naturally occurring), and for slaughter where this is required. The procedures shall be designed to minimize unnecessary or inadvertent animal suffering, and records shall be available to demonstrate compliance with the procedures.

12.4: The AWS shall specify methods for the slaughter of surplus, unwanted or compromised animals that minimize animal suffering. Records shall be available to show these methods are followed when animals are euthanized.

12.5: The AWS shall define and justify acceptable minimum water quality limits for the species being reared. Daily or more frequent monitoring records shall show that when these limits are breached, immediate corrective action is taken.

12.6: The appearance and behavior of all hatchery stocks shall be observed at least daily for signs of distress or ill health. Actions taken to correct signs of distress or ill health shall be documented.

12.7: The AWS shall explain, set and keep under review stocking density limits appropriate to the species and size of animals being reared. Documents shall be available to verify these limits are observed.

12.8: The facility shall develop procedures that minimize unnecessary stress or injury to animals during crowding, capture and handling of animals prior to and during transfer within the facility or transport to another. Records using survival rates as an indicator of the adequacy of such procedures shall be available.

12.9: The facility shall develop and follow procedures to estimate the numbers of animals in each shipment and provide documentation to show the estimated margin of error of the procedure used.

## 13. Food Safety (All Production Systems)

### Chemical and Drug Management

**Proactively prohibited antibiotics, drugs and other chemical compounds shall not be used. Approved therapeutic agents shall be used prudently and as directed on product labels for the treatment, control and prevention of diseases and not for prophylactic purposes without veterinary oversight.**

### Reasons for Standard

Some therapeutic agents can be hazardous to human health through direct contact with those who use them or if they accumulate in fish or crustacean tissue that may be eaten by humans later. Therefore, certain compounds have been proactively prohibited, and residue limits have been mandated for others.

Improper use of chemicals and therapeutants can harm or lead to accumulation in other organisms that live around hatcheries or are exposed to them in hatchery effluent. Moreover, inappropriate use of antibiotics can lead to antibiotic resistance in disease-causing organisms that can affect fish and other species, including humans.

#### Critical Concerns for Therapeutant Use

- Chloramphenicol and nitrofuran antibiotics are proactively prohibited for use in food production in all countries.
- Other drugs and chemicals, such as antibiotics, malachite green, heavy metals, parasiticides and hormones, may be proactively prohibited in specific countries.

Therapeutants that are proactively prohibited in the producing or importing country shall not be used. Any therapeutant use shall be guided by the principle of "prudent use" (see Additional Information), recorded and made available, if requested, to the recipient of the juvenile animals when they are shipped.

### Implementation

Good health management focuses on the prevention of disease rather than disease treatment with chemical compounds. Methods by which disease prevention can be achieved include avoiding stocking diseased animals, the adoption of fallowing and "all in, all out" stocking procedures, and maintenance of good water quality in culture systems. (Also see Sections 12 and 14.) In some cases, water quality management can involve pretreatment of water, such as ultraviolet sterilization, before it flows through culture systems.

Disease prevention can require the use of vaccines, including autogenous vaccines under veterinary supervision, if these are available and thought to be effective against diseases known to be a threat to the cultured species. Where effective, vaccines should be applied to aquatic seedstock prior to known risks of exposure, such as when they are stocked in ponds or shipped to growout facilities.

If an infectious disease is diagnosed in the facility's stock, the Health Management Plan (Section 14) shall explain the steps to be taken in treating it with approved chemicals and procedures to be followed when the treatment is complete, including verification of efficacy and the application of required withdrawal times. During inspections, auditors shall have access to full records of all applications of drugs, chemicals and hormones. A sample traceability form for use at the pond, tank or cage level is provided in Appendix I.

#### Hormone Use for Sex Reversal

When hormones are used to produce single-sex fry, records of hormone applications shall be maintained. Employees who work with methyl testosterone or other sex-reversal hormones shall be trained in the handling of such hormones and be required to wear protective clothing and masks with air filters. The facility shall have a protocol for managing water used for sex reversal and not release hormone treatment water directly into the environment, or comply with government standards, where these exist.

## Additional Information

**Responsible Use of Antimicrobials in Fish Production**
Responsible Use of Medicines in Agriculture Alliance – 2004
http://www.ruma.org.uk/guidelines/antimicrobials/long/fishantimicrobialguidlineslong.pdf

**Judicious Use of Antimicrobials for Aquatic Veterinarians**
Food and Drug Administration Center for Veterinary Medicine
American Veterinary Medical Association
http://www.fda.gov/AnimalVeterinary/SafetyHealth/AntimicrobialResistance/JudiciousUseofAntimicrobials/ucm095473.htm

**Prudent Use Guidelines: A Review of Existing Veterinary Guidelines**
Teale, C. J., and Moulin, G – 2012
http://www.oie.int/doc/ged/D11824.PDF

**Fish and Fishery Products Hazards and Controls Guidance**
Department of Health and Human Services
U.S. Food and Drug Administration Office of Food Safety – 2011
http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/seafood/ucm2018426.htm#toc

## Standards

13.1: If used, drug treatments shall be based on recommendations and authorizations overseen by a qualified veterinarian or qualified aquatic animal health professional (AAHP) and used only to treat diagnosed diseases in accordance with instructions on product labels and national regulations. Extra-label use of drugs shall be with the approval of a qualified veterinarian only.

13.2: Records shall be maintained for every application of drugs and other chemicals for therapeutic treatment that include the date, compound used, approving veterinarian or health professional (if applicable), dose and date on which the animals were transferred to another facility and the name of the facility. If the animals were harvested for human consumption, records of compliance with required withdrawal times shall also be maintained. See the Traceability requirement in Section 15. A list of therapeutants used by the facility shall be available for inspection.

13.3: Where vaccines or anesthetics are used, records shall be available to show they were used in accordance with manufacturers' instructions and with the approval of a qualified veterinarian or AAHP, or, if used outside manufacturers' instructions, then with the express direction of a qualified veterinarian.

13.4: Antibiotics or chemicals that are proactively prohibited in producing or importing countries shall not be used in feeds, pond additives or any other treatment. The facility's Health Management Plan (Section 14) shall include a list of these prohibited substances.

13.5: For feed suppliers that are not BAP-certified, statements are required attesting to the application of production procedures that exclude proactively prohibited drugs, by-products from the same species reared in the applicant's facility and unsafe levels of heavy metals and physical or other contaminants.

13.6: Where toxicant-based antifouling agents are used on cage or net pen nets, documents shall be available to show that all necessary authorizations for their use were obtained. Net-cleaning procedures that allow the collection, treatment and disposal of wash water in compliance with national regulations shall be used.

13.7: Antibiotics, antimicrobials or hormones shall not be used as growth promoters. The use of hormones for sex reversal is not considered growth promotion.

13.8: If hormones are used for sex reversal of animals, documents shall show that such use is approved in the country of production. Workers shall be trained in the handling of hormones and wear protective clothing and masks with air filters.

13.9: The facility shall have a written procedure and facilities for treating water used in the sex reversal of aquatic animals using hormones. If governmental standards exist for the discharge of hormone-treated water, the facility shall conform with such standards.

13.10: Chemicals used for the induction of triploidy in mollusks shall be approved and used only according to manufacturers' instructions and/or local regulations.

# 14. Biosecurity (All Production Systems)

## Disease Control

**Hatcheries shall work to prevent infectious disease in facility stocks and disease transmission to recipients of their animals. Hatchery practices shall include regular disease surveillance, sanitation of equipment and personnel, quarantine of diseased animals and controlled movement of personnel and equipment. Hatchery staff and visitors shall be trained in and apply biosecurity measures. Hatcheries shall conform to relevant regulations on biosecurity and disease surveillance, and defer to the direction of a veterinarian or qualified aquatic animal health professional in all related matters.**

### Reasons for Standard

Hatchery processes may require the import of gametes or animals from another country, as well as transfers between hatchery facilities in the same region or country. Each time such a transfer occurs, there is a risk of transmitting pathogens or parasites, which may then infect farm and/or wild stocks. The severity of the risk will vary according to the culture species, the location of the facility and the types of pathogens in question. Responsible hatchery practices require that biosecurity and risk reduction measures proportional to the severity of risk must be applied as part of normal operations.

### Implementation

Each facility involved in hatchery operations shall have a written Health Management Plan that includes policies and procedures that describe how the facility complies with applicable laws governing aquatic animal health, maintains biosecurity, responds to disease events and measures batch performance. Implementation of the plan shall be overseen by a veterinarian or qualified aquatic animal health professional who, in addition to the hatchery manager, shall be available in person or by phone at audit to present the plan and answer questions.

### Additional Information

**World Organization for Aquatic Health (OIE)**
**Aquatic Animal Health Code**
http://www.oie.int/doc/ged/D7821.PDF

**World Organization for Aquatic Health (OIE)**
**Manual of Diagnostic Tests for Aquatic Animals**
http://www.oie.int/en/international-standard-setting/aquatic-manual/access-online

**FAO Technical Guidelines for Responsible Fisheries 5, Supplement 2**
Aquaculture Development, Health Management for the Responsible Movement of Live Aquatic Animals
Section 4.4 – Pathogen Lists
ftp://ftp.fao.org/docrep/fao/010/a1108e/a1108e00.pdf

### Standards

14.1: The facility shall have a written Health Management Plan (HMP), and a qualified aquatic animal health professional (AAHP) shall oversee its implementation.

14.2: The AAHP's qualification documents shall be available for inspection by the auditor. The AAHP shall be available in person or by phone at audit to present the HMP and answer questions. If the auditor considers the AAHP's qualifications inadequate, the provisions of standard 14.19 shall apply.

14.3: The applicant shall demonstrate familiarity with the OIE Animal Health Code and FAO Technical Guidelines for Responsible Fisheries 5, Supplement 2: Health Management for the Responsible Movement of Live Aquatic Animals and be able to explain how the HMP incorporates these provisions.

14.4: The facility shall have a training program for designated facility staff who implement the HMP and documents to confirm that such training has been given. Their understanding of the HMP will be verified by interview during the facility audit.

14.5: Potential pathogens of the species reared at the facility shall be listed in the HMP and shall include diseases listed by the World Organisation for Animal Health (OIE, Ref. 1, Chapter 1.3), other diseases of national or regional concern (Ref. 2) and pathogens of concern to the facility and for which monitoring is undertaken. The HMP shall include specific measures to address each disease.

14.6: The HMP shall contain a site-specific risk analysis that identifies ways in which pathogens might be brought into the hatchery or transmitted to other facilities by its live aquatic products. The applicant shall demonstrate how the facility protects against such risks, including but not limited to diseases introduced through live aquatic products, water supply, feeds, hatchery personnel, equipment, visitors and local wildlife.

14.7: Health status documents for all live aquatic products brought into the facility since the last audit shall be available and shall demonstrate the products were free of diseases (to the extent detection is possible) listed in 14.5 or entered quarantine and were released into the rest of the hatchery only once disease-free status was established. This excludes locally endemic diseases.

14.8: The applicant shall have an isolation facility if new broodstock or other stocks of animals of uncertain health status are brought into the hatchery. The HMP shall explain how it is used to protect against the risk of bringing infectious disease agents into the hatchery and/or spreading them within it.

14.9: Disinfection procedures for all incoming and outgoing personnel, visitors, equipment and other materials brought into the facility shall be described in the HMP. The applicant shall be able to demonstrate the procedures are followed.

14.10: The HMP shall describe the procedures and indicators used by staff to monitor and document the health of facility stocks. These can include daily or more frequent observations of physical appearance, feeding response and mortality, or of larval development and/or growth rate at biologically relevant intervals.

14.11: The HMP shall describe procedures for tracking the indicators listed in 14.10, comparing them with earlier batches, and recording actions taken when trends are negative.

14.12: The HMP shall describe procedures for identifying diseases in hatchery stocks, diagnosis of pathogens and, where necessary, determination of susceptibility to therapeutants and treatment with them. Surveillance records shall be available for inspection.

14.13: The HMP shall explain how fallowing or dryout periods in different parts of the facility are planned and used to break infection cycles. Records shall be available to show this is done.

14.14: The HMP shall stipulate procedures for the routine collection, examination and sanitary disposal of dead animals, and for quarantining and/or depopulation of facility stocks, when required.

14.15: The health status of all animals or gametes shipped from the facility shall be recorded. Documents for all animals shipped since the last audit shall be available and shall show that products with diagnosed or suspected disease were not shipped, unless to a region of equal or lower health status, and that the transfer was approved by the customer and local regulator.

14.16: Where effective vaccines are available for the culture species, animals shipped from the facility shall be vaccinated according to the requirements of the importing region or country, or customer specification. Records that show this shall be available for inspection.

14.17: Transport containers for shipping live animals shall be clean and if reused, shall be sterilized between uses.

14.18: An annual or more frequent facility health status report that includes records of batch or lot health indicators, treatments for disease and customer complaints shall be available for inspection. Actions taken to correct deterioration in any performance category shall be described. Uncorrected and/or sustained deterioration are grounds for seeking independent health status examination (Standard 14.19) or denial of certification.

14.19: When the auditor has concerns about the health status of the applicant's live aquatic products and/or is not satisfied with the information provided on health status, monitoring programs or the qualifications of the AAHP, the applicant shall agree that during inspection the auditor may take samples from stocks held at the facility and submit them to an independent, third-party laboratory for verification of health status regarding the diseases for which health claims are made. The cost of such testing shall be borne by the applicant.

14.20: The hatchery shall demonstrate that it works with neighboring BAP-certified hatcheries and farms, and seeks to work with neighboring facilities that are not BAP-certified to standardize biosecurity procedures and share disease control and diagnostic information.

## 15. Traceability (All Production Systems)

### 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 live aquatic products stocked
- source of live aquatic products
- health status of live aquatic products stocked
- drug and vaccine use
- herbicide, algicide and other pesticide use
- manufacturer and lot number or production date for each feed used
- source and lot number for each live feed used
- shipment date
- shipment quantity
- movement document number (if applicable)
- recipient(s) or purchaser(s) (identify all if any egg or juvenile crop goes to more than one farm or purchaser)
- health status of live aquatic products sold or transferred to another facility.

### Reasons for Standard

Product traceability is a crucial component of the BAP program. It connects the links in the production chain and allows tracing of each processed lot back to the culture unit and inputs of origin. Food quality and safety analyses by accredited laboratories can also be included. Traceability ultimately assures purchasers that all steps in the production process were in compliance with environmental, social and food safety standards.

### Implementation

Hatcheries may utilize any traceability system that meets the BAP requirements. This can be an online system; the hatchery's own in-house database, paper records, files and documents; or a combination thereof.

Where paper records, documents or notebooks are used, if possible, the information should also be transferred to computer database files to allow electronic transmission. The original files or paper records shall be kept to allow for verification of the electronic data.

The data referenced in BAP's standards on broodstock, egg, postlarvae and fingerling sources, chemical management, etc., are required for traceability. This information and other tank, pond or cage-related records can be captured on the sample Product Traceability Form in Appendix I. Each form corresponds to the shipment of hatchery products on a particular day from a particular culture unit.

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

### Product Identity Preservation

To assure the integrity of the Best Aquaculture Practices "star" system, traceability controls must be in place that allow verification of all facilities that contribute to the claim of multiple-star BAP-certified status.

To insure the proper separation and traceability of all hatchery inputs and outputs, the following components must be in place:

- Hatcheries that purchase all of their broodstock, eggs, shrimp postlarvae, fish fry or fingerlings and feed from BAP-certified sources shall maintain records of the sources of stocking material and feeds used.
- Hatcheries that purchase stocking material and feed from both BAP- and non-BAP-certified sources shall identify all sources and have adequate systems in place to prevent mixing of BAP and non-BAP production lots.
- To enable mass balance verification of multiple-star products, certified hatcheries shall maintain a list, including harvest dates and volumes, of the farms and facilities to which they sell or deliver products.
- The number of backward and forward trace exercises conducted by the auditor will be determined by hatchery volume.

### BAP Logo Use

Use of the Best Aquaculture Practices logo, a registered trademark of the Global Aquaculture Alliance, for any purpose shall be approved by BAP in advance and used in compliance with the BAP trademark usage agreement.

### Customer Complaints

The applicant must prepare and implement an effective system for the management of complaints and complaint data to control and correct shortcomings relating to its products' compliance with the BAP standards.

## Standards

15.1: The facility shall operate an effective record-keeping system that provides timely, organized, accurate entries, performed and overseen by a designated trained person or team responsible for collecting the data, ensuring it is complete and accurate, and that traceability requirements are met.

15.2: The facility shall keep complete and accurate records for each culture unit and production cycle, including the culture unit identification number, unit area and volume, species and, if applicable, species specification such as triploid or GMO.

15.3: The facility shall keep complete and accurate records concerning any antibiotic or other drug use at the facility.

15.4: Complete and accurate records on the use of herbicides, algicides and other pesticides shall be maintained.

15.5: Complete and accurate records regarding manufacturer and lot numbers for each feed used, and/or the sources of live feeds shall be maintained.

15.6: The facility shall maintain complete and accurate records of the sources and numbers of broodstock, eggs, postlarvae or fingerlings stocked; stocking dates and all feeds used for each culture unit.

15.7: Complete and accurate records regarding the harvest date, harvest quantity, movement document number (if applicable) and receiving farm(s) or purchaser(s) shall be maintained. If product lots are destined to more than one farm or purchaser, each lot shall be separately identified.

15.8: In order to use the BAP logo, facilities shall have such use approved and registered in advance with BAP Management.

15.9: The facility shall keep records of any customer complaints related to its products' compliance with the BAP standards.

15.10: The facility shall keep records of investigations of such complaints and actions taken to address/correct them.

# Appendix A

**BAP Effluent Water Quality Criteria – Land-Based Hatcheries and Nurseries**

| Variable (units) | Initial Value | Final (after 5 years) | Collection Frequency |
|---|---|---|---|
| pH (standard pH units) | 6.0-9.5 | 6.0-9.0 | Monthly |
| Total suspended solids (mg/L) | 50 or less | 25 or less | Quarterly |
| Soluble phosphorous (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<br>Water with less than 1 ppt salinity, specific conductance below 1,500 mmhos/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 |

### Sampling

- Samples shall be collected near the point where effluents enter natural water bodies or exit the hatchery 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.
- 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 shall be placed on ice in a closed, insulated chest to prevent exposure to light.
- Samples or direct measurements for dissolved oxygen and pH from pond systems 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 from pond systems should be collected between 0500 and 0700 hours.
- Source water samples shall be collected quarterly directly in front of the upstream source, pump station or pump discharge outlet but before pumped water mixes with the supply canal. These samples enable the calculation of annual loads (Equation 2, Appendix C) and establish if the Limited Option is applicable.

### Analyses

- Hach and Merck water analysis equipment or equipment of a comparable standard is approved for total ammonia nitrogen, soluble phosphorus and chloride analyses. However, auditors can reject analytical results if sampling, in situ measurements or lab protocols are deficient.
- Measurements for dissolved oxygen and pH shall be taken in situ with portable meters. Auditors shall verify the correct application of calibration procedures.
- Hatcheries that discharge into freshwater receiving bodies should determine salinity by a conductivity meter with a salinity scale, rather than a hand-held, refractometer-type salinity meter. Alternatively, specific conductance can be measured.

Assume that water with specific conductance above 2,000 mmhos/cm exceeds 1.5 ppt salinity, and water with specific conductance over 1,500 mmhos/cm exceeds 1.0 ppt salinity. Note: 1 mS/m = 10 mmhos/cm, and 1 mmho/cm= 1 mS/cm.

### Rules for Compliance

At least three months of effluent data are required for initial certification. Initially, for each variable measured monthly, at least 10 values obtained during a 12-month period shall comply with the criteria. After five years, the target is no more than one annual case of non-compliance for each variable.

For variables measured quarterly, one non-compliance is initially permitted for each variable during a 12-month period. The target after five years is no more than one case of non-compliance for each variable during a 24-month period. When non-compliances occur, hatcheries should make every effort to correct the problems within 90 days.

# Appendix B

**Sample Effluent Monitoring Form – pH and Dissolved Oxygen**

| Date (day/month/year) | pH (standard units) | | | Dissolved Oxygen (mg/L) | | | No. Units 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 Units 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 Units Harvested |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| Annual Average | | | | |

# Appendix C

## Calculation of Annual Effluent Volume

An estimation of annual effluent volume shall be determined using one of the following equations.

### Hatchery Discharge Calculation

**Equation 1 – Pump Discharge Method**
Hatchery discharge ($m^3$/yr) = Pump discharge ($m^3$/min) x Average time of pump operation (hr/day) x 60 min/hr x 365 days/yr

**Equation 2 – Water Exchange Method**
Hatchery discharge in $m^3$/yr = [Volume of ponds in $m^3$ x Number of crops/yr] + [Volume of ponds in $m^3$ x Average daily water exchange rate as fraction of pond volume x Crop in days x Number of crops/yr]

**Equation 3 – Watershed Method**
Effluent = (Water added + Precipitation + Runoff) – (Seepage + Evaporation) + (Hatchery volume, day 1 – Hatchery 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/yr) or other appropriate method

Precipitation ($m^3$) = Annual precipitation (m) x Hatchery water surface area ($m^2$)

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

Seepage ($m^3$) = Hatchery water surface area ($m^2$) x 0.55 m/yr

Evaporation ($m^3$) = Class A pan evaporation (m/yr) x 0.8 x Hatchery water surface area ($m^2$)

Hatchery volume = [Average depth of ponds (m) – Average distance of water level below overflow structure (m)] x Hatchery water surface area ($m^2$)

## Additional Data

The BAP program will 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.

Pooled, anonymous data for loads and indices will be used as the basis for setting metric standards by June 2015.

## Annual Effluent Loads

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

**Equation 4**
Load of variable (kg/yr) = Hatchery discharge ($m^3$/yr) x [Mean annual variable concentration in effluent – mean annual variable concentration in source water (mg/L, same as g/$m^3$)] x $10^{-3}$ kg/g

## Water Use and Load Indices

While not a recommended practice, it is possible to comply with numerical water quality criteria by increasing the amount of water passing through a hatchery to dilute the concentrations of tested variables. Compliance with the water use index assures that facilties 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 5**
Water use index ($m^3$/kg fish or crustaceans) = Annual effluent volume ($m^3$) ÷ Annual fish or crustacean production (kg)

**Equation 6**
Load index (kg variable/mt fish or crustaceans) = Annual load of variable (kg/yr) ÷ Annual fish or crustacean production (mt/yr)

### Example: Water Use, Load Indices For Annual Effluent Estimated By Pond Volume-Water Exchange Method

A facility 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 source water of the facility contains an average of 10 mg/L total suspended solids (TSS), 0.03 mg/L soluble phosphorus (S.P.), 0.15 mg/L total ammonia nitrogen (TAN) and 1.5 mg/L biochemical oxygen demand (BOD).

The hatchery effluent contains an average of 45 mg/L TSS, 0.19 mg/L S.P., 0.87 mg/L TAN and 9.6 mg/L BOD. Production for the past year was 230,000 kg (230 mt).

**Calculations**

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

Annual effluent volume = [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 = (45 – 10 g/$m^3$)(9,200,000 $m^3$/yr)$10^{-3}$ = 322,000 kg/yr

S.P. load = (0.19 – 0.03 g/$m^3$)(9,200,000 $m^3$/yr)$10^{-3}$ = 1,472 kg/yr

TAN load = (0.87 – 0.15 g/$m^3$)(9,200,000 $m^3$/yr)$10^{-3}$ = 6,624 kg/yr

BOD load = (9.6 – 1.5 g/$m^3$)(9,200,000 $m^3$/yr)$10^{-3}$ = 74,520 kg/yr

Water use index = (9,2000,000 $m^3$/yr)/(230,000 kg fish or crustaceans/yr) = 40 $m^3$/kg fish or crustaceans

TSS index = (322,000 kg/yr)/(230 mt fish or crustaceans) = 1,400 kg TSS/mt fish or crustaceans

S.P. index = (1,472 kg/yr)/(230 mt fish or crustaceans) = 6.4 kg S.P./mt fish or crustaceans

TAN index = (6,624 kg/yr)/(230 mt fish or crustaceans) = 28.8 kg TAN/mt fish or crustaceans

BOD index = (74,520 kg/yr)/(230 mt fish or crustaceans) = 324 kg BOD/mt fish or crustaceans

### Example: Water Use, Load Indices For Annual Effluent Estimated By Pump Operation Method

A facility has two pumps that discharge a combined volume of 136 $m^3$/min. The pumps operate an average of 8 hr/day. The source water of the facility contains an average 10 mg/L total suspended solids (TSS), 0.03 mg/L soluble phosphorus (S.P.), 0.15 mg/L total ammonia nitrogen (TAN) and 1.5 mg/L biochemical oxygen demand (BOD).

The hatchery effluent contains 91 mg/L total suspended solids, 0.23 mg/L soluble phosphorus, 1.20 mg/L total ammonia nitrogen and 12.7 mg/L biochemical oxygen demand. Production during the past year was 378,000 kg (378 mt).

**Calculations**

Annual effluent volume = 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)(91 – 10g/$m^3$)$10^{-3}$ = 1,930,000 kg/yr

S.P. load = (23,827,200 $m^3$/yr)(0.23 – 0.03 g/$m^3$)$10^{-3}$ = 4,765 kg/yr

TAN load = (23,827,200 $m^3$/yr)(1.20 – 0.15 g/$m^3$)$10^{-3}$ = 25,018 kg/yr

BOD load = (23,827,200 $m^3$/yr)(12.7 – 1.5 g/$m^3$)$10^{-3}$ = 266,865 kg/yr

Water use index = (23,827,200 $m^3$/yr)/(378,000 kg fish or crustaceans/yr) = 63.0 $m^3$/kg fish or crustaceans

TSS index = (1,930,000 kg/yr)/378 mt fish or crustaceans) = 5,106 kg TSS/mt fish or crustaceans

S.P. index = (4,765 kg/yr)/(378 mt fish or crustaceans) = 12.6 kg S.P./mt fish or crustaceans

TAN index = (25,018 kg/yr)/(378 mt fish or crustaceans) = 66.2 kg TAN/mt fish or crustaceans

BOD index = (266,865 kg/yr)/(378 mt fish or crustaceans) = 706 kg BOD/mt fish or crustaceans

# Appendix D

**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 mid-depth | Quarterly |
| Chlorophyll a | Equal to cage mid-depth | Quarterly |
| 5-day biochemical oxygen demand | Equal to cage mid-depth | Quarterly |
| Secchi disk visibility | Not applicable | Weekly |
| Soluble phosphorus | Equal to cage mid-depth | Quarterly |
| Total ammonia nitrogen | Equal to cage mid-depth | Quarterly |
| Phytoplankton abundance and species | Equal to cage mid-depth | Quarterly |

## Sampling – Cages, Net 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 auditor must approve the locations of the stations, which shall be set following a study on prevailing surface currents. For methods, refer to the U.S. Army Corps of Engineers document Estimating Surface Currents Using Dyes and Drogues, http://chl.erdc.usace.army.mil/library/publications/chetn/pdf/chetn-vi-37.pdf.

Water should 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 a calibrated line. Samples should be transferred to clean plastic bottles and placed on ice in a closed, insulated chest to avoid exposure to light.

## Analyses

- Analysis of the samples collected by the auditor 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 or equivalent.
- Hach and Merck water analysis equipment, or equipment of an equivalent standard, is approved for total ammonia nitrogen, soluble phosphorus and chloride analyses. However, auditors can reject analytical results if sampling, in situ measurements or lab protocols are deficient.
- Measurements for dissolved oxygen and pH should be taken in situ with portable meters. Auditors must verify the correct application of calibration procedures.

# Appendix E

## Production Practices for Cages, Net Pens

The most reliable way of reducing nutrient outputs from cage and net pen culture is to improve 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, culture animals should have access to the feed for enough time so 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 feeding activity are enhanced by using floating feed for certain species. For waters less than 30 m deep, a diver should periodically go beneath cages to determine if uneaten feed is accumulating on the bottom. A video survey is an acceptable alternative and shall be used where depths exceed 30 m.

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 rapidly mix and dilute wastes. The distance between cage bottoms and the bottoms of water bodies should be at least equal to the depth of the cages 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 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 animals in cages, as well. Sediment quality in areas with cages can be protected by fallowing – periodically moving cages to new sites and allowing the original sites to recover. Observations on sediment quality should be used to determine when to move cages.

# Appendix F

## Hydraulic Rentention Time Feeding Rate Limits in Lakes, Reservoirs

### Cages, Net Pens in 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.

Lakes and reservoirs used 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 choose 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 auditor and 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 lake water surface area (ha)
- Moderate HRT – 5.0 kg/ha/day x lake water surface area (ha)
- Short HRT – 7.5 kg/ha/day x lake 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 total daily feed inputs of all operations shall 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 or other potentially harmful algae assessed. See phytoplankton methods manual at http://npsi.gov.au/files/products/national-river-health-program/pr990300/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 or other potentially harmful 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.

# Appendix G

### Sedimentation Basins

The minimum required sedimentation basin volume can be estimated using the following equation:

Sedimentation basin volume = 37.5 x
[Fish or crustacean production (mt) ÷
Sludge transfers (times/crop)] +
Fish or crustacean production (mt) ÷ 0.6]

In the above equation, fish and crustacean production is the total quantity produced in all ponds that discharge into the sedimentation basin, and sludge transfers are the mean frequency at which sludge is moved from ponds to the sedimentation basin. It is also assumed that:

- The minimum hydraulic retention time to allow coarse and medium solids to settle out is six hours.
- One mt of production equates to 1 mt sediment.
- Sludge removal can be spread over a 24-hour period.
- Sediment bulk density is 0.6 mt/$m^3$.
- The solids content of sludge is 6.5 kg/$m^3$.
- Accumulated sediments in the basin are removed at the end of each crop to return the basin to its original capacity.

Note: If sludge is removed more frequently from ponds, the required size of the sedimentation basin is reduced.

# Appendix H

### Calculation of Fish in:Fish Out Ratio

### Feed-Conversion Ratio

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

**Equation 1**

Feed-conversion ratio = Annual feed use (mt) ÷
Net fish or crustaceans harvested (mt)

The feed-conversion ratio is also known as the economic FCR. Note that economic FCR is very sensitive to survival rate, rising sharply if the survival rate drops significantly. For precise calculation, the total weight of stocked juveniles is subtracted from the total weight of the harvested fish or crustaceans.

### "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 or crustaceans produced.

Aquaculture producers should strive to obtain the lowest fish in:fish out ratio practicable in order to conserve industrial fish resources. Facilities 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 to be used are 22.5% and 5%, respectively.

Anonymous, pooled FCR and fish in:fish out data shall be used to establish metric standards before June 2015.

**Equation 2**

Fish in:fish out ratio = Feed fish inclusion factor of feed (from manufacturer) x feed-conversion ratio
Where feed fish inclusion factor = [Level of fishmeal in diet (%) + Level of fish oil in diet (%)] ÷
[Yield of fishmeal from wild fish (%) +
Yield of fish oil from wild fish (%)]

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

# Appendix I

**Sample Product Traceability Form**

| | |
|---|---|
| Hatchery Name | Pond or Cage Number Pond Area (ha) |
| **POSTLARVAE OR FINGERLINGS**<br>Stocking Date | **FEED**<br>Feed Type |
| Stocking Quantity Species | Manufacturer |
| Any Species Specifications (e.g., triploid, GMO) | Lot Number(s) |
| Hatchery BAP No. | |
| Confirmation: No Use of Proactively Prohibited Chemicals Yes No | Confirmation: No Use of Proactively Prohibited Chemicals Yes No |
| **THERAPEUTIC DRUG USE**<br>Compound 1 | **PESTICIDE USE**<br>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**<br>Harvest Date | Harvest Purchaser Name/ Adddress |
| Harvest Quantity (kg) | |