



Hatchery Standard

Issue 2.1

30-January-2023

Best Aquaculture Practices Certification Standard

Environmental Responsibility • Social Responsibility • Food Safety • Animal Health and Welfare

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A. Summary of Key Changes from Issue 1.0 to 2.1

1. Hatcheries are now required to conduct a risk assessment of potential human food safety risks associated with their operations.
2. The worker safety and employee relations requirements have been updated, including requirements for wages and benefits, working hours including overtime, voluntary labor, child labor and young workers, use of workers from recruitment agencies, discrimination, disciplinary procedures, worker voice, and worker health and safety.
3. The effluent monitoring parameters and limits for land-based systems have been updated and include unique parameters and limits for recirculating aquaculture systems (RAS).
4. The water quality monitoring requirements for cages or net pens in fresh or brackish water have been revised, consistent with the approach adopted in the BAP Farm Standard 3.0.
5. The BAP Fish In Fish Out (FIFO) limits for hatcheries using over 50 mt dry feed/year have been revised, and a requirement to calculate the Forage Fish Dependency Ratio (FFDR) has been added.
6. Requirements for live feeds produced in hatchery operations have been added.
7. Hatcheries are required to control the sources of their broodstock/eggs/etc. (stocking material) via an effective internal auditing process.
8. Requirements to limit escape events were updated.
9. Traceability requirements, particularly those related to demonstrating BAP Star Status, were updated, and trace-forward and trace-back exercise are now required.
10. "Outsourcing activity" to an uncertified "downstream" hatchery/nursery phase, as was considered in the introduction to BAP Hatchery Standard 2.0, will not be allowed under the certification process of hatcheries. The stage of the seedstock supply chain immediately preceding transfer of live aquatic products to a farm must be certified for the hatchery-related Star to transfer through to a BAP-certified farm.

B. Introduction

Best Aquaculture Practices Certification

The following Best Aquaculture Practices Standards apply to all aquaculture hatchery and nursery 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 net pens (cages) floating in a body of water. For the purposes of this standard, “hatchery” or “hatcheries” will be the generic terms used to describe such facilities.” Throughout this document the term “hatchery” also includes nursery. In the case of multi-phase hatchery operations under a single company’s ownership, depending upon the physical locations of facilities and other factors, the scope of the annual third-party audit may be limited to the final phase of production preceding transfer or sale of live aquatic products to a farm where the animals are grown to harvestable size for human consumption. Other affiliated “upstream,” production operations must be internally audited under the full scope of the BAP Hatchery and Nursery Standard.

Processes that may occur within the general scope of hatchery operations include:

- Broodstock acquisition, production, selection, and management
- Mollusk spawning and larval setting
- Egg collection, fertilization, incubation, and hatching
- Larval rearing
- Feeds and feeding practices
- A nursery phase or intermediate juvenile production phase before final grow out 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, larvae, or juveniles from the wild to supply as stocking material in farms is not permitted under these standards.

The above processes may be carried out in sequence at one location or in multiple locations with live aquatic products transferred between them, and ownership of the products may be changed in the case of supply chains that are not vertically integrated. For facilities with multiple locations, each location shall be considered a separate facility for BAP certification.


Some requirements may only apply to specific production systems (e.g., earthen pond facilities, facilities that produce effluents, or facilities using net pens). Each section of the standard and guideline identifies which specific standards apply to the different production systems.

For understanding the certification process, please review the information available on the GSA website (<https://www.bapcertification.org/WhatWeDo>). A decision tree outlining the rationale to be used in determining what production unit must be certified to achieve the BAP hatchery-related “Star” will be posted alongside the hatchery Standard on the Standards page on the GSA website. If there is any uncertainty concerning these requirements, BAP’s Program Integrity department may be contacted for guidance.

References

<https://www.bapcertification.org/Standards>

<http://www.fao.org/3/a-i2296t.pdf>

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Acknowledgements

An expert group, the BAP Hatchery and Nursery Standard Technical Committee, develops and endorses the Standard, with representatives throughout the supply chain and interested parties including industry associations, processors, producers, regulators, non-governmental organizations and conformity assessment and standards experts. The GSA is grateful to the members of the Hatchery and Nursery Standard Technical Committee members who created the earlier versions of the Standard and to other specialists that offered valuable input during the review process.

Special thanks are due to the Technical Committee that worked on this 2019-2021 update of the BAP Hatchery and Nursery Standard.

BAP Hatchery and Nursery Technical Committee

Daniel Benetti (Chair), University of Miami Aquaculture Program

Bruno Sardenberg, Atlantic Sapphire

George Nardi, InnovaSea

Jorge Alarcon, Open Blue Sea Farms

Gavin Partridge, Australian Centre for Applied Aquaculture Research

Federico Rotman, Hubbs-SeaWorld Research Institute

Ronald Hoenig, University of Miami Experimental Hatchery

Carlos Lara, Aquaculture Intelligence

Carlos Lopez, Spring Genetics (Benchmark)

Enrique Mauser, Inter-American Tropical Tuna Commission

Rodrigo Oliva, Salmones Blumar

Robert Jones, The Nature Conservancy

Dan Rothen, University of Miami Medical School

Fernando Aranguen, University of Arizona Aquaculture Pathology Laboratory

Aaron Welch, Two Docks Farms Tampa Florida

Peter Van Wyk, Zeigler Bros. Co. and HBOI/FAU

Standard Version History

2012 - Shrimp Hatcheries Standard

2014 – Finfish, Crustacean and Mollusk Hatcheries and Nurseries


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Table of Abbreviations

Abbreviation	Meaning
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
FFDR	Forage Fish Dependency Ratio
GIP	Genetic Improvement Plan
HMP	Health Management Plan
ILO	International Labor Organization
ISO	International Organization for Standardization
mt	Metric Ton
PPE	Personal Protective Equipment
ppt	Parts Per Thousand
RAS	Recirculating Aquaculture System
SCP	Stock Containment Plan
SPF	Specific Pathogen Free
SPR	Specific Pathogen Resistant
WIP	Wildlife Interaction Plan

Definitions

Term	Meaning
Aquatic Animal Health Professional	A practitioner who specializes in the health management of freshwater and marine animals and invertebrates. While not required to be licensed, this individual must be able to demonstrate the appropriate training, certification, education, and/or professional experience to competently oversee the facility's routine animal health care activities. This may include conducting basic health exams and evaluations, observing, and evaluating behavior, taking samples of blood or other bodily fluids, gill tissue, parasites, treating and suturing wounds, handling animal emergencies, conducting follow-up exams after treatment(s), euthanize animals, and ensuring that electronic records of animals' treatments are correct and current.
Bioengineered	a food "(A) that contains genetic material that has been modified through in vitro recombinant deoxyribonucleic acid (DNA) techniques; and (B) for which the modification could not otherwise be obtained through conventional breeding or found in nature." https://www.govinfo.gov/content/pkg/FR-2018-12-21/pdf/2018-27283.pdf
Brackish Water	Water that has an average salinity between 1-ppt to 25-ppt.
Deep Well Injection	A liquid waste removal process that uses injection wells to put treated or untreated liquid waste into geological formations that have no possibility of permitting the movement of contaminants into possible potable water aquifers.
Ecologically Sensitive Areas	Places that have special environmental attributes worthy of retention or special care. These areas actively are critical to the maintenance of productive and diverse plant and wildlife populations. http://www.env.gov.bc.ca/wld/documents/bmp/urban_ebmp/EBMP%20PDF%204.pdf
Eubiotics	Feed additives, such as organic acids, probiotics, prebiotics, essential oil compounds, and zinc and copper compounds used to improve animal health and performance by promoting an optimal balance of microflora in the gastrointestinal tract.
Fish	"Fish" in this standard is used interchangeably with "aquatic animals". Hence, fish in this context means any and all aquatic animals produced in the hatchery or nursery.
Genetic Engineering	Manipulation of an organism's genes by introducing, eliminating, or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant DNA techniques.
Genetically Modified Organism	An organism produced through genetic engineering. https://www.usda.gov/topics/biotechnology/biotechnology-glossary
Hatchery	A facility where aquatic animals are bred in controlled conditions, hatched, and raised until transferred to a grow-out system or facility (includes nursery stage animals and systems). Throughout this document the term "hatchery" also includes nursery.
Juvenile	A post metamorphosis animal that displays the standard phenotypic traits as adults of the species but is not yet sexually mature.

Marine Water	Water that averages greater than 25-ppt salinity.
Nursery	Facility where young of any species, plant, or animal, are nourished prior to transfer elsewhere; typically, another facility where the nursed animals (or plants) are grown to a commercial size.
Net Pen (cage)	A net or mesh enclosure deployed in a body of water in which aquatic animals are held. Sometimes these are also called cages. The term net pen is used throughout in these standards and refers to both floating and submerged structures.
Point Source Effluents	Effluents discharged from a pipe or canal as a single stream (in contrast to effluents discharged from net pens, which “leak” out through the net mesh).
Proactively Prohibited Therapeutics	Compounds that are specifically identified and officially banned for use (including off-label use), in aquatic animals in producing or importing countries https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=530.41
Therapeutics	Antibiotics, drugs, and chemical agents used in the treatment of aquatic animal disease.

Multi-Phase Hatchery Related Definitions

Broodstock / Maturation Facility

- a. The terms “broodstock” or “maturation” facility is characterized as a location where broodstock populations are kept. Broodstock may also be referred to as parent stock or founder stock. Broodstock populations often incorporate genetic improved programs through selective breeding to improve disease resistance, growth, feed conversion, etc. Such facilities may supply customers juvenile or adult broodstock animals as is the case with shrimp, or they may supply customers “eyed eggs” or juvenile fish as in the case of salmonids (parr or smolt) or fry, fingerling, etc. in the case of other species.
- b. A Nucleus Breeding Center (NBC) is a specialized type of broodstock facility typically far removed geographically from other phases of “hatchery” operations. NBCs maintain a high degree of biosecurity, including strict quarantine procedures, to avoid the introduction and/or dissemination of diseases and may ship eggs, nauplii and/or mature broodstock to all parts, or specific regions of the world. Examples of NBCs include SPF shrimp broodstock (e.g., Hawaii, Florida), SPR shrimp broodstock (e.g., Ecuador), salmon and trout broodstock (e.g. Norway, USA), and tilapia (Malaysia, Philippines, Brazil, etc.).

Hatchery

The term “hatchery” has evolved over time and refers to different types of facilities performing different phases of production over the entire hatchery and nursery cycle. Characteristics of such operations are described below:


- a. Traditional Hatchery: These facilities have at least two and sometimes three of the following phases:
 - Maturation (breeding)
 - Incubation and hatching
 - Eggs and fry or fingerlings for fish (or nauplii, larvae and post larvae for shrimp) are grown to commercially-accepted stages for transfer or sale to nursery and/or grow-out facilities.
- b. Larval Rearing Facility: Fish egg and fry (or nauplii for shrimp) are grown to commercially-accepted stages for transfer or sale to nursery and/or grow-out facilities.
- c. Hatch House: A term used to describe hatchery production systems located within a farm facility where eggs (example: trout or tilapia eggs brought to farms from breeding centers) are hatched, typically in incubators, and then the fry/larvae are reared in varying production units to a size suitable for stocking at the farm or for transfer or sale to other nearby farms.

Nursery

Facility where fish fry or salmon smolts or shrimp post larvae are grown to an intermediate size prior to transfer or sale to a grow-out facilities where the animals are grown until final harvest size for the market.

Multi-phase Hatchery Production

The above operations may be located at a single site or in multiple locations. Sites can be geographically distant from one another but to be considered “multi-phase” under BAP certification, they would have to be under the same ownership.

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BAP-Multi Star Claim

The BAP program recognizes product from associated or integrated facilities with a “star-based” ranking system. Star status is assigned when the processing plant and associated farm(s) have attained certification, a 2-star designation. Associated hatcheries and feed mills attain BAP certification to reach the 3-star or highest 4-star designation.

C. Standard Requirements – Food Safety

A. General Requirements – All Production Systems

- 1.1 Hatcheries shall conduct an assessment that identifies potential food safety risks. The hatchery shall develop a management plan that describes procedures to prevent, monitor and control those risks and provide evidence that the plan is operational and effective.

Implementation


Perhaps the best framework for the Food Safety Risk Assessment is the Hazard Analysis and Critical Control Point (HACCP) system for management of food safety risks that is commonly used in seafood processing plants. A hatchery level HACCP plan would identify, evaluate, and control the food safety risks that occur during production. Such a plan would meet the requirements of this audit clause. The plan must address hazard analysis, critical control point (CCP) identification, establishing critical limits, monitoring procedures, corrective actions, verification procedures, and record-keeping and documentation. The individual responsible for performing monitoring, corrective actions, verification procedures and record-keeping must be identified.

B. Chemical and Drug Management – All Production Systems

- 1.2: The facility's Health Management Plan (HMP) shall describe protocols for all drug, chemical, or hormone treatments. Such treatments shall only be used in accordance with instructions on product labels, with adherence to all applicable local and national regulations, and only under the oversight of a licensed veterinarian or Aquatic Animal Health Professional (AAHP). Off-label use of drugs shall only be done with the approval and guidance of a qualified veterinarian or AAHP.

A list of therapeutics and other approved substances used by the facility shall be available.

- 1.3: Records shall be maintained for every application of drugs or other chemicals used for approved treatments, or during transport of live animals. These records shall include the date, the compound used, the approving veterinarian or AAHP, the dose, and the date on which the animals were transferred to another facility and the name of that facility. If the animals were harvested for human consumption, records of compliance with required drug withdrawal times shall also be maintained in addition to the residue levels complying to the country where the harvested products are sold.
- 1.4: When vaccines or anesthetics are used, records shall be available to ensure compliance in the facility's HMP. The use of vaccines or anesthetics shall be in accordance with manufacturers' instructions and with the approval of a qualified veterinarian or AAHP.
- 1.5: Antibiotics or chemicals that are prohibited in producing or importing countries shall not be used in feeds, pond additives, or for any other treatment.

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- 1.6: For hatcheries using feed provided by non-BAP-certified sources, statements shall be obtained from feed manufacturers attesting to the application of production procedures that exclude prohibited drugs, proteinaceous by-products from the same species as those reared in the applicant's hatchery/nursery, unsafe levels of heavy metals or other contaminants, and that are in compliance with the requirements for the countries of production and sale of hatchery animals.
- 1.7: Where toxicant-based antifouling agents are used on net-pen/cage nets, documents shall be available to demonstrate that their usage is in accordance with local and national regulations. Net-cleaning procedures that allow the collection, treatment, and disposal of wash water shall be in compliance with local and national regulations.
- 1.8: Antibiotics, antimicrobials, or hormones shall not be used as growth promoters. Eubiotics are considered acceptable for use as growth promoters unless otherwise prohibited by local or national regulations. Records of all applications shall be available.
- 1.9: If hormones are used for sex reversal of animals, documents shall show that such use is not prohibited in the country of production. Records of hormone application shall be available for at least two years. Workers shall be trained in the safe handling of hormones and use of personal protective equipment, including gloves and masks with air filters.
- 1.10: The hatchery/nursery shall have a written procedure and appropriate systems/amenities for treating any water used in the hormonal sex reversal of aquatic animals. If government standards exist for the discharge of hormone-treated water, the hatchery/nursery shall conform to such standards and maintain records of approval and usage.
- 1.11: If chemicals are used for the induction of triploidy in mollusks, only approved substances shall be used, and only according to manufacturers' instructions and existing local and national regulation. Records shall be kept of any such treatments.

Implementation


Prohibited antibiotics, drugs, and other chemical compounds must not be used. Approved therapeutic substances must be used as directed on product labels for the treatment or under the guidance of a locally licensed veterinarian. These substances must be used for control and prevention of diseases, and not for haphazard prophylactic purposes without veterinary oversight.

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. In some cases, water quality management can involve pretreatment of water, such as ultraviolet sterilization, before it flows through culture systems.

Disease prevention may 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 grow-out facilities. and procedures to be followed when the treatment is complete, including verification of efficacy and the application of any required withdrawal times.

Treatment with Antimicrobial Agents

Health Management Plans must explain the steps to be taken when a diagnosed disease will be treated with approved chemicals and procedures to be followed when the treatment is complete, including verification of efficacy and the application of any required withdrawal times. Lists of approved chemicals can usually

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be obtained from government regulatory authorities, seafood processing plants, government health and agricultural agencies, or university aquaculture or fisheries research and extension programs.

Chapter 6.2 of the OIE Aquatic Animal Health Code describes the principles for responsible and prudent use of antimicrobial agents. Responsible and prudent use:

- Maintains the efficacy of antimicrobial agents both for veterinary and human medicine and to ensure the rational use of antimicrobials in aquatic animals with the purpose of optimizing both their efficacy and safety.
- Complies with the ethical obligation and economic need to keep aquatic animals in good health.
- Prevents or reduces the transfer of both resistant microorganisms and resistance determinants from aquatic animals to humans and terrestrial animals.
- Prevents antimicrobial residues that exceed the established maximum residue limit (MRL) occurring in the food.

Article 6.2.7 of the OIE Aquatic Animal Health Code describes the responsibilities of veterinarians and other aquatic animal health professionals. These include:

- Identification, prevention, and treatment of aquatic animal diseases, as well as the promotion of sound animal husbandry methods, hygiene procedures, vaccination, and other alternative strategies to minimize the need for antimicrobial use in aquatic animals.
- Prescription, dispensation, or administration of a specific course of treatment with an antimicrobial agent for aquatic animals under their care.
- Carrying out a thorough clinical assessment of the aquatic animal(s), including as appropriate: clinical examination, post-mortem examination, bacteriology with culture and sensitivity, and other laboratory tests to arrive at the most definitive diagnosis possible before initiating a specific course of treatment with an antimicrobial agent.
- Evaluation of environmental factors and husbandry at the production site (e.g., water quality) should be considered as potential primary factors leading to infection and should be addressed prior to prescribing a course of antimicrobial agent treatment.

If therapy with an antimicrobial agent is deemed necessary, it should be initiated as soon as possible. Selection of the agent shall be based on the knowledge and experience of a veterinarian or a recognized AAHP authorized to prescribe veterinary medicines. Timely application of sensitivity testing of the target microorganism shall be used to confirm the choice of treatment. The veterinarian or AAHP shall indicate precisely the treatment regime: dosage, method of application, treatment intervals, duration of the treatment, any required withdrawal period and the quantity of antimicrobial agents to be delivered, depending on the dosage and the number of aquatic animals to be treated.

Antimicrobial agents must only be used on the prescription of a veterinarian or a recognized AAHP. Hatcheries must ensure that antimicrobial agents are properly stored, handled, and disposed of. Treatments should not be withheld from aquatic animals to preserve certification. If disease outbreaks occur and treatments are required to maintain good welfare for the aquatic animals, these should be provided.

The Health Management Plan, and specifically disease treatments with antimicrobial agents, must be overseen by a veterinarian or a recognized AAHP. Recognizing that such expertise is not always available nearby, hatchery owners should endeavor to secure the services of experts or consultants with training, experience and expertise in aquatic animal health.

Prohibited Antimicrobial Agents

Chloramphenicol and nitrofurantoin 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. Hatcheries must have lists of antimicrobial agents prohibited for use in the country where production occurs as well as in the country or countries representing the primary markets for farmed aquatic animals. The recordkeeping system and inspection of drug storage containers must demonstrate that prohibited antimicrobial agents are not in use at the hatchery/nursery.

Hormone Use for Sex Reversal

Employees who work with methyl-testosterone or other sex-reversal hormones must be trained in the safe handling of such hormones and be required to wear personal protective equipment, including gloves and masks with air filters. The hatchery must have an established protocol for managing effluent water used for sex reversal to prevent the release of hormone-treated water directly into the environment, and comply with government standards, where these exist.

Chemical Use in Transport

Aquatic animals may be transported at any life stage, typically from hatcheries or nurseries to grow-out facilities. Chemicals used in transport may include sedatives/anesthetics/tranquilizers to reduce aquatic animal metabolic rate, salts for enhanced osmoregulation and handling stress reduction, oxygen-producing chemicals (e.g., hydrogen peroxide), pH buffering chemicals, ammonia control chemicals (e.g., zeolite), and antifoaming agents to improve visibility to allow better observation of aquatic animals. Antimicrobial agents shall not be used during transport from hatchery to nursery/grow-out facility. All chemicals used during transport must be approved by regulatory authorities for application to aquatic animals. A list of such approved chemicals shall be available at the hatchery.

Additional Information

Responsible Use of Antimicrobials in Fish Production Responsible Use of Medicines in Agriculture Alliance – updated 2007 <https://ruma.org.uk/wp-content/uploads/2014/09/fishantimicrobialguidelineslong.pdf>

The Judicious Use of Medically Important Antimicrobial Drugs in Food-Producing Animals – 2012


Food and Drug Administration Center for Veterinary Medicine
<https://www.fda.gov/media/79140/download>

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>

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D. Standard Requirements – Social Accountability

A. Legal Rights and Regulatory Compliance – All Production Systems


Hatcheries must 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.

- 2.1: The hatchery shall have current and valid documents to prove legal land and water use by the hatchery.
- 2.2: The hatchery shall have current and valid documents to prove all business and operating licenses have been acquired.
- 2.3: The hatchery shall have current and valid documents to prove compliance with applicable local and national environmental regulations for hatchery siting, construction, operation and liability for environmental damage.

Implementation

Regulations regarding the operation and resource use of hatcheries are often variable depending on geography. Among other requirements, such laws can require current and valid:

- business licenses
- aquaculture licenses
- land deeds, leases, or concession agreements
- land use taxes
- construction or habitat modification permits
- water use permits
- protection of mangroves or other sensitive habitats
- effluent or waste discharge permits
- adherence to veterinary and aquatic animal health regulations
- use of therapeutic and antimicrobial agents
- permits related to non-native species
- introductions or movements of seed (fingerlings, juveniles, post-larvae)
- use of genetically modified or bioengineered organisms
- predator control permits
- well operation permits
- landfill operation permits
- disposal of mortalities
- adherence to environmental regulations (e.g., water quality monitoring)
- environmental impact assessments
- bonds for potential environmental damage

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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 from local aquaculture associations.

A hatchery representative must provide all necessary documents to the auditor prior to or during the audit. Hatcheries must be in compliance with the requirements stipulated by the documents provided. For example, if a hatchery has an effluent discharge permit with water quality standards, those standards are enforced. In cases where governmental agencies have waived one or more permits, proof of these waivers must be available.

B. Local Community Relations – All Production Systems

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

- 2.4: The hatchery shall accommodate local inhabitants by not blocking traditional access routes to fishing grounds, wetland areas and other public resources.
- 2.5: The hatchery shall manage water usage to avoid restricting the amount of water available to other users.
- 2.6: The hatchery shall demonstrate interactions with the local community to avoid or resolve complaints or conflicts through meetings, committees, correspondence, service projects or other activities performed at least annually.
- 2.7: The hatchery shall demonstrate efforts to mitigate any negative impacts on local communities and the surrounding environment including but not limited to: waste disposal, sensory impacts (visual, noise, and odor), and livelihoods of local residents.

Implementation


Access to Public Resources

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

Hatchery Appearance

Hatcheries must maintain a clean and organized appearance, absent of debris and garbage, to avoid becoming an eyesore to local residents. Machinery should be maintained in good repair to avoid unnecessary noises that may disturb neighbors.

Compliance with this standard is verified through the examination of maps that may define public and private zones; on-site inspection of fences, canals and other barriers, and interviews with local people and hatchery/nursery workers.

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Community Engagement

Hatcheries must make a good-faith effort to have at least one face-to-face meeting annually with community representatives or with the community at large in an open meeting. Evidence of the effort to hold community meetings can include posters advertising a meeting, email messages to community leaders or representatives, posts on social media platforms and meeting minutes. Other evidence of community engagement or in-kind contributions can include invoices, receipts, signed declarations of donations or contributions to community events, construction of facilities (e.g., a playground), timesheet records of staff volunteering time at community events (e.g., replanting of mangroves), records of the applicant's initiative towards engagement. Hatcheries are encouraged to contribute to the provision of facilities such as access roads, schools, community centers and other tangible and intangible contributions to community cohesion and building social capital. Local community members should have the opportunity and a mechanism or procedure to register complaints.

C. Worker Safety and Employee Relations – All Production Systems

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

General Requirement


- 2.8: Hatcheries shall operate in compliance with this standard and all local, national, and international conventions, rules and regulations, whichever provides the highest protection to the worker. Hatcheries shall have in place policies and procedures pertaining to, but not limited to: worker health and safety and compliance with requirements regarding wages, benefits, hours, hiring practices, minimum age, status of workers, and good employee relations that provide the highest protection to the workers.
- 2.9: All records of recruitment, compensation, benefits, access to training, promotion and termination shall be separated by sex.

Wages and Benefits

- 2.10: The hatchery shall ensure that workers are paid at least the legal minimum wage, or the wage rate established by an employment contract or collective bargaining agreement, whichever is higher. Regular wages and compensation shall cover the workers' basic expenses and allow for some discretionary funds for use by workers and their families.
- 2.11: The hatchery shall provide benefits that, at a minimum, are required by local or national law (such as paid holidays, maternity leave, health insurance, paid sick time, etc. as applicable).
- 2.12: The hatchery shall not have inappropriate access to the worker's bank account. Payment of wages shall not be made to someone other than the worker or into an account not controlled by the worker, unless otherwise required by law.
- 2.13: The hatchery shall issue wages directly to workers and not withhold or delay or make irregular payments. All wage payments shall be documented. A record of wage payment (such as a pay slip) shall be provided to the worker and include itemized detail of all benefit provided and deductions made.

Working Hours

- 2.14: The hatchery shall abide by the mandatory national work week, and where that is absent, an average work week of no more than 48 hours. The specific timing and organization of the working day may be agreed in a voluntary agreement between hatchery owners/management and workers.

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- 2.15: Overtime shall not exceed 12 hours per week except as permitted by national law and agreed to between the facility and workers in a voluntary contractual agreement. The facility shall demonstrate any overtime that exceeded 12 hours per week only occurs under exceptional circumstances with due measures taken to ensure workers' health and safety during overtime work.
- 2.16: The hatchery shall not terminate a worker's contract for refusal to work overtime or deploy any other detriment for noncompliance.
- 2.17: Hatcheries shall comply, at a minimum, with national laws regarding meal and rest breaks during work shifts. Hatcheries shall respect the right to a rest day after six consecutive days worked.
- 2.18: Documentation of the time each worker starts and finishes each workday shall be accurately recorded and accessible to both facility managers and each worker.

Forced, Bonded, Indentured, Trafficked, and Prison Labor

- 2.19: All work, including overtime, shall be voluntary, and shall not be under threat of any penalty or sanctions.
- 2.20: The hatchery shall not engage in any form of forced or indentured labor. This includes human trafficking, use of prison labor, the confiscation or holding of original identity papers and other valuable possessions, prohibiting workers from leaving the premises after their shift or other means of 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 workers upon request and readily available to them at all times.
- 2.21: Bonded labor shall be prohibited. The hatchery shall not require the payment of deposits, bonds or other financial or collateral guarantees that may result in debt bondage. This includes recruitment fees, fines, and deductions from wages, and withholding of pay that are not part of a written contractual agreement with the worker.
- 2.22: Workers shall have the right to leave the premises after their work shift. Workers shall also have the right to terminate their employment after reasonable notice. The hatchery shall not otherwise unreasonably restrict workers' freedom of movement including but not limited to surveillance during rest or non-work hours, during transportation, in dormitories provided by the hatchery.

Child Labor and Young Workers

- 2.23: The hatchery shall not engage in or support the use of child labor. The hatchery shall comply with local child labor laws regarding minimum working age, or the age of compulsory education, or the ILO Minimum Age Convention 138, whichever is higher. Although the ILO Minimum Age Convention 138 states that the minimum age shall be 15, local law of minimum age of 14 may apply if it is in accordance with developing nation's country exceptions under this convention. Records shall be collected, verified, and retained to verify age requirements are met.
- 2.24: The employment of young workers (above the minimum age but under 18 years old) shall be in compliance with local or national laws, including required access to compulsory education and any restrictions on hours and time of day.
- 2.25: Young workers (above the minimum age but under 18 years old) shall not be subjected to conditions which compromise their health, safety, or moral integrity, or which harms their physical, mental, spiritual, moral or social development. This includes restrictions on working hours and prohibiting night work and hazardous work.

- 2.26: The hatchery shall have in place procedures for support to anyone identified as a child laborer on the hatchery. Depending on the age of the child, support must include at a minimum removal and reintegration into education (for children below the minimum age and/or children who have not completed basic education and/or changing job functions for young workers above the minimum age to non-hazardous tasks).
- 2.27: The hatchery may accept young people into trainee and apprenticeships programs in accordance with national regulations and provided the young person has completed compulsory education and that the young person receives adequate training and supervision at all times.

Hiring and Terms of Employment

- 2.28: The hatchery shall only employ workers with a legal right to work in the country, whether national citizens or migrants. Work performed and terms of employment shall be in compliance with local, national law or international labor standards, whichever is stricter. Records shall be collected, verified and retained to document right to work documents.
- 2.29: The hatchery shall maintain all relevant documents that verify that any contracted/subcontracted workers, whether contracted through a labor service or otherwise, are paid in compliance with all local wage, hour, and overtime laws.
- 2.30: The hatchery shall not use contractors, subcontractors, temporary workers, homeworkers, apprentices, or other non-full-time employment schemes to avoid the payment of social security and other benefits required by local or national law under a regular employment relationship.
- 2.31: All labor recruiting agencies or employment services used by the hatchery must be licensed to operate by the local or national government as a labor provider. Workers shall not be subject to recruitment practices that utilizes threats, penalties, coercions, physical force, or fraud.
- 2.32: The hatchery shall provide to all workers, prior to hire and during employment, with written and understandable information regarding the terms and conditions of employment, worker's rights, benefits, compensation, expected working hours, details of wages for each pay period each time they are paid; and hatchery policies regarding disciplinary actions, grievance procedures, any authorized deductions from pay, physical work requirements, environment and housing, and workplace safety. This information shall be provided in the appropriate language of the employees. This requirement shall apply to all workers, regardless of status, including but not limited to hourly, salary, piece rate, temporary and seasonal workers.
- 2.33: Where contracted/subcontracted or temporary workers are hired through a labor recruiting agency, the hatchery shall ensure that these services provide 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.
- 2.34: The hatchery shall document the agencies used to recruit, hire, and/or employ workers, in addition to any known fees paid by or debts accrued by workers in order to secure employment.
- 2.35: If provided or mandated by the hatchery or employment agency/labor agency, worker housing shall meet local and/or national standards. Such housing conditions shall include at minimum, ensuring that structures are safe and watertight, that space is adequate as per occupational load for the buildings and that heating/ventilation/cooling, pest control, sink, shower and toilet facilities are provided.

Discrimination, Discipline, Abuse and Harassment

- 2.36: The hatchery shall provide for equal opportunity with respect to recruitment, hiring, terms of employment, compensation, access to training, promotion, termination and retirement.
- 2.37: The hatchery shall not engage in or permit discrimination in any aspects of employment, including but not limited to recruitment, hiring, compensation, terms of employment, discipline, access to training, promotion, termination, or retirement on the basis of race, color, gender, national origin/ heritage, religion, age, nationality, social or ethnic origin, maternity, sexual orientation, political opinion, disability or any other status. There shall be no discrepancy in wages and benefits between men, women, ethnic or religious groups for equal qualifications, experience and/or responsibilities. Terms and conditions of employment shall be based upon the ability to do the job, not on personal characteristics or beliefs.
- 2.38: The hatchery shall treat workers with respect and not engage in or permit physical, verbal or sexual abuse, bullying or harassment.
- 2.39: The hatchery shall not terminate workers for pregnancy, subject workers to pregnancy or virginity testing, force the use of contraception, or reduce wages after maternity leave.
- 2.40: The hatchery shall have a written disciplinary procedure made available in appropriate language of the workers. Records shall be maintained of all disciplinary actions.
- 2.41: The hatchery shall have a written worker grievance process/procedure and make it available to all workers, that allows for the anonymous reporting of grievances to management without fear of retaliation.
- 2.42: The hatchery shall have in place an established complaints and remediation system to handle cases and allegations of sexual abuse/harassment, bullying, or discriminatory practices. This process shall, at a minimum, include a confidential reporting mechanism, information on any hotlines or other outside support services available and the possibility of calling in independent assessment/arbitration.
- 2.43: The hatchery shall have the information regarding hotlines, competent authorities, and other resources for victims of labor rights abuse displayed prominently for easy access to workers.

Freedom of Association and Collective Bargaining

- 2.44: Workers shall have the right to associate, organize, and bargain collectively (or refrain from doing so) without the need of prior authorization from management. Hatcheries shall not interfere with, restrict, or prevent such activities and shall not discriminate against or retaliate against workers exercising their right to representation in accordance with international labor standards.
- 2.45: Where the right to freedom of association and collective bargaining is prohibited or restricted under local law, the hatchery shall not prevent alternative means to facilitate worker representation and negotiation (for example, the election of one or more workers by other workers to represent them to management).

Worker Health and Safety

- 2.46: Safe drinking water shall be readily available to workers. If meals are provided, they shall be wholesome and commensurate with local eating customs.
- 2.47: The hatchery shall have a sufficient number of toilets for men and women in compliance with local and national laws. These shall be readily accessible to workers and kept in good repair.
- 2.48: The hatchery shall designate a management person responsible for managing worker health, safety, and training.

- 2.49: The hatchery shall identify, prevent, eliminate, or minimize any workplace health and safety hazards. This includes a requirement for documenting incidents, and investigations of accidents and their cause and correction.
- 2.50: An Emergency Response Plan shall be prepared for serious illnesses, accidents, natural disasters, or other incidents.
- 2.51: Select workers shall be trained in the details of the Emergency Response Plan and in first aid to include electrical shock, profuse bleeding, drowning, boat accidents and other possible medical emergencies. A list of the trained workers shall be available.
- 2.52: In the event of accidents or emergencies, the hatchery shall provide basic medical care, including access to or communication with medical authorities. Additionally, first aid kits shall be readily available to workers, and any expired content shall be replaced.
- 2.53: Personal protective gear and equipment (e.g., eye protection for welding, gloves for shop work, boots for wet areas, life jackets on boats) in good working order and in alignment with local laws and work conditions shall be provided to and used by workers based on an assessment of workplace risks.
- 2.54: Electrical pumps and aerators shall be connected to power supplies according to standard safe procedures that include proper wiring, grounding of cables, and coverage of circuit boxes. Machinery shall have proper driveshaft and/or drivebelt safety guards.
- 2.55: The hatchery shall provide training in personal health and hygiene to promote worker health and safety at least annually.
- 2.56: The hatchery shall have a training program to ensure workers that handle or are exposed to antimicrobial agents, agricultural chemicals, fuels, or other toxic substances that represents a physical, human health, food safety or environmental hazard are properly trained in their safe use.
- 2.57: The hatchery shall have in place a policy that workers can refuse to work in an unsafe environment, without disciplinary action being taken against the worker.
- 2.58: If applicable, the hatchery shall comply with laws that govern diving on aquaculture facilities and develop a written Dive Safety Plan that documents procedures for safe diving, response to diver emergencies, and equipment maintenance. Limits for time under water shall be established and monitored through diver logs. Diver safety training is required.
- 2.59: If the hatchery requires boat usage, the hatchery shall provide written procedures and staff training for the safe operation of boats to avoid accidents and the risk of drowning.


Implementation

Worker Rights and Employee Relations

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

Hatcheries must comply with local and national labor laws, including those related to young workers, overtime pay and compensation, worker safety, and where applicable, on-site living conditions. Hatcheries must take into account national and local regulations, however, if the law differs from a requirement in this standard, the provision that provides the greatest protection to the worker applies. Recommendations of the International Labor Organization (ILO) should be used as a normative reference when local and national legislation regarding worker/employee safety, wellbeing and rights is not sufficiently comprehensive in comparison.

Hatcheries must demonstrate compliance through worker contracts, documented method of payment, timesheets, disciplinary records, and piece rate records, among others. Hatcheries must maintain policies

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related to working hours, benefits, anti-discrimination, and remediation for anyone identified as a child worker. In addition, hatcheries should maintain thorough records regarding their labor supply chains including recruitment agency agreements, any fees paid by the worker, and the legal status of each worker. Age documentation for every worker should also be maintained and available at the time of the onsite audit. When hiring foreign workers, hatcheries must have documentation of legal status. Records must be maintained of all disciplinary actions, worker grievances and mediation. Records of disciplinary actions should document the date, time, personnel involved, evidence reviewed, and disciplinary action taken, and corrective actions to address the issue. Workers should sign the record to indicate awareness. These records must be available to the auditor.

The principal of equal opportunity must be adhered to throughout this section of the Standard. All records of recruitment, compensation, benefits, access to training, promotion and termination must be disaggregated (separated) by sex. Men and women must receive equal pay for similar tasks.

Living quarters must be well ventilated and have adequate shower and toilet facilities. Meals, where provided for workers, be wholesome, with food storage and preparation done in a responsible manner. Trash and garbage must not accumulate in living, food preparation or dining areas.

Worker Health and Safety

Workers must be provided with:

- Knowledge and skills needed to do their work safely and avoid creating hazards that could place themselves or others at risk.
- Awareness and understanding of workplace hazards and how to identify, report, and control them.
- Specialized training, when their work involves unique hazards.

Staff and workers must be given initial orientation training as new workers as well as refresher training on safety in all areas of hatchery operations. Hatcheries must take the approach that workers have a “right to know” about worker safety and hazardous conditions associated with employment. Training programs should be accurate, credible, clear and practical. Training materials should be prepared by qualified individuals and updated as needed. Trainers should have a general safety background or have practical experience in safety or be a subject matter expert. Training programs must be clear and presented in terms understandable by workers. Training programs should be useful to workers, with demonstrated application on the hatchery.

Workers must be trained in first aid for electrical shock, profuse bleeding, drowning and other possible medical emergencies. A plan must be available for obtaining medical assistance for injured or ill workers. Training must be provided on response to natural disasters such as severe floods and tropical cyclones.


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 must be correctly and safely wired. Tractors should have roll bars, shields over power take-offs and other appropriate safety devices. Use of personal protective gear and equipment should align with local conditions and local dress customs. However, these conditions and customs should not preclude use of personal protective gear when the job or task requires their use.

Hatcheries that use divers to clear sludge from pond bottoms or perform other underwater tasks must develop a written Dive Safety Plan to assure safety and require directly employed or contracted divers to follow the plan. The plan must include specialized diver safety training, maintenance records for diving equipment and procedures for diving emergencies.

Additional Information

- ILO Conventions and Protocols (www.ilo.org)
- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- Workers' Representatives Convention, 1971 (No. 135)
- Collective Bargaining Convention, 1981 (No. 154)
- Forced Labour Convention, 1930 (No. 29)
- Protocol of 2014 to the Forced Labour Convention, 1930 (No. P029)
- Minimum Age Convention, 1973 (No. 138)
- Equal Remuneration Convention, 1951 (No. 100)
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- Employment Policy Convention, 1964 (No. 122)
- Protection of Wages Convention, 1949 (No. 95)
- Occupational Safety and Health Convention, 1981 (No. 155)
- Safety and Health in Agriculture Convention, 2001 (No. 184)
- Migration for Employment Convention (Revised), 1949 (No. 97)
- Migrant Workers (Supplementary Provisions) Convention, 1975 (No. 143)
- ILO Declaration on Fundamental Principles and Rights at Work and its Follow-up (1998, rev. 2010)
- ILO Declaration on Social Justice for a Fair Globalization (2008)

Occupational Safety and Health Administration (OSHA, 2016). Recommended Practices for Safety and Health Programs <https://www.osha.gov/shpguidelines/education-training.html>

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E. Standard Requirements – Environmental Responsibility

A. Protection of Ecologically Sensitive Areas - All Production Systems

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

- 3.1: Where the site plan shows that an Ecologically Sensitive Area (ESA) has been damaged by hatchery construction and/or operation since 1999, such loss shall only have been for allowable activities and purposes (installation of inlet and outlet canals, pump stations and docks).
- 3.2: If net loss of ecologically sensitive area occurred on hatchery 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.
- 3.3: For hatcheries constructed before 1999 and where an ESA was damaged but not restored, the hatchery 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. Evidence of the facility's compliance with the mitigation plan shall be provided.
- 3.4: Operation of the hatchery shall not lead to erosion, beach deterioration, or cause other ecosystem damage.
- 3.5: Unless allowed under specific regulatory permits, 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.


Implementation

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

Construction and operation of new hatcheries or nurseries must not result in the loss of critical habitat. Critical habitat, as defined by the International Finance Corporation (2012), is "any area of the planet with high biodiversity conservation significance based on the existence of habitat of significant importance to critically endangered or endangered species, restricted range or endemic species, globally significant concentrations of migratory and/or congregatory species, highly threatened and/or unique ecosystems and key evolutionary processes." Critical habitat for species classified as Endangered or Critically Endangered according to the IUCN Red List of Threatened Species or any species on the list by the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora shall not be lost by construction and operation of new facilities. New facilities shall not be constructed in legally protected areas, particularly IUCN Protected Area Categories I through IV.

Ecologically sensitive areas must be identified and protected during construction.

- Hatcheries 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. Legal authorizations required for construction and operation of such infrastructure shall be documented.

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- ESAs damaged by construction or operations since 1999 must 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.
- In cases where ESAs were damaged before 1999, the hatchery must be the subject of a five-year restoration or mitigation plan.

Additional Information

IUCN Red List of Threatened Species: <https://www.iucnredlist.org/>

Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1975 (Appendix I): <https://www.cites.org/eng/app/appendices.php>

IUCN Protected Area Categories: <https://www.iucn.org/theme/protected-areas/about/protected-area-categories>

Convention on Biological Diversity, 1992: <https://www.cbd.int/>

Convention on Wetlands of International Importance, 1971 (Ramsar Convention): <https://www.ramsar.org/>

B. Effluent Monitoring and Management– Land-Based Systems including Recirculating Aquaculture Systems


Hatcheries must 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 they qualify for one of the specific exemptions provided in the standard. Hatcheries must also meet conditions for discharge as specified in their operating permits.

Effluent Compliance Options

- 3.6: The average annual concentration of each effluent water quality parameter shall comply with BAP Water Quality Criteria (Appendix B) or applicable local and national regulations, whichever is stricter.

NOTE: For each variable measured monthly, at least 10 of the values obtained during a 12-month period shall comply with the criteria, provided the 12-month average of the monthly data remains below the BAP limit for each variable. For variables measured quarterly, only one deviation is permitted for each variable during a 12-month/4 quarter period, provided the average of the quarterly data remains below the BAP limit for each variable. When such deviations occur, facilities should make every effort to correct the problems within 90 days.

- 3.7 During the annual inspection process, auditors shall 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, and results shall conform to the limits stated in Appendix B.
- 3.8: In cases where the source water for a hatchery has individual water quality variables that exceed limits established as BAP Effluent Water Quality Criteria, hatcheries will be considered compliant as long as concentrations of those variables reflect no deterioration between intake and discharge of the relevant variable. For variables of source water that do not exceed BAP Effluent Water Quality Criteria, compliance with these effluent criteria is required. Reports of source water quality variables shall be available.

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Effluent Compliance Exemptions

- 3.9 Hatcheries operating with an average water exchange rate of <1.0% of production system volume per day on an annual basis shall be exempt from BAP Effluent Water Quality monitoring. Hatcheries seeking such an exemption shall provide documentary evidence to validate the exemption.
- 3.10: Hatcheries that release no effluent to natural water bodies, or whose effluent is exclusively destined to irrigate agricultural crops, discharged into deep injection wells, or disposed into percolation ponds, are exempt from BAP Effluent Water Quality monitoring. Hatcheries seeking such an exemption shall provide documentary evidence to justify their claims.
- 3.11: Hatcheries that produce less than 5 mt of live aquatic products or use ≤5 mt of compound feeds per year are exempt from BAP Effluent Water Quality monitoring. Hatcheries seeking such an exemption shall provide documentary evidence of the quantities claimed.

Water Use

- 3.12: The hatchery shall provide the auditor with an estimated annual water use during the last calendar year, as illustrated in Appendix C, and shall provide documentary evidence of how the estimate was derived.

Effluent Monitoring and Management – Land-Based Systems including Recirculating Aquaculture Systems


Hatcheries and nurseries must demonstrate that effluent of good quality, as defined by the BAP Effluent Water Quality Criteria, is discharged to receiving waters. The water quality criteria also assure that the effluents from hatcheries have no greater concentrations of pollutants than typically allowed for effluents from other point sources. To confirm compliance with BAP water quality criteria at hatcheries, the auditor will review the written effluent sampling and analysis protocols used by the hatchery, and, during the audit process, witness effluent sampling and dispatch for analysis by an independent laboratory. Sampling and testing protocols must conform to the guidelines outlined in Appendix B. Routine sampling and testing may be performed by an independent laboratory, or by the hatchery itself, provided that in both cases, tests conform to standard methods as published by the American Public Health Association, American Water Works Association and Water Environment Federation, or other equivalent international standards. Any in-house water quality laboratories will be inspected during an audit.

At least 3 months of effluent data are required for initial hatchery certification, including those variables that are to be recorded quarterly.

In recognition of the diversity of production system types and intensities, this standard provides several options and exemptions to achieve conformity. These options should demonstrate that application of good management practices is effective in reducing the volume and improving the quality of hatchery effluents.

Source Water Quality

Some hatcheries may use surface waters from streams, rivers, lakes or estuaries as source water for production. On occasion, the concentration of some of the water quality variables in the source water exceeds the limits for effluents as defined in the BAP Effluent Water Quality Criteria. For those variables, hatcheries can demonstrate that there is no deterioration in water quality between intake and discharge points. Specifically, hatcheries can demonstrate that there is no increase in concentrations of total suspended solids, soluble phosphorus, total ammonia-nitrogen, 5-d biochemical oxygen demand and no decreases in dissolved oxygen concentration. This option does not apply to pH and chloride concentration. For those variables that do not exceed BAP Effluent Water Quality Criteria in source water, compliance with these criteria is expected and required. To demonstrate no deterioration in water quality between and intake

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and discharge, water quality variables of both source water and effluent must be measured and records maintained. Samples must be collected according to the frequencies stated in Appendix B.

Low Water Exchange Rate Systems

The mass discharge of nutrients and organic matter from hatcheries or nurseries is the product of concentration multiplied by effluent volume. As a practical matter, it is much easier to reduce mass discharge by reducing effluent volume. In recognition of this, an exemption to meeting BAP Effluent Water Quality Criteria is established for hatcheries that limit the volume of effluent discharged. Hatcheries and/or nurseries that qualify for this exemption shall demonstrate water reuse, only occasional water exchange and no intentional discharge of effluents into natural water bodies during production, such that less than 1% of the culture water volume is exchanged daily on an annual basis and effluent is discharged to a receiving watershed.

An estimate of the total water volume used in production of aquatic animals shall be reported. Records indicating the volume of effluent discharged must be available. Hatcheries qualifying for this exemption are nevertheless required to report an annual effluent discharge volume. An estimation of annual effluent volume, water use, and nutrient load indices must be determined as described in Appendix A. Hatchery intake water volume must be recorded monthly.

Recirculating Aquaculture Systems (RAS)

The BAP effluent water quality limits were originally established for flow-through aquaculture systems. Concentrations of effluent parameters in such systems, due to their high rates of exchange, are considerably diluted, resulting in the low concentrations typically observed. In contrast, when hatchery facilities operate under a recirculating model of water management, such that 90% or more of their total water flow is recirculated on a daily basis, dissolved nutrients such as Total Phosphorus or Nitrate-N have a tendency to become concentrated in the recirculated water, resulting in a reduced volume effluent stream containing more concentrated levels of nutrients. Several factors may influence this: the degree to which facilities recirculate the water in their production system, the biomass of animals in the system, the nutritional characteristics of the feeds used, the total water volume of the production system, and other design specifications of the culture system. It is generally true however that the overall load of nutrients to the receiving environment is significantly reduced by the use of recirculating systems vs. flow-through systems. Recirculating hatchery facilities that can be classified as “limited-exchange systems” are exempted from meeting the limits described in the BAP effluent monitoring requirements (>99% recirculation on average).

Additional Information

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


<https://www.fao.org/3/i0970e/i0970e00.pdf>

AQUACULTURE BEST MANAGEMENT PRACTICES MANUAL November 2016:

https://www.fdacs.gov/content/download/64045/file/BMP_Rule_and_Manual_FINAL.pdf

Best Management Practices for Marine Cage Culture Operations in the U.S. Caribbean – 2014:

https://eos.ucs.uri.edu/seagrant_Linked_Documents/pru/CaribbeanAquaBMP.pdf

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C: Water Quality and Sediment Monitoring – Cages or Net Pens in Fresh or Brackish Water

- 3.13: Water quality in the surface mixed layer of water bodies used for cage culture shall conform to at least two out of three of the following: not more than 40 µg/L for total phosphorus; not more than 15 µg/L for chlorophyll a; not less than 3m for Secchi disk visibility (as an average of Secchi measurements encompassing four consecutive months). In addition, dissolved oxygen concentration at 50cm depth shall not be less than 4 mg/L for more than four consecutive months.
- 3.14: From a baseline established through an independent third-party study during the first year after a facility becomes certified under this standard, any increase in annual average total phosphorus, or chlorophyll a concentrations, or any decrease in annual average Secchi disk visibility shall not exceed 25%. In addition, any decrease in annual average dissolved oxygen concentration shall not exceed 25%.
- 3.15: In water bodies with a Secchi disk visibility less than 5 m, scum-forming or potentially toxic blue-green algae or other potentially harmful algae shall not comprise more than 60% of the phytoplankton biomass over four consecutive months of sampling.
- 3.16: For cages in lakes or reservoirs, cages shall be placed in locations with an average water depth of greater than 10 m or at least twice the depth of the cage, whichever is greater.
- 3.17: For cages in water less than 30 m deep, and where sediments are usually aerobic in the absence of cages, divers or cameras shall be used periodically, at least once per production cycle, to inspect the bottom for accumulation of feces and uneaten feed. When such conditions are identified, aerobic benthic conditions shall be restored by fallowing or other means. Records of inspection and restoration shall be available.

Implementation


Production Practices for Cages and Net Pens in Fresh or Brackish Water

The best way to reduce nutrient outputs from cage and net pen culture is to increase the efficiency of feed use (i.e., reduce FCR). Hatcheries must use feed manufactured by a reputable feed mill and meet the nutritional needs and presented in a form (i.e., pellet size) that is suitable for each particular life stage of the aquatic animal. The feed should contain ingredients of high digestibility and contain no more nitrogen and phosphorus than necessary.

Feed shall be provided at a frequency and duration to maximize efficiency. Hatchery personnel responsible for feeding should assure that fish consume all feed offered. Fish should have access to the feed for sufficient time so that it is consumed before feed is lost through the cage or pen mesh. Feeding rings that retain floating feed should be used in low-volume (<25 m³) cages. Feeding rates should be monitored to avoid overfeeding. Observations of fish feeding activity are facilitated by using floating feed for certain species.

It is currently not practical to collect and treat wastes from cages and net pens. The main precaution against pollution is to locate culture units in open-water areas where water currents are sufficiently high to transport wastes away from cages and rapidly mix and dilute wastes.

High fish biomass in a particular location can increase the likelihood of pollution. In bodies of water that stratify thermally, a high fish biomass can result in severe organic enrichment and dissolved oxygen depletion in the bottom water layer (hypolimnion). Subsequent sudden thermal destratification, a naturally occurring process, can result in dissolved oxygen depletion throughout the water column. This phenomenon has been responsible for serious fish mortality of caged fish as well as wild fish populations

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outside cages. Although 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 and anticipate the need to take action in the event of sudden destratification.

Water Quality Limits

Cages and net pens may be installed in lakes, reservoirs, rivers, streams, irrigation systems, ponds, estuaries and embayments. Uneaten feed, feces and metabolic excretions of aquatic animals enter directly into the water bodies that contain the cages or net pens. The release of these wastes, derived from feeding, can cause enrichment (eutrophication) of the water bodies where hatcheries have installed cages. The potential of cage and net pen culture to cause eutrophication of lakes and reservoirs depends primarily on the total amount of feed added, location of production facilities relative to the water body outlet, the area and depth of the water body and the hydraulic retention time (HRT) or flushing rate of the water body. 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. Collectively these factors affect the capacity of the water body to assimilate the wastes from feeding, often called the carrying capacity. Assimilation capacity is impractical to measure for purposes of aquaculture certification.


The approach used to demonstrate environmental responsibility with respect to the effects of feed-derived wastes released during cage and net-pen operations is water quality monitoring. Specifically, this standard sets limits for certain water quality variables that are indicative of a mesotrophic or intermediate state of eutrophication. In mesotrophic conditions, an extreme level of environmental enrichment is avoided. In mesotrophic waters, the risk of dissolved oxygen depletion is less than in eutrophic or hypereutrophic waters. Thus, a mesotrophic condition simultaneously limits the extent of environmental enrichment and protects aquatic animal welfare to enable conditions suitable for healthy animals, good growth and efficient feed conversion. The water quality limits provide some flexibility because each water body responds uniquely. Furthermore, water quality in many water bodies varies seasonally (cold, warm / dry, rainy) and these water quality limits account for that variation. Natural water bodies can already be eutrophic when certification is sought. Sites at which water quality in the water body containing cages or net pens does not comply with BAP effluent guidelines shall not be eligible for certification.

Water samples must be collected once every two months for analysis of total phosphorus and chlorophyll *a* concentration by standard laboratory methods. Samples must be collected within the lease or concession at a depth of 50 cm. Secchi disk visibility must be measured once every two weeks during clear weather and around mid-day. Dissolved oxygen concentration must be measured once monthly in the morning, between 0600 and 0900 h, at 50 cm depth. Appendix D has additional information on water sampling and analysis.

One of the typical consequences of eutrophication in water bodies used for cage or net-pen culture is a shift in the composition of phytoplankton communities towards species that are tolerant of low light intensities. Often these species can be broadly categorized as blue-green algae (cyanobacteria), which are undesirable because they are potentially toxic to fish or livestock, produce unsightly surface scums, and may cause off-flavor in farmed and wild fish. These algae typically appear in water of low transparency.

Once every two months, in water bodies with a Secchi disk visibility less than 5 m, a water sample must be collected at 50 cm depth and the percentage of blue-green or other potentially harmful algae assessed. There are numerous examples of suitable methodological approaches for sampling and enumeration of phytoplankton. One example is "A Phytoplankton Methods Manual for Australian Freshwaters" (http://phytobioimaging.unisalento.it/Portals/7/Documents/General_Documentation/A%20Phytoplankton%20Manual%20methods%20Australia.pdf).

Blue-green algae have a wide size variation, but the focus of sampling should be directed towards the relatively large-sized, scum-forming blue-green algae, including but not limited to representatives of the following genera: *Anabaena*, *Aphanizomenon*, *Microcystis* and *Planktothrix/Oscillatoria*. Blue-green and

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other algae must be enumerated to estimate relative community composition. Sub-samples can be used periodically to estimate algal biovolume by multiplying cell or colony counts by estimates of cell volume for the main species identified.

Allowable Water Quality Changes

To assure that environmental quality is maintained at a level to support good aquatic animal welfare and mesotrophic conditions, hatcheries must evaluate changes in water quality that may anticipate reaching the water quality limits established in 3.13. During the first year after initial certification, an independent laboratory must be contracted to establish a baseline of environmental quality. Specifically, the hatchery must have the laboratory measure concentrations of total phosphorus and chlorophyll a concentration in samples collected from 50 cm depth within the lease or concession every two months. Hatcheries must measure baselines for Secchi disk visibility and minimum dissolved oxygen concentration. Measurements of Secchi disk visibility are to be done every two weeks and dissolved oxygen concentration monthly. In subsequent years, the monitoring program must proceed as outlined in 3.13. Changes in any water quality variable greater than 25% of the value of the baseline will be considered a non-conformity and require corrective action, typically a reduction in fish biomass.


Sediment Monitoring

Wastes can accumulate beneath cages and cause deterioration of sediment quality. This is environmentally undesirable and can have negative impacts on the welfare of fish in cages as well. Sediment quality in areas with fish cages can be protected by fallowing – periodically moving cages to new sites in a concession and allowing the sediment beneath the original sites to recover. Observations on sediment quality must be used to determine if and when to move cages. For cages located in rivers or in reservoirs with extremely short HRT's (<5 days), the restriction concerning location of cages where depths are >10 m or where the reservoir depth is at least twice the depth of the cage, is not applicable.

Some freshwater lakes and reservoirs are normally stratified throughout the year, with a bottom layer of water with little or no oxygen. In such conditions, restoration of bottom condition is not possible or practical because the processes leading to anaerobic bottom waters are naturally occurring. In this case, hatcheries are not required to inspect sediment. However, hatcheries must demonstrate that bottom waters are anaerobic with monthly sampling of dissolved oxygen concentration in the hypolimnion (bottom layer), with specification of the depth sampled. Hatcheries placed in locations with water depths greater than 30 m are exempt from sediment monitoring.

D: Cages or Net Pens in Marine Water Above 25-ppt Salinity, Coastal RAS and Coastal Flow-Through Facilities

- 3.18: The hatchery shall provide documents that describe local standards for benthic impacts under net pen facilities, which shall include the benthic indicator “trigger level” above which the facility would not be in full compliance with the local standard.
- 3.19: For established hatcheries, three years of monitoring data shall be available to show that the hatchery meets or exceeds sediment quality criteria specified in its operating permits and/or its own monitoring plan at current operating levels.
- 3.20: Where sediment monitoring is not required as described above and/or where an allowed sediment impact zone is not defined, the hatchery shall document and implement a Sediment Monitoring Plan. The Plan shall incorporate:

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- 3.20.1 Securing the services of an independent individual or company with demonstrated expertise in sediment sampling and analysis to design a sediment sampling and analysis program appropriate to the hatchery conditions and to conduct sediment monitoring as required below.
 - 3.20.2 Establishing and mapping an allowable sediment impact zone that shall not exceed the total area of the hatchery plus a boundary zone of 40 m around it. The footprint may be shifted in any direction to account for normally occurring current patterns as long as the total area remains the same.
 - 3.20.3 Monitoring organic matter accumulation 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 hatchery is located.
 - 3.20.4 Conducting sediment sampling to coincide with the period of peak sustained feeding during each crop cycle.
- 3.21: 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 hatchery's operating permits or its own Sediment Monitoring Plan in countries or regions where sediment monitoring is not required, and as specified in the implementation guidance.
- 3.22: 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.
- 3.23: Copies of sediment monitoring reports submitted to regulatory agencies shall be available, together with evidence of any remedial actions that were implemented and completed by the hatchery to remain in compliance with its operating permits.
- 3.24: Production cycles and fallowing shall be coordinated with other neighboring BAP applicants or BAP-certified facilities, or with members of an established Area Management Agreements (AMA).
- 3.25: Where an AMA has not been established, hatcheries 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 from the hatchery.

Implementation


Sediment Monitoring – Marine Net Pens/Cages, Coastal RAS and Coastal Flow-through Facilities

This section applies to net pens in marine and brackish water environments. It also applies to coastal RAS and coastal flow-through hatcheries that operate with a high rate of water exchange, greater than one system volume exchange per hour.

Specific Regional Standards

In some countries and regions, cage facilities are subject to specific regulations about benthic impacts, but in other places, regulations may be inadequate or non-existent. This standard reinforces any existing regulations and describes minimum requirements where effective rules are not already in place.

Hatcheries must provide documents that describe local standards for benthic impacts under cages. Hatchery 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 evaluate this area. Because biological sampling of sediments (i.e., benthic invertebrate community composition) 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 if a chemical indicator trigger point is exceeded.

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Production cycles and fallowing shall be coordinated with neighboring aquaculture facilities, whether or not they are BAP-certified, or with members of an established Area Management Agreement. Whole leases, not only bays with cages, should be fallowed for at least six months. BAP-certified hatcheries are encouraged to make a good-faith effort to participate in the creation and implementation of Area Management Agreements to address cumulative benthic impacts associated with multiple facilities. BAP-certified operations that operate in isolation should have a statement of intent to enter an AMA, if another operation moves into the area.

Hydrographic and Benthic Characterization

Hatcheries utilizing cages facilities are usually located following a hydrographic, biological and physical study of the site to determine that operations will not have significant negative impacts on animal populations that comprise the benthos under or near the hatchery. Then “allowable” benthic impacts are set as conditions in the operating permits for the hatchery, 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 that are based on prior knowledge of local sediment biology or analysis of sediment reference samples collected from the site.

Sediment Monitoring Plan

Chemical indicators used for sediment monitoring include sediment oxidation-reduction potential; concentrations of dissolved oxygen, sulfide, total organic carbon or total volatile solids; or visual inspection with documentation by video. Certain variables are better suited to some environments than others. 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 concentration 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.


An existing hatchery must provide at least one production cycle of monitoring data to show that the hatchery meets or exceeds benthic standards required by operating permits at current production levels. Newly established cage facilities (first production cycle) must have completed a baseline study, with review by an independent expert, that describes hydrographic and benthic conditions at the site, and that in the expert’s opinion (given without liability), the hatchery can meet or exceed the benthic standards required by its operating permits at current or proposed production levels. This opinion must be verified by reference to sampling results at the subsequent audit.

Sediment Sampling and Analysis

Samples are taken along at least two transects that pass directly through the cages and align with the dominant flow of water at the cage site. One sample with three replicates must be taken at the edge of the cage site and another at the 25-m or 40-m boundary. Five replicate samples must also be taken from at least two reference stations within 1 km of the site that have similar depth and sediment characteristics as occur at the site and where there is no aquatic animal production.

Hatcheries must provide documents to show that sediment quality was determined using generally accepted sample collection and analytical methods. As 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 this standard, only that whatever method is used must be undertaken using standard methods of sampling and analysis that conform to generally accepted international standards.

Hatcheries must demonstrate by statistical analysis of the results that there is no organic matter accumulation from hatchery activities at the boundary of the allowable sediment impact zone in comparison to the reference station, as determined by the monitoring method chosen.

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Additional Information

British Columbia Salmon Farmers and Province of British Columbia – 2001

<http://www.salmonfarmers.org>

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

<https://www.standard.no/en/webshop/productcatalog/productpresentation/?ProductID=135410>

Code of Good Practice for Scottish Finfish Culture

Scottish Salmon Producers' Organization

<http://www.scottishsalmon.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

<https://www.fao.org/3/i0970e/i0970e00.pdf>

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E: Soil and Water Conservation – Land Based Systems Only

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

Land-Based Systems


- 3.26: If ponds with brackish or saline water are constructed on permeable soil, management measures shall be taken to control seepage (e.g., use of pond liners) and avoid contamination of aquifers, lakes, streams and other natural bodies of freshwater.
- 3.27: For inland brackish and saline water production systems operating in freshwater areas, quarterly monitoring of neighboring well and surface water shall show that chloride levels are not increasing due to hatchery operations.
- 3.28: If groundwater sources are used for production purposes, 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 being adversely affected.
- 3.29: 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.
- 3.30: The hatchery 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.
- 3.31: If the hatchery 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.
- 3.32: Any accumulated sludge removed from ponds, tanks, reservoirs or sedimentation basins shall be confined within the hatchery property until it is properly disposed of. Operations should favor utilization of sludge for agricultural production when feasible and practical.
- 3.33: Removed sediment shall be properly contained and located to prevent the salinization of soil and groundwater and shall not be placed in sensitive locations such as mangrove habitats or other protected areas.
- 3.34: The hatchery shall take mitigation measures to control erosion and other impacts caused by outfalls.

Implementation

Salinization

Salinization of freshwater bodies and/or aquifers can result from hatchery operations where saltwater or brackish water is used in production systems 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:

- Not discharging saline water into freshwater areas.
- Avoidance of pumping of groundwater from freshwater aquifers that significantly lowers the water table in neighboring wells.
- Where water is pumped from deep saline aquifers under freshwater aquifers, the well casing shall be properly cemented to prevent leakage of saltwater into overlying freshwater aquifers.

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- Monitoring of 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 and Sludge Management

Most aquaculture ponds have long hydraulic retention times and solids generated during production from feeding will settle and to some extent be treated on the pond bottom. However, 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, uneaten feed, and dead algae and mineral particles from source water, if rivers and streams are used, and scoured from embankments or resuspended from the pond bottom.

The first principles of sediment management on land-based aquaculture facilities are to prevent excessive sedimentation through good management practices and confine sedimentation to specific parts of the hatchery. Where supply water has a large sediment load, reservoirs for pre-sedimentation can remove much of the suspended material so it will not settle in water supply canals and production ponds.

Sediment accumulation in ponds and canals can be reduced by:

- Implementing proper earthen infrastructure design and construction to reduce erosion by rainfall and water currents.
- Placing aerators to avoid impingement of water currents on embankments that cause scouring.
- Placing a layer of large stones (riprap) or other lining materials in erosion-prone areas.
- Covering bare areas of embankments with gravel or grass.


Discharge of sludge may not be an issue for ponds with production of less than 20 mt/ha per crop, but above this threshold, sedimentation basins for sludge storage are needed. The minimum required sedimentation basin volume can be estimated using the following equation:

Sedimentation basin volume = $37.5 \times [\text{Fish production (mt)} \div \text{Sludge transfers (times/crop)}] + [\text{Fish production (mt)} \div 0.6]$

In this equation, fish production is the total quantity of fish produced in all ponds that discharge into a sedimentation basin, and sludge transfers are the mean frequency at which sludge is moved from ponds to a 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 fish production equates to 1 mt sediment.
- Sludge removal can be spread over a 24-hour period.
- Sediment bulk density is 0.6 t/m³.
- The solids content of sludge is 6.5 kg/m³.
- Accumulated sediments in the basin are removed at the end of each crop to return the basin to its original capacity.

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

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For hatcheries producing more than 20 mt/ha per crop, the hatchery shall provide the auditor with mean values for fish production and sludge transfer frequency so the required sedimentation basin volume can be calculated. The auditor will verify that the facility has the required volume of basins in use and available for sludge containment. Basins should be configured so that raw sludge enters at the surface at one end of the basin and the resulting effluent exits at the surface at the other end of the basin. Five or six calibrated poles should be installed in basins to allow the accumulation of settled solids to be monitored and ensure the available capacity can always support a minimum six-hour hydraulic retention time.

Raceways or similar flow-through systems have short retention times, and in high-intensity operations, sediment loads can often exceed acceptable limits. Therefore, such facilities must incorporate suitably sized settling zones or other engineered solutions that assure removal of the majority of settleable solids. Accumulated solids must be pumped or siphoned periodically to offline sludge basins, where they can be dewatered and subsequently removed for use as fertilizer in land-based agriculture crops.

Any accumulated sludge removed from ponds, reservoirs or sedimentation basins shall be confined within the hatchery property or consolidated and used locally as fill material or for agriculture. Pond sediment from bank erosion can usually be reused to restore the slope of eroded pond embankments. Sludge or sediment shall not be applied to sensitive natural wetlands or wetland buffers. On large hatcheries, sediments removed by dredging shall discharge into offline containment areas within the hatchery property rather than directly into streams or other estuarine areas. These can be installed along the margins of canals or on areas of salt flats above high tide. When sediment is stored, it shall be confined within a diked area so that solids resuspended by rainfall can be retained. The sediment can also be spread in a thin layer over the land and vegetative cover established. If dredged accumulated sediment is disposed of outside water-holding structures, care shall be exercised to prevent the formation of spoil piles that can cause ecological disruption through erosion and transport to surrounding areas.

F: Responsible Feed Use - All Production Systems

Hatcheries shall accurately monitor feed inputs and take steps to minimize potential risks of contamination or spoilage. Hatcheries that produce juvenile animals with average live weights over 5 g and use more than 50 mt of dry feed yearly shall minimize the use of fishmeal and fish oil derived from wild fisheries.

All Production Systems

- 3.35: Accurate records shall be documented and maintained for all feeds used, their sources, and quality control tests undertaken to detect the presence of contaminants or toxicants.
- 3.36: Live, fresh or frozen feed for juveniles and broodstock brought into the hatchery from an outside source shall be accompanied by a written record 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.
- 3.37: To retain quality and freshness, all feed shall be stored under cover in compliance with manufacturer's recommendations with enough space from the walls provided to allow ventilation and movement for inspection.
- 3.38: Feeds and feed additives (premixes) shall be protected from moisture and fouling pests, and stored separately, from fuels, chemicals and other potential contaminants.
- 3.39: Biosecurity provisions for feeds brought into or produced at the hatchery shall be followed as described in the Health Management Plan. Documented records shall be available to demonstrate this.

- 3.40: The hatchery shall obtain written assurance from the feed manufacturer that the feed does not contain aquatic feed protein from the same genus as the species being produced. However, protein hydrolysates verified to <10,000 Daltons are permissible.

Hatcheries Producing Juveniles With Average Weight >5g and Using Over 50 mt Dry Feed/Year

- 3.41: The hatchery shall use feed for which the manufacturer has provided data on the inclusion rate (%) in feeds of total fishmeal, fishmeal from byproducts, fish oil, and fish oil from byproducts. The hatchery shall obtain a written declaration from the feed manufacturer that it maintains records on the species and fishery origins of each batch of fishmeal and fish oil.
- 3.42: The hatchery shall record the characteristics of all feeds used, the total amounts of each feed used each year, and the total annual crustacean or fish production.
- 3.43: The hatchery shall calculate and record a feed-conversion ratio for each completed production cycle.
- 3.44: The hatchery shall calculate and record a final Fish-in Fish-out (FIFO) ratio and Forage Fish Dependency Ratio (FFDR) value for all completed production cycles.
- 3.45: The FIFO shall not exceed 4 (or 5 if fish processing byproducts are included in the feed). Note: no FFDR limits have yet been set for the Hatchery Standard.
- 3.46: The hatchery shall obtain feed either from a BAP-certified feed mill or from a feed mill that provides declarations that it complies with the BAP Feed Mill Standard's requirements for responsible sourcing of marine ingredients (current version), specifically:
- The recording of species and fishery origins of each batch of fishmeal and fish oil, and;
 - Having a written Plan of Action defining policies for responsibly sourcing fishmeal and fish oil from reduction fisheries and setting clear goals for responsibly sourcing soy ingredients.

Hatcheries Producing Live Feeds


- 3.47: Hatcheries that produce live feeds such as phytoplankton, copepods, rotifers, Artemia, etc., in-house shall have written procedures that define production methodologies, sanitary procedures for avoiding contamination of cultures, disinfection procedures, harvesting and concentrating and feeding processes to ensure optimal use of such feeds, shall train staff responsible for live feed production, and shall have appropriate infrastructure, equipment, and supplies to optimize production of such live feed products.

Implementation

Hatcheries shall keep accurate records of all feed brought into and used at the facilities. Management 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 or live feeds produced at the facility shall be the subject of measures outlined in the site-specific Health Management Plan (HMP). Because of the extremely small early life stages in some aquaculture species, it has been necessary for many hatcheries to produce live feeds, in place of purchasing formulated dry feeds, at least for early feeding stages. Hatcheries that rely upon in-house production of live feeds must develop and implement written procedures for optimizing production of nutritious, healthy live feeds for their culture animals.

Hatcheries that use more than 50mt of dry feeds yearly and produce juveniles of over 5 g average live weight shall maintain records that enable FIFO and FFDR values to be calculated as described in Appendix F.

To promote the responsible sourcing of marine ingredients, the hatchery shall obtain feed from a BAP-certified feed mill or a feed mill that declares and documents compliance with responsible sourcing criteria

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of the BAP Feed Mill Standards. 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.

Aquaculture producers shall strive to use marine feed ingredients efficiently, relative to current industry standards, as well as in the global context of livestock feeds and the different species and system intensity combinations. The fish-in fish-out (FIFO) ratio and forage fish dependency ratio (FFDR) are two related indices of the ecological efficiency of fishmeal and fish oil use in an aquaculture system. In short, FIFO considers fishmeal and fish oil together and FFDR considers fishmeal and fish oil separately. Many aquaculture feeds incorporate only small amounts of fishmeal and fish oil and farms that use these feeds can have FIFO and FFDR values less than 1, indicating that they make a net contribution to global fish supplies.

Farms shall obtain documentation concerning the percent fishmeal and fish oil in feeds from feed manufacturers or suppliers. The inclusion levels in feeds shall include any meal or oil derived from whole, wild-caught fish, squid, krill, mollusks or any other wild aquatic animals. However, they shall exclude meal or oil derived from by-products such as trimmings, offal and their derivatives such as squid liver powder, aquaculture by-products such as shrimp head meal and ingredients derived from invasive aquatic species. The quantity of each feed type used, along with the fishmeal and fish oil content of each feed shall be recorded in the audit report.

Additional Information

MarinTrust Standard (formerly IFFO RS Version 2.0 Standard) – Global Standard for Responsible Supply of Marine Ingredients

<https://www.marin-trust.com/sites/marintrust/files/2017-07/FINAL%20V2.0%20Standard%20for%20publication.pdf>

Fish in: Fish Out (FIFO) ratios for the conversion of wild feed to farmed fish, including salmon, IFFO

<https://www.iffonet/fish-fish-out-fifo-ratios-conversion-wild-feed>


Fish In – Fish Out Ratios [Explained], IFFO

<https://effop.org/wp-content/uploads/2019/10/5-IFFO-EUFM-FIFO-251019.pdf>

G: Stocking Sources and GMOs - All Production Systems

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 collected, stocked, or supplied to growout farms.

- 3.48: The hatchery 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 (bioengineered) status. Records shall also include documentation to support the stock characteristic claims made.
- 3.49: 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 entity.

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- 3.50: The hatchery shall keep records of sources and purchases of stocking material, and document 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 include an estimated margin of error.
- 3.51: The hatchery shall comply with all government regulations regarding importation of native and non-native gametes, juveniles, and broodstock, where applicable.
- 3.52: The hatchery shall not source and stock wild juveniles to supply to growout farms. The collection of seed of certain wild mollusks is allowed and when practiced by the hatchery, such collection and stocking shall comply with applicable regulations.
- 3.53: Hatcheries shall avoid utilizing wild populations as a continuous supply of broodstock, except as necessary to improve genetic diversity as documented in the hatchery's Genetic Improvement Plan (GIP). 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.
- 3.54: Where the species produced is neither native nor already approved for farming, further documentation 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.
- 3.55: Hatcheries that engage in genetic improvement of stock through selective breeding shall have a written Genetic Improvement Plan (GIP) that describes improvement goals and how genetic fitness will be maintained as these goals are pursued.
- 3.56: The hatchery shall demonstrate effective control over any non-BAP-certified suppliers of broodstock, eggs, smolt/fry/juveniles/post larvae, spat or any other stocking material. Control measures at non-BAP-certified suppliers shall include either annual audits by a hatchery's own internal auditors to the full scope of the BAP Hatchery and Nursery Standard, or third-party certification against the Standard. Records of all control measures shall be available.

Recordkeeping

From the standpoint of product traceability, at the hatchery level, records of purchases or transfers of stocking material are the fundamental first step. For each production unit (pond, tank, cage) and each production cycle, comprehensive records about the source, broodstock or seed attributes and characteristics, number stocked, and number surviving shall be maintained. The list of examples of species characteristics given in the audit clause is not exhaustive, and there may be other relevant characteristics that should be noted. For example, some aquatic animal seed batches may have been vaccinated or treated with chemicals as disease prophylaxis prior to stocking. The flow of aquatic animal seed through the facility as the animals grow, including transfers among production units, shall be tracked with the recordkeeping system. Facilities shall demonstrate that populations of aquatic animals in a production unit can be traced back to their sources at any time while the animals are being grown. A sample Traceability Form that records such data is provided in Appendix E.

Importation Permits

During an audit, documentation of compliance with government regulations (i.e., permits) relating to the importation of aquatic animal broodstock and any associated health certificates shall be available for review. The hatchery shall demonstrate awareness of the relevant national and local laws and regulations regarding introductions and transfers of live aquatic animals. The hatchery shall establish a link to the domestic competent authority (veterinary health authority or other government regulatory body) to verify international importation requirements and follow the International Health Certificate protocol defined by

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the OIE. Government regulations differ by country and the certification body is not expected to maintain complete records of the requirements in every country. However, auditors should become familiar with relevant regulations and importation procedures in countries where they regularly perform audits. Hatcheries importing a new species for the first time should be scrutinized with extra vigilance to demonstrate that legal channels were followed.

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

Non-native Species

Many non-native species are a major segment of productive aquaculture sectors in many countries. Tilapia have been spread to many countries outside native ranges in Africa and the Middle East. White shrimp have been introduced from the Americas to many countries in Asia. For intentional introductions of non-native species, hatcheries shall demonstrate regulatory approval that is based on the 2005 ICES Code of Practice on Introductions of Marine Organisms or the Codes of Practice and Manual of Procedures for Consideration of Introduction and Transfers of Marine and Freshwater Organisms (FAO 1988). A non-native species is considered established if it has a reproducing population within the watershed, as inferred from multiple discoveries of adult and juvenile life stages over at least two consecutive years. Given that successful establishment may require multiple introductions, species are not considered established if their records of discoveries are based on only one or a few non-reproducing individuals whose occurrence may reflect merely transient species or unsuccessful invasions. To reduce the potential deleterious impact of escapes, technologies such as sterility, ploidy and monosex production are encouraged.

Genetically Modified or Bioengineered Organisms

Bioengineered (BE) organisms, otherwise also referred to in some jurisdictions as Genetically Modified Organisms (GMOs) or transgenic organisms are defined as organisms that have been genetically modified by artificial transfer of genetic material from another species. Sterile or sex-reversed organisms and their subsequent offspring, and organisms created by hybridization and polyploidy are not GMOs. Should genetically modified fish or crustaceans be commercialized in the future, producers shall comply with all regulations in producing and consuming countries regarding such organisms. Information regarding the BE status of harvested aquatic animals must be transferred from the farm to processing plants or other buyers that receive those animals.

Additional Information

ICES 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%20Practice.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>

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H: Control of Escapes – All Production Systems, Several Standards for Net pens Only

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

All Production Systems

- 3.57: A site risk analysis, updated after every production cycle, shall identify the potential and actual causes of escapes, determine the relative likelihood of their occurrence or recurrence, and identify critical control points for effective escape risk monitoring, reduction, and response.
- 3.58: Employees shall be trained in the findings of the risk analyses, and the efficacy of procedures in place to monitor and reduce escape risks, and effectively respond to all actual and suspected escape events for broodstock, eggs, and juveniles. Training records shall be available.
- 3.59: If it is determined that an escape event has occurred, it must be reported to the appropriate regulatory authorities immediately with supporting documentation.
- 3.60: All holding, harvest, stock transfer, transport, and culture systems shall be designed, operated and maintained to minimize the unintended release of eggs, larval forms, juveniles and adult animals.
- 3.61: Screens, nets or other controls sized to retain the smallest live aquatic animals present shall be installed on water outlet pumps, pipes or sluices.
- 3.62: Screens, nets or other controls shall be installed around pump intakes to minimize the introduction of local aquatic fauna.
- 3.63: All screens shall be well-maintained and checked for damage at least daily. Screens on larval rearing systems that are not changed daily shall be checked during cleaning or exchanges, and prior to installation.
- 3.64: Effluents released to natural water bodies shall be monitored for the presence of live cultured organisms and records of such monitoring shall be available.

Net pens

- 3.65: The hatchery shall provide documentation demonstrating that the facility's moorings were installed according to the manufacturers or marine engineer's specifications.
- 3.66: Based on the escape risk analysis, the hatchery shall have a written Stock Containment Plan (SCP) that describes how net pen system integrity is assured and maintained. Unless a hatchery can demonstrate by engineering specifications, operational considerations, or government regulations that alternative procedures provide equal or better safeguards against escapes, the criteria outlined in clauses 3.67 through 3.73 shall be followed.
- 3.67: The hatchery shall provide documents to show that all staff members have received training in the Stock Containment Plan, which shall be verifiable by training certificates in workers' files and verified during the audit by interviews with a subset of workers.

- 3.68: The main surface components of the net pen system shall be inspected at least monthly and repaired or replaced as needed. The subsurface components shall be inspected at least every six months and replaced as needed.
- 3.69: 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.
- 3.70: All operational nets shall be surface checked for holes daily and checked subsurface with an underwater camera or by a diver at least weekly, weather permitting. Nets and cage superstructure shall be checked for holes and other indications of structural damage immediately after risk events such as cyclones or big tides when inspections can be safely conducted.
- 3.71: Boats shall have protective guards on the propellers and staff members who operate the boats shall be trained to avoid contact between boats and cage nets.
- 3.72: At marine sites, procedures, and equipment consistent with local Coast Guard (or equivalent) rules shall be in place to warn marine traffic of the facility's presence.
- 3.73: The hatchery shall maintain equipment for the recapture of escapees and have written procedures for its use. The procedures must enable a rapid response, subject to legal constraints on the types of equipment used.

Implementation

Containment System Integrity

Avoiding breaches in containment leading to escapes of aquatic animals is in the economic interest of producers. It is also in the interest of minimizing environmental interactions between hatchery-reared and wild organisms, such as disease transfer and changes in gene frequency in wild populations. Thus, containment systems for any life stage shall be designed, constructed and operated to minimize the escape of culture animals. These containment systems can be used to grow, hold temporarily or transport cultured aquatic animals. Containment systems shall be designed and constructed using applicable standards or best practices.


The infrastructure and equipment used to contain aquatic animals shall be inspected according to a regular schedule. A program shall be in place for regular preventative maintenance and repair of containment infrastructure and equipment. A reporting system shall be in place to indicate inspection results and preventative maintenance undertaken.

Screening

Screens and nets of a size to retain the smallest aquatic animals present shall be installed as a barrier between the culture unit and the environment. This applies to cages or net pens and outlets (pipes, gates, etc.) from land-based pond, tank or flow-through systems. Examples of acceptable filter devices include a series of mesh screens capable of screening all water, dry-bed filters constructed with gravel and sand, microscreen solids filters, and pond traps with screened discharge.

Escape Detection and Incidence Response

All incidents involving animal escapes shall be accurately documented, including the reason for the escape, the estimated number of organisms that escaped, the health status of the escapes, and any recovery plans/effectiveness statistics. If an escape is known or suspected to have occurred, the root cause shall be investigated immediately, the steps shall be taken to correct it, and plans and actions proposed to address future escape risks. These actions shall be documented in hatchery records. If, after investigation, there are grounds for believing an escape occurred, the remaining aquatic animals in the culture system shall be

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counted, if and/or when water and welfare indicators indicate this can be done without causing excessive distress to the aquatic animals, and any loss of inventory shall be recorded.

Net Pens

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

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


Containment Plan

Hatcheries or nurseries using cages or net pens shall have a written Stock Containment Plan (SCP) that covers escape prevention and deals with known or suspected escapes. The SCP shall include the following elements:

- Integrity of Infrastructure and Equipment – design and construction standards for an effective containment system, equipment testing.
- Inspections – inspection program for infrastructure and equipment, including preventative maintenance program and repair.
- Inventory Control Procedures – counting methodology and verification, aquatic animal inventory reconciliation.
- Aquatic Animal Handling Practices – precautions during transfers, counting, grading, disease treatment, harvesting, transport and other hatchery operations.
- Predator Deterrence and Control Plan – predator control structures (as appropriate), control of predator access, control methods.
- Response Procedures and Escape Mitigation – recapture and recovery of stock, escape incident reporting requirements, root cause analysis of escapes or containment failure.
- Recordkeeping – equipment testing results, aquatic animal inventory reconciliation or escape detection, escape event log, training activities.
- Training – definition of employee responsibilities, oversight.

Escape Prevention

- Documents shall show the net pen's moorings were installed according to the manufacturer's and/or marine engineer's specifications.
- A site risk analysis updated at least annually shall identify the potential and actual causes of fish escapes, determine their relative likelihood of occurrence or recurrence at the hatchery site, and identify critical control points for effective escape risk monitoring, reduction and response by hatchery staff.

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- Procedures based on the risk analysis shall include management protocols and actions designed to monitor escape risks, reduce them when identified and respond to escape events in a timely and effective manner. The efficacy of these measures shall be verified and documented through the year.
- Procedures shall require the main surface components of the system to be inspected at least monthly and repaired or replaced as needed. The sub-surface components must be inspected and replaced as needed at least every six months or between each crop cycle, whichever is shorter. Equipment shall be replaced as needed.
- Net inventory management procedures shall track the ages of all nets on the hatchery or in storage and provide strength tests on all nets between crops or every two years, whichever period is shorter. Nets shall be retired when their strength is below levels specified in local regulations or, where there are none, below the manufacturer's or supplier's recommendations.
- Cage inspection procedures shall ensure all operational nets are surface checked for holes at least weekly and checked sub-surface at least every two 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.
- Predator deterrence procedures shall minimize the risk that predators can make holes in nets.
- Boat equipment shall include guards on propellers and staff training procedures that minimize the risk of contact between boats and hatchery nets.
- At marine sites, procedures and equipment consistent with local Coast Guard rules shall warn non-hatchery marine traffic of the hatchery's presence.
- Procedures for handling live fish shall prevent "spillage" during transfers.

Additional Information

British Columbia Net Cage Strength-Testing Procedure, 2002


http://www.agf.gov.bc.ca/fisheries/aqua_report/2004-5/Appendix3.pdf

Aquaculture operations in floating HDPE cages, FAO 2015

<http://www.fao.org/3/a-i4508e.pdf>

Norwegian Standard N. S. 9410.E

<https://www.standard.no/en/webshop/ProductCatalog/ProductPresentation/?ProductID=135413>

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I: Wildlife Interactions – All Production Systems, Several Standards for net pens Only)

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

All Production Systems


- 3.74: The hatchery shall use humane methods of predator exclusion and deterrence, actively favor non-lethal control methods, and avoid lethal methods. Where applicable, government permits for predator control shall be made available for review.
- 3.75: The hatchery 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.
- 3.76: Only under exceptional circumstances, such as when there is risk to human life, shall controls other than non-lethal exclusion be applied to predator species. In cases where lethal controls are determined to be necessary, the hatchery shall ensure that specific members of staff have been designated and trained to carry out lethal control measures in a humane manner.
- 3.77: The hatchery 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.

Net Pens

- 3.78: The hatchery shall provide a list of relevant local laws and specific conditions of operating permits that apply to wildlife management and protection.
- 3.79: Marine sites shall maintain maps that identify officially designated “critical” and/or “sensitive” marine and coastal habitat in the region. If the hatchery 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 hatchery and of mobile coastal species within the region. The list shall be updated where necessary to show wildlife established after the hatchery began operations. New sites shall actively avoid areas official designated as critical or sensitive marine habitats.
- 3.80: Documents shall be available that describe the passive measures in place to deter the entry into net pens of would-be predators and procedures for the routine inspection and maintenance of the measures.
- 3.81: Documents from regulatory authorities shall be available to show that any active but non-lethal deterrent measures used have been approved by regulators, following 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.

Implementation

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 (IUCN) 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.

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Wildlife Interaction Plan

Hatcheries shall have a written Wildlife Interaction Plan (WIP) that includes provisions stipulated in local laws and the hatcheries operating permits, as well as the following requirements, if not stipulated in local laws. Hatcheries that fully enclose culture units within a building or greenhouse that effectively exclude wildlife are exempt from the requirements of a WIP, other than meeting the required legal compliance. The hatchery shall designate an individual in the hatchery management team to be responsible for implementation of the WIP. The WIP shall include but not be limited to the following elements:

- A list of relevant local laws and specific conditions of the hatchery's operating permits that apply to wildlife management and protection and allowed wildlife deterrent measures.
- A list of local species classified as endangered or threatened under local laws and/or listed as "Critically Endangered" or "Endangered" on the IUCN Red List.
- A map that identifies officially designated "critical" and/or "sensitive" protected areas in the region and the location of any wildlife colonies or migratory corridors.
- If the hatchery or nursery is in or near an area designated as critical or sensitive habitat, a list of endangered non-migratory species within a 2-km radius of the hatchery and of migratory species within the region, updated when necessary, as new habitat is designated.
- A recordkeeping system for reporting observations of endangered, threatened and protected species.
- Designation of workers or management staff responsible for implementing lethal control measures, if needed.
- Description of the hatchery's passive measures (barriers) to deter the entry of predatory birds, mammals or reptiles into production units (ponds, tanks, cages, etc.).
- Procedures for regular inspections to evaluate and report on the integrity of culture units and the effectiveness of wildlife barriers.
- At marine net pen sites with carnivorous marine mammals (seals, otters, sea lions, orcas) and predatory sharks, a description of the hatchery's passive measures (primary or secondary barriers) to protect net pens from underwater attack.
- At marine net pen sites, the WIP shall include documentation to show that any acoustic harassment devices used are approved by regulators through a review of environmental impacts with specific reference to endangered, protected, threatened or cetacean species in the area. Such devices shall not be deployed if the review indicates they can adversely affect these species.
- At marine net pen sites, the hatchery may only use acoustic harassment devices to control predators if independent expert opinion verifies that their use will not harm endangered, protected or threatened species or any cetaceans, and if they are legally approved and/or permitted for use.
- Documentation that any active, non-lethal wildlife deterrent measures used by the hatchery are approved by government regulators.
- Reporting procedures in the event that control measures cause the accidental death of wildlife and proposed actions to prevent reoccurrence.
- Procedures that state that legally approved lethal methods shall only be used after all non-lethal methods are attempted.
- Prohibition of deliberate lethal controls on species classified as endangered or critically endangered, except under exceptional circumstances, such as risk to human life, and then only after specific written authorization is obtained from regulators.
- Procedures for regulatory authorization, implementation and reporting of lethal control measures

when these are deemed necessary.

Worker Training

The management staff member responsible for implementation of the WIP shall be responsible for training workers and other management staff on elements of the plan. Workers shall be trained in aspects of wildlife predator deterrence and control that they may be called upon to implement. Hatchery workers and management staff shall be trained to recognize, and report endangered, threatened and protected species observed on the hatchery. The individual designated to carry out lethal control measures shall be adequately trained to implement humane and effective lethal control methods.

Predator Exclusion and Deterrence

Humane, non-lethal methods for exclusion and deterrence of wildlife predators is required. Hatcheries shall keep records to demonstrate that, if used, a wildlife predator exclusion and deterrence program is operational and effective. Hatchery site inspection during the audit will assess ongoing wildlife predator exclusion and deterrence activities. As site characteristics and conditions vary widely, the use and effectiveness of various predator control methods will vary, and no single approach is likely to be effective. A combination of approaches is encouraged, and an empirical approach should be taken to evaluate effectiveness. Compliance with laws and regulations that apply to wildlife (especially threatened and endangered species) and permitted predator deterrence methods is expected.


If humane, non-lethal methods for exclusion and deterrence of wildlife predators fails after every effort is made, then attempts should be made to capture, remove, and relocate the potential predator from the hatchery. In extreme cases, after all non-lethal methods are attempted, and especially when worker safety is at risk, lethal methods can be considered. Lethal control methods must only be those allowed by applicable national laws and regulations. Lethal methods must be rapid, safe, and done as humanely as possible. If firearms are used, they must be within the scope of government permits, and only weapons appropriate for the predator should be used. Only properly trained workers licensed to use firearms shall be assigned to kill such predators, and any mortalities shall be documented and reported properly. Only predators actively engaged in an attack that endangers worker safety should be shot without a permit. No lethal predator controls can be used with species that are listed as endangered or critically endangered on the IUCN Red List or that are protected by local or national laws.

Recordkeeping

The Wildlife Interaction Plan has a recordkeeping requirement for reporting observations of endangered, threatened and protected species on the hatchery. Hatcheries are encouraged to be transparent with stakeholders in providing public access to these records. Hatcheries shall maintain a recordkeeping system that records the species and numbers of all avian, mammalian (except rodent pests) and reptilian mortalities associated with predator control efforts. It is not necessary to record mortalities of these species that are not caused by predator control efforts.

J: Storage, Disposal of Supplies and Wastes – All Production Systems

- 3.82: Fuel, lubricants, feed and chemicals used at the hatchery 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.
- 3.83: Chemicals used for hatchery operations shall be neutralized or diluted before discharge into natural bodies of water. Neutralization or dilution shall be in compliance with manufactures' recommendations and all local and national regulations.

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- 3.84: Fuel, lubricants and agricultural chemicals shall not be stored near feed, in employee housing or kitchen areas, or near harvest equipment and supplies.
- 3.85: Fuel, lubricants and chemical storage areas shall be marked with warning signs and risk indicators.
- 3.86: 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.
- 3.87: Garbage from housing and food waste shall be retained in water-tight receptacles with covers to protect contents from insects, rodents, and other animals.
- 3.88: 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). All hatchery related trash shall be removed regularly and properly to avoid accumulation and under no circumstances be dumped into mangrove areas, wetland, or other vacant lands.
- 3.89: Discarded hatchery supplies and equipment (e.g., tires, pallets, bags, barrels, aeration paddles or engines) shall be stored tidily and removed properly to avoid excessive accumulation.
- 3.90: Measures shall be taken to prevent infestation by animal and insect vectors and pests.
- 3.91: Secondary fuel containment volume shall be at minimum equivalent to the total fuel container capacity plus 10%.
- 3.92: 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).

Implementation

The range of chemicals and supplies used, and solid wastes generated in aquaculture hatcheries and nurseries is diverse, depending on type of culture system, production intensity and species grown. Release of those materials can compromise the food safety of farmed aquatic animals, environmental pollution, or the spread of disease pathogens. Hatcheries are encouraged to develop a systematic approach to the management of chemical and solid wastes in their particular production context. The goal of such a system should be to track the flow, generation and disposal of materials that result in waste and to reduce their volume.

Safe Storage

Some materials used in the operation and maintenance of aquaculture hatcheries represent an environmental risk if released intentionally or inadvertently to the environment. Safe storage of these materials is the initial barrier between the material and the environment.

Labels, risk indicators and warning signs should align with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). All physical, human health and environmental hazards should be identified and labeled as such. Material Safety Data Sheets (MSDS) shall be available for all chemicals used on the hatchery. A chemical inventory shall be maintained. Chemicals shall be labeled with the date received and date opened.

Storage and containment facilities that are safe, secure, and properly designed, well ventilated and properly managed must be provided for all fuel, lubricants and agricultural chemicals used. Chemicals shall be stored in secure area with access only to authorized personnel. Chemicals shall never be stored on the floor. Materials shall be segregated by hazard class and according to compatibility to prevent undesirable chemical reactions should two or more chemicals accidentally mix. Material used in shelving should be compatible with the chemical being stored. Chemicals must not be stored in direct sunlight or near any heat source. Cylinders of compressed gases shall be secured properly such as by using chains and not using

breakable materials such as rope or raffia string. Highly toxic or controlled substances and veterinary medicines shall be stored in a locked cabinet. 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%.

Chemicals such as insecticides, herbicides, and algicides shall be stored in locked, well-ventilated water-tight buildings. The buildings' concrete floors should slope to a center basin for containing spills. Risk indicators and warning signs for these materials shall be posted.

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

Oil leaks from tractors, trucks and other equipment shall be prevented through regular scheduled maintenance. Spills shall be avoided during oil changes and refueling of vehicles, generators and pump motors. Used oil should be sent to a recycling or aggregation center. Used chemicals and leaking or deteriorating containers shall be disposed of responsibly.

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. First aid supplies, emergency phone numbers, eyewash and emergency shower equipment, fire extinguishers, spill cleanup supplies and personal protective equipment shall be readily available, and workers trained in their use.

Feed Storage

Feed represents the largest variable cost item in fed aquaculture. Thus, care must be taken to guard the quality of feeds during storage at the hatchery. During storage, lipids (fats) in the feed break down, causing rancidity that reduces the palatability of feed. Mold can create mycotoxins that affect fish kidney and liver function. The potency of vitamins, especially vitamin C and thiamine, also decreases during storage. Spoilage of feed can be caused by excessive moisture from rain, condensation and high humidity; high temperatures; scavenger pests such as rodents and birds; insect infestations by weevils, beetles and moths; and spoilage by fungi, which can cause mold. Moldy feed shall never be fed to aquatic animals. Spoiled or otherwise unusable feed is both a resource and financial loss.

A covered, well-ventilated and secure building should be constructed for the specific purpose of feed storage. The roof should protect the feed from rainfall and direct sunlight. All ventilation openings and junctions between the roof and walls should be sealed with mesh coverings to prevent entry by scavenging rodents and birds. The air in the building should be as dry and cool as possible.

Hatcheries that utilize live or fresh-frozen feeds, or formulated dry hatchery diets that require refrigeration or freezing, must have facilities and equipment to produce and/or store such feeds in a fresh and sanitary manner.

The feed storage building shall be kept clean. Any spilled feed shall be collected and removed to avoid attracting rodents. The storage building should be cleaned before new feed enters storage. When the storage building is empty, the walls, floors and storage pallets can be sprayed with insecticide. The outside area around the feed storage building should not have tall weeds or other overgrown plants that provide cover for rodents or other pests. There should not be any stagnant water near the feed storage building.

Feed bags should be arranged in stacks on pallets or above-ground racks. Feed shall not be stored directly on the floor because spoilage may occur from condensation. There should be a 1-m gap between and around stacks and between stacks and storage building walls and at least 1.5 m between the top of a stack and the roof. Stacks that are more than 4 m high can cause damage of feed pellets in bags at the stack bottom, creating fine feed particles that are usually not consumed by fish and can contribute to environmental waste loading. Bagged feed should be handled carefully because rough handling can damage pellets and create fines. Excessive handling of feed bags should be avoided. Walking or sleeping on feed bags should be discouraged.

The hatchery shall keep an accurate and current inventory of all feed types used. The oldest feeds should be used first (first in, first out). Feeds should not be stored past the manufacturer's recommended use date, usually 90 days, especially in the tropics. Feed purchases should be managed to keep feed fresh.

Measures shall be taken to prevent infestation of feed storage buildings by animal and insect vectors and pests. Hatcheries and nurseries shall have a Pest Management Plan for the control of key pests. The hatchery shall designate an individual responsible for pest management in the feed storage building, for documenting regular inspections of the feed storage building to monitor for pest activity or infestation, and for training workers on proper feed handling and storage. Traps shall be placed in the feed storage building for control of rodents. Pesticide applications may be necessary, and these shall be documented and done using only legally approved chemicals and safe application methods by trained workers.

Spoiled or expired feed can be disposed of in a landfill and handled similarly to other solid wastes generated by the hatchery. Given that feed is decomposable, spoiled feed can be composted or used as an agricultural fertilizer for plant or tree crops. Spoiled feed shall never be dumped directly into aquatic ecosystems.

Solid Waste Disposal

Solid wastes generated at hatcheries and nurseries include decomposable wastes such as kitchen and housing wastes (garbage) and expired or moldy feed, dry materials such as paper and glass, various bulky items, discarded hatchery supplies and equipment (tires, pallets, bags used for feed, chemicals, chemical barrels, pumps and motors, and vehicle parts), construction debris, and electronic wastes (computers, mobile phones). Solid wastes may also include biofouling organisms removed during onshore net-cleaning operations. If these wastes are not disposed of properly, there is a risk of environmental pollution and unsanitary hatchery conditions. Hatcheries and nurseries shall take a systematic approach to managing solid wastes by developing a plan that specifies procedures for the collection, storage, and disposal of solid wastes. In general, the approach should be to reduce, reuse, or recycle potential wastes of any kind. Paper and plastic should be recycled if possible. Waste collection for recycling requires readily accessible waste containers that are serviced at regular intervals.

Solid wastes should not be allowed to accumulate on hatchery property. Such wastes shall be collected promptly as it is generated and placed in temporary solid waste storage areas (dumpsters, bins) prior to final disposal. Solid wastes shall be disposed of responsibly in a well-designed and legally operated sanitary landfill. Solid wastes shall not be dumped in open areas of mangroves or other wetlands or vacant land. Hatchery solid wastes should not be incinerated unless part of a waste-to-energy production facility. If wastes are composted, the process should not create an odor problem or attract wild animals. Biofouling organisms on net cages shall not be cleaned at the production site. Nets should be transported to a shore-based facility for cleaning in facilities designed to capture solid wastes from net cleaning. Biofouling solid wastes should be diverted into a sedimentation pond, sanitary sewer or other treatment system.

Managing Derelict Gear, Marine Litter and Plastic Waste

Some aquaculture production systems require deployment of cages or net pens, rafts, racks, moorings, marker buoys, floating docks or other gear that floats or is submerged near the water surface. All deployed gear shall be clearly marked or identified as property of the hatchery. During extreme weather events with high wind, waves and flooding, gear may become detached or damaged. Once safe to do so, every effort shall be made to retrieve this gear from the bottom, adjacent shorelines, or water surfaces. Damaged gear that is retrieved can be repaired or disposed of like other solid wastes in a sanitary landfill. A procedure shall be in place for the management and recording of lost, "end of life" or recovered aquaculture gear to control any risks of entanglement with wildlife.

Aquaculture uses many plastic items, including synthetic ropes, netting, floats and buoys, drums, buckets, trays, feed bags, plastic bags for transport of fry or post-larvae, Styrofoam cooler boxes, various packaging materials, boats, pipes, tanks, and pond liners, among many other items. Hatcheries are encouraged to conduct a plastics inventory to track the procurement, use and disposal of all plastic items in an effort to

avoid release to the environment. All plastics shall be disposed of in a manner that will not generate marine litter or have other detrimental impacts on the environment. Records of how this waste material is disposed of shall be retained.

Mortality Disposal

Occasionally large numbers of aquatic animals will die as a result of natural causes or human error. Dead aquatic animals, whether arising from an acute mortality episode or chronic daily mortality, shall be removed promptly and placed in dedicated containers. Containers of stored aquatic animal waste should be leak-proof and secured to prevent contact with aquatic animals, other animals or birds and unauthorized personnel. Aquatic animal waste containers should be labeled with regard to content. Dead aquatic animals should be stored for the minimum time that is practical before disposal and storage containers should be cleaned to prevent insect infestation. The storage area should be separated from hatchery production areas and bodies of water to minimize the risk of spread of pathogenic agents. Transport should be accompanied by appropriate documentation detailing origin, content, and destination to allow tracing if required.

Aquatic animal waste infected by an agent causing a disease referred to as “listed” in the OIE Aquatic Animal Health Code, or suspected of being so, may not be transported without permission from the Competent Authority. The Competent Authority may assess the requirement for this condition based on the disease situation in the Member Country (e.g., where a disease referred to in the Aquatic Animal Health Code is enzootic in the Member Country).

Mortalities shall be disposed of on land by responsible procedures, including rendering, incineration, sterilization, composting, biogas production, ensiling or burial after removal by a competent contractor and in accordance with all applicable regulations. Carcasses shall never be discarded in water bodies. Equipment used for transportation of aquatic animal waste shall be cleaned and disinfected before being returned to the hatchery.

Additional Information

Marine Litter Inventory


<https://aqua-lit.eu/assets/content/MARINE%20LITTER%20INVENTORY.pdf>
<https://aqua-lit.eu/assets/content/MARINE%20LITTER%20INVENTORY.pdf>

OIE Aquatic Animal Health Code (2019), Chapter 4.7 – Handling, disposal and treatment of aquatic animal waste

<https://www.oie.int/standard-setting/aquatic-code/access-online/>

United Nations (2011), Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

https://www.unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev04/English/ST-SG-AC10-30-Rev4e.pdf

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F. Standards Requirement - Animal Health and Welfare

A. Health and Biosecurity – All Production Systems

Hatcheries shall work to prevent infectious disease entry and spread in facility stocks and animal for export. Hatchery practices shall include regular and appropriate disease surveillance, sanitation of equipment and personnel, quarantine or removal of diseased animals, and controlled movement of personnel and equipment. Hatchery staff and visitors shall be trained in and apply appropriate biosecurity measures. Hatcheries shall conform to relevant local and national regulations regarding biosecurity and disease surveillance and defer to the direction of a veterinarian or qualified AAHP for all related matters.

- 4.1: The hatchery shall have a written Animal Health Management Plan (HMP) developed in coordination with a licensed veterinarian or qualified AAHP. The veterinarian/AAHP shall assist in its implementation and maintenance through an annual review.
- 4.2: The AAHPs qualification documents shall be available for inspection at time of the audit and shall conform to the qualification requirements for AAHPs outlined in the introduction to the Hatchery Standard. The AAHP shall be available in person or by phone or other electronic means of communication at the time of the audit to present the HMP and answer questions.
- 4.3: The hatchery 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.
<https://www.fao.org/in-action/globefish/publications/details-publication/en/c/346120/>
- 4.4: The hatchery shall have an established training program for designated hatchery staff who implement the HMP and records of such training available.
- 4.5: Potential pathogens relevant to the species reared at the hatchery shall be listed in the HMP. This list shall include diseases listed by the World Organization for Animal Health (OIE currently-listed diseases, infections and infestations) and other diseases of national or regional concern (Ref. 2) and other pathogens of concern to the hatchery. The HMP shall include specific measures to address surveillance and response measures to each disease.
<https://www.oie.int/en/what-we-do/standards/codes-and-manuals/aquatic-code-online-access/>
- 4.6: The HMP shall contain site-specific risk analyses that identify ways in which pathogens might be introduced into the hatchery or transmitted to other facilities by its aquatic products. The hatchery shall demonstrate protection against such risks, including but not limited to diseases introduced through live aquatic products, water supply, feeds, hatchery personnel, equipment, visitors, and local wildlife.
- 4.7: Health status documentation for all live aquatic products (including plankton cultures used as feeds) brought into the hatchery shall be retained for a two-year period and shall demonstrate that the products were free of detectable diseases listed in conjunction with clause 4.5, or entered quarantine and were subsequently released into the hatchery once disease-free status was established. This excludes locally endemic diseases.
- 4.8: The hatchery shall have appropriate quarantine facilities if new broodstock or other stocks of aquatic animals are brought into the hatchery. The hatchery shall document within the HMP describing protection against the risk of bringing infectious disease agents into the hatchery and/or spreading them within it.

- 4.9: To minimize the chance of disease transmission from effluents discharged to natural waters, quarantine facilities shall screen out solids and treat effluents by chlorination or another method of disinfection which will kill the disease organisms before release. Once the effluents are properly treated, disinfectant residues shall be neutralized, removed, or allowed to dissipate prior to effluent discharge.
- 4.10: Biosecurity procedures for all incoming and outgoing personnel, visitors/contractors, equipment, and other materials brought into the hatchery shall be described in the HMP. The hatchery shall demonstrate that these procedures are followed.
- 4.11: The HMP shall describe the procedures and indicators used by staff to monitor and document the overall health of facility stocks. These can include daily or more frequent observations of physical appearance, feeding response, mortality, or larval development and/or growth rate at biologically relevant intervals. The HMP shall describe procedures for tracking these indicators, comparing them with earlier batches, and recording actions taken when trends are negative.
- 4.12: The HMP shall describe procedures for identifying diseases in hatchery stocks, diagnosis of pathogens and, where necessary, determination of susceptibility to therapeutics and treatment with them. Surveillance records shall be available.
- 4.13: The HMP shall describe fallowing or dry out periods are scheduled in different parts of the facility to break infection cycles. Records shall be kept of fallowing or dry out periods.
- 4.14: The HMP shall have procedures implemented for the routine collection, examination and sanitary disposal of dead animals, and for quarantining and/or depopulation of facility stocks, when required.
- 4.15: The health status of all animals, fertilized eggs, or sperm (milt) shipped from the hatchery shall be recorded. Determination of the health status of eggs and sperm will be based on evaluation of the broodstock of origin. Documents for all aquatic animals shipped from the hatchery shall be retained for a two-year period. Documents shall demonstrate 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 dually approved by the customer and local regulator.
- 4.16: When appropriate and approved vaccines are available for specific pathogens, culture species, and age class, animals shipped from the hatchery shall be vaccinated according to the requirements of the importing region or country, or customer specifications. Records of vaccinations shall be available.
- 4.17: Transport containers for shipping live animals shall be new or properly disinfected. If containers are reused, they shall be sterilized between uses and records of sterilization shall be available.
- 4.18: An annual hatchery health status report that includes records of batch or lot numbers for live aquatic products with performance metrics (quantity, estimated survival, age, etc.), health indicators, treatments for disease, customer contact information and complaints shall be available. Actions taken to correct deterioration in any performance metrics shall be documented.
- 4.19: The hatchery shall demonstrate collaboration with neighboring BAP-certified facilities and seek to work with neighboring facilities that are not BAP-certified to standardize biosecurity procedures, and to share disease control and diagnostic information.

Implementation

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

The AWS shall specifically include details of how brood animals are to be treated. This includes, but is not limited to, interventions used 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 for surgical procedures, and handling techniques that minimize animal stress. Invasive procedures shall only be used if viable, non-invasive alternatives are not available.

Prevention and protection are the two general approaches to control disease pathogens and their spread. The goal of prevention is to manage the rearing environment, primarily through husbandry Best Management Practices, to minimize stress on farmed aquatic animals, thereby reducing susceptibility to disease. Maintaining water quality within the tolerance limits of the aquatic animals, using high-quality feeds that meet nutritional needs, and stocking at a density that will not cause stress are the key approaches. The goal of protection (biosecurity) is to limit the pathogen from entering the hatchery or nursery. Using disease-free broodstock for stocking, disease monitoring, using water that is free of pathogens, hygienic practices (e.g., disinfection), all-in, all-out stocking and harvesting, and control of vectors are some options to prevent pathogen entry.

Animal Health Management Plan

The Animal Health Management Plan is the practical guide to the activities and practices that are implemented to maintain aquatic animals in good health and thus realize their productive potential. The Animal Health Management Plan shall be linked to the biosecurity and welfare plans. A hatchery-specific written Animal Health Management Plan shall include, at minimum, the following elements:

- Protocols for water quality management to maintain water quality within the tolerance limits of aquatic animals – aeration, water exchange, liming, fertilization, etc.
- Protocols for feeding. How the hatchery will meet the nutritional requirements of aquatic animals for each life stage.
- Routine disease surveillance and characterization of the health status of the hatchery. Regular health monitoring is a fundamental part of the health and welfare management of aquatic animals. It provides an early warning detection system that allows rapid response to disease outbreaks. Protocols for regular observation of the behavior and welfare of aquatic animals shall be described. Operational disease surveillance shall be demonstrated by a health-monitoring record-keeping program. The plan shall describe the diagnostic capacity (on-hatchery and contracted labs) available to support infectious disease surveillance.
- Disease diagnosis techniques that will be used to evaluate prevalence of expected diseases.

- Disease control procedures that will be followed in the event of disease outbreaks. The procedures shall consider a broad range of options, including vaccination, quarantine, therapeutic treatments, and treatment types (e.g., medicated feed, baths, or dips, etc.) and humane slaughter (euthanasia). The steps followed shall include reporting to the Competent Authority if the disease is listed by the OIE or is required by local regulations. Procedures shall also consider responses in the event of a disease emergency with potential to cause mass mortality.

To demonstrate that the Animal Health Management Plan is operational and fit-for-purpose, the hatchery shall maintain or have access to regularly updated records of water quality monitoring, feeding, aquatic animal health and behavior, daily mortalities, disease outbreaks, and use of veterinary drugs, therapeutic chemicals, or disinfectants.

The Animal Health Management Plan shall be evaluated once per year to assess compliance with the plan, effectiveness in meeting goals of improved health and greater survival, and whether documentation and record-keeping have been sufficient.

The Animal Health Management Plan shall designate a member of the hatchery staff as health plan manager that will be responsible for implementing health plan elements, maintaining the recordkeeping system, and training staff. The health plan manager shall be a professional aquatic animal veterinarian or other trained specialist. The veterinary professional shall guide the health monitoring program, conduct health checks, and prescribe any treatments deemed necessary.


Biosecurity Plan

Biosecurity in aquaculture consists of all practices, activities and policies that minimize the risks from the introduction and spread of aquatic animal diseases. Biosecurity in aquaculture spans multiple levels of governance from international (e.g., OIE guidelines on introductions and transfers), to national (legislative controls) and down to the hatchery level. Each hatchery and nursery is responsible for biosecurity within the facility.

Proper biosecurity controls will minimize the risk associated with the introduction or spread of disease agents within a hatchery or nursery. The Biosecurity Plan shall be linked to the overall hatchery aquatic animal health and welfare plan. A hatchery-specific written Biosecurity Plan shall include, at minimum, the following elements.

- Identification of the likely infectious disease risks for the culture species within the region around the hatchery.
- Identification of entry and exit points and establishment of critical control points such as movement of aquatic animals and equipment, and hatchery access by visitors/contractors.
- Active control measures to prevent disease introduction and spread by movement of aquatic animals. This includes new introductions, regular stocking and internal movements of aquatic animals. Stock health inspections and certificates shall be used to demonstrate the disease-free status of batches of introduced aquatic animals.
- Active control measures to prevent disease introduction and spread by movement of people and equipment. The plan shall establish protocols that allow tracing of equipment and people movements, such as through visitor and delivery logs.
- Hygiene and sanitization protocols and standards for equipment and personnel.

To demonstrate that the Biosecurity Plan is operational and fit-for-purpose, the hatchery and/or nursery shall maintain regularly updated records that trace aquatic animal movements from hatchery to grow-out farm (see Traceability Section). Stock health inspections and certificates shall be retained and

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compiled. Personnel, equipment, and vehicle movement logs shall be maintained. Logs of sanitization and disinfection events shall be maintained.

The Biosecurity Plan shall be evaluated once per year to assess compliance with the plan, effectiveness in meeting goals of improved biosecurity, and whether documentation and record-keeping have been sufficient.

The Biosecurity Plan shall designate a member of the hatchery staff as biosecurity plan manager that will be responsible for implementing biosecurity measures, maintaining the recordkeeping system, and training staff and making visitors aware of their roles and responsibilities in implementing biosecurity measures.

Training

The biosecurity plan manager shall be responsible for training hatchery and nursery workers in:

- Aquatic animal husbandry practices that provide a low-stress environment conducive to good growth and survival.
- Identification of abnormal behavior and external clinical signs of diseases likely to be encountered on the hatchery.
- Disease reporting and notification procedures.
- Workers' responsibilities in the event of disease outbreaks.
- Role of worker movements in transmitting diseases. Training logs shall be maintained by the biosecurity plan manager.

Area Management

Although most BAP standards address facility-level impacts, they do not often address the cumulative impact of multiple aquaculture operations. Cumulative impacts are especially critical with respect to disease transmission among neighboring facilities, irrespective of certification status. Aquaculture zones or areas should be disease-free. To achieve area management of disease risks, qualifying hatcheries are required to make a good-faith effort to initiate or participate in an Area Management Plan to coordinate disease surveillance and control and other biosecurity activities with neighboring aquaculture facilities within one year of an audit. An exception is provided where facilities can demonstrate, through a formal disease risk assessment by qualified and independent experts in aquatic animal diseases, that there is a low risk of disease transmission among facilities.


Additional Information

SRAC 4707: Biosecurity in Aquaculture, Part 1: An Overview (Roy P. E. Yanong and Claire Erlacher-Reid)

<https://srac.tamu.edu/fact-sheets>

Finfish Biosecurity Measures Plan, Centre for Environment, Fisheries & Aquaculture Science (Cefas)

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/278581/Finfish_biosecurity_measures_plan.pdf

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B. Welfare – All Production Systems

Hatcheries shall demonstrate that all operations are designed and operated with a focus on animal welfare to maximize survival and seed quality. Employees shall be trained to provide appropriate levels of husbandry and animal welfare.

- 4.20: The hatchery shall include an Animal Welfare Section (AWS) within its Health Management Plan (HMP), and all facility personnel shall receive training in its provisions at least annually.
- 4.21: The AWS shall be written and/or approved by a qualified veterinarian or AAHP. Implementation of the AWS shall be overseen by a member of hatchery management or the AAHP, one of whom shall be available at the time of the audit to answer questions.
- 4.22: The AWS shall include procedures for the humane treatment of brood animals during spawning and/or egg and sperm collection (whether induced or naturally occurring), and for slaughter where this is required. The procedures shall be designed to identify and minimize unnecessary or inadvertent animal suffering, and records shall be available to demonstrate compliance with the procedures.
- 4.23: The AWS shall include methods for the humane 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.
- 4.24: The hatchery shall have a written Water Quality Management Plan (WQMP) which defines and justifies 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.
- 4.25: The appearance and behavior of stocks in each production unit shall be observed at least once daily (including weekends and holidays) for signs of distress or poor health. Corrective medical or other actions taken to correct signs of distress or poor health shall be documented.
- 4.26: Mortalities, body condition factor, lesions, abrasions or fin damage, gill damage or condition, and other indicators appropriate to the cultured species shall be measured regularly in each production unit as individual-based welfare indicators of physical health.
- 4.27: The hatchery shall describe, set and review, stocking density limits appropriate to the production system, species, and size of animals being reared. Regardless of set stocking density limits, water quality parameters must remain within acceptable limits for the species. Documents shall be available to verify that these limits are observed.
- 4.28: The hatchery shall develop procedures that minimize unnecessary stress or injury to animals arising from overcrowding, capture, and handling prior to and during internal and external transfer. Records of survival rates used as an indicator of the adequacy of such procedures shall be available.
- 4.29: The hatchery shall develop and follow procedures to estimate the approximate number of animals in each shipment and provide documentation to show the estimated margin of error of the procedure used.

Implementation

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

For aquatic animals in aquaculture, welfare can be defined simply as an animal that is healthy and whose needs are met by the hatchery operator. Fundamentally, good welfare will lead to good health, i.e., freedom

from disease. Selecting sites and managing facilities to maximize fish welfare can improve production potential by providing conditions conducive to good growth and high survival. Attention to aquatic animal welfare is a characteristic of responsible aquaculture.

Aquatic animals experience numerous stressors that can affect welfare. These include handling, transport, crowding, grading, vaccination, chemical or therapeutic treatments, stocking density (space), water quality, water velocity, light, feed (access, distribution, quality), social interactions, predator control, and parasites and diseases, among others. The welfare requirements of different species and different life stages vary and so practices and considerations to provide good welfare also vary. Each hatchery shall develop its own program to ensure good welfare of their aquatic animals. In general, culture conditions shall be managed to avoid situations that could lead to stress, injury or disease.

Hatcheries and nurseries shall apply a maximum biomass limit based on standard best management practices and operational welfare indicators. Feeding shall be managed to avoid stress caused by under- or over-feeding. For intensive production systems where there is a high risk to animal welfare in the event of a power failure, hatcheries shall have in place back-up or fail-safe systems (e.g., standby power generators, pure oxygen systems, tractor-powered paddlewheel aerators, emergency alert systems) to ensure maintenance of good water quality and support aquatic animal welfare.

Welfare Indicators

Best management practices to maintain good culture conditions and routine surveillance as part of health and welfare monitoring program are the keys to promoting good fish welfare. Operational welfare indicators can be measured by hatchery workers trained to recognize normal and abnormal physical health, water quality and animal behavior. Regular inspections of the culture facility, water quality analysis, and assessment of the behavior and condition of crustaceans or fish shall be conducted regularly.

Individual – Physical Health

The hatchery shall maintain a recordkeeping system for individual-based welfare indicators of physical health. Mortality is one of the most basic indicators of aquatic animal welfare. Ideally floating dead fish would be removed and recorded as they appear at the water surface, but regular daily removal is best practice. Mortality is much easier to perceive and measure with finfish than with crustaceans.

Finfish body condition factor (L/W) shall be measured regularly, preferably weekly. Various physical abnormalities associated with external physical health shall be recorded, including lesions, abrasions or fin damage and gill damage or condition. Crustaceans will have a different set of indicators of physical health. A scoring system can be used to assess all indicators of physical health. Sub-sampling for physical abnormalities can be done during normal biometric sampling, preferably weekly.

Group – Water Quality

The hatchery shall maintain a recordkeeping system for group-based welfare indicators of environmental quality. Although hatcheries are required to measure the water quality of effluents, regular measurement of water quality to demonstrate that conditions are suitable for good production performance is also required. These are the same water quality variables that are normally measured as part of good husbandry practices. In each production unit, temperature, salinity, dissolved oxygen concentration, pH, ammonia and nitrite concentrations, and some index of solids concentration – transparency, turbidity, or total suspended solids concentration – shall be measured regularly, as determined by culture system type and production system intensity (i.e., stocking density). For finfish and crustacean species grown in flowing, tidal or turbulent water, current speed should be measured and not exceed limits defined by species and life stage. Fish should never be forced to the downstream end of the culture unit by water flow during the grow-out period. Hatcheries

shall have contingency plans and/or alarms in place in the event of system failure, including having staff on-call to respond to water quality emergencies.

Group – Animal Behavior

The hatchery shall maintain a recordkeeping system for group-based welfare indicators of aquatic animal behavior. Trained hatchery workers shall regularly inspect each production unit, noting the behavior of aquatic animals in each unit. Through training and experience, hatchery workers learn and can assess normal behavior. Often, a loss of appetite is the first sign of disease. Thus, regular assessment of feeding response is a component of health management that can permit rapid response, if necessary. Assessing feeding response can also indicate if fish are being underfed. Swimming behavior is a good indicator of group welfare in a production unit. Abnormal swimming behavior such as vertical orientation, lethargy, whirling, flashing, rubbing, and piping are indicators of disease. For both behavior measures, hatcheries may develop custom indices that may be qualitative or semi-quantitative (e.g., percentage range of group exhibiting a certain behavior).

Handling and Transport Operations

Aquatic animals that are concentrated during handling operations experience stress. Thus, handling operations shall be conducted in ways that minimize stress, including limiting crowding time and time out of water. Procedures for routine handling operations (crowding, transfer, grading, vaccination, chemical treatment, etc.) used in the hatchery shall be described in a Standard Operating Procedure document. Equipment used for handling operations shall be maintained in good working order and shall be maintained and used in ways that minimize the potential for animal injuries.


Chapter 7.2 of the OIE Aquatic Animal Health Code provides detailed guidance on welfare of aquatic animals (especially finfish) during transport, including planning for transport, vehicles and transport containers, procedures for maintaining water quality, preparation for transport, loading, transport and unloading. All live transport operations shall be done with due consideration to aquatic animal welfare, biosecurity, and potential disease transmission, and minimizing physical injuries to preserve product quality. Transport containers and vehicles shall be washed and disinfected before and after use. Aquatic animals shall be loaded at densities suitable for the species and for distance travelled to other production units. If live aquatic animals are transported from one production unit to another within the hatchery, animals shall be acclimated to new conditions prior to unloading. A transport logbook shall be maintained that includes information about the group of aquatic animals loaded to allow traceability to destination, and mortalities that may occur during transport.

Training

Hatchery workers shall be trained in their roles and responsibilities in maintaining the welfare of hatchery-reared aquatic animals. Hatchery managers are responsible for providing training to workers about:

- Evaluation of welfare indicators, including normal and abnormal behavior, signs of poor welfare and expected diseases.
- Water quality management and aquatic animal husbandry.
- Aquatic animal handling procedures (crowding, disease treatment, transfers, loading for transport).
- Humane euthanasia methods.

Training logs shall be maintained by the hatchery to indicate worker training activities.

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Additional Information

OIE Aquatic Animal Health Code (2019), Section 7 – Welfare of Farmed Fish

<https://www.oie.int/international-standard-setting/aquatic-code>

Noble, C., Gismervik, K., Iversen, M.H., Kolarevic, J., Nilsson, J., Stien, L.H. & Turnbull, J.F. (eds.) (2018)

Welfare Indicators for farmed Atlantic salmon: tools for assessing fish welfare

<https://nofima.no/wp-content/uploads/2018/11/FISHWELL-Welfare-indicators-for-farmed-Atlantic-salmon-November-2018.pdf>

AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

<https://www.avma.org/resources-tools/avma-policies/avma-guidelines-euthanasia-animals>

G. Standards Requirement - Traceability – All Production Systems

A. 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 animals stocked
- source of live aquatic animals
- health status of live aquatic products stocked
- drug and vaccine use
- eubiotic use
- herbicide, algicide and other pesticide use
- manufacturer and lot number or production date for each feed used
- source and lot number (if applicable) for each live feed used
- shipment date
- shipment quantity
- batch age and survival
- 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 and stock characteristics such as triploidy or GMO/BE status of live aquatic products sold or transferred to another facility, including any required certifications and testing results.

- T1: Hatcheries and nurseries shall operate an effective record-keeping system that provides up to date, organized, accurate entries, performed and overseen by a designated trained person or team responsible for collecting the data, ensuring it is complete and accurate.
- T2: The hatchery shall have an online traceability system or an in-house database consisting of paper records, documents, forms, notebooks, files, or any combination thereof, and all records shall be available for verification during an audit.
- T3: The hatchery 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, stock characteristics such as triploidy or GMO/BE status.
- T4: The hatchery shall keep complete and accurate records of the sources (including BAP certification status, if any) and numbers of broodstock and/or other stocking material (e.g., post-larvae, juveniles, fingerlings) stocked, stocking dates, species stocked and any relevant stock characteristics such as non-native, specific pathogen-free, specific pathogen-resistant, hybrid, triploid, sex-reversed, genetically modified (GM) or bioengineered (BE).
- T5: Hatcheries that purchase stocking materials from both BAP and non-BAP certified suppliers shall identify and record all sources and have adequate systems in place to prevent mixing/comingling of stocking materials.
- T6: The hatchery shall keep complete and accurate records concerning any vaccine, antibiotic, or other drug use, including dosage and dates of treatment initiation and completion.
- T7: The hatchery shall keep complete and accurate records on the use of herbicides, algicides and other pesticides/chemicals used, including dosage and dates of treatment.
- T8: The hatchery shall keep complete and accurate records regarding manufacturer, quantity, lot numbers, and expiration date for eubiotics and feeds used for each culture unit. In the case of live feeds, the sources of live feeds shall be maintained.
- T9: The hatchery shall keep complete and accurate records regarding the harvest date, harvest quantity, movement document number (if applicable) and receiving farm(s), or purchaser(s). If product lots are destined to more than one farm or purchaser, each lot shall be separately identified.
- T10: The hatchery shall provide to all farms or purchasers the following information, as applicable, concerning the harvested products:
- Hatchery name
 - Hatchery government registration number(s)
 - BAP hatchery certification number
 - Production method (pond, cages, reservoir, etc.)
 - Production unit identification number (i.e., individual pond/cage ID number)
 - Sources of stocking material, including relevant stock characteristics such as BAP Star status, native/non-native, specific pathogen-free, specific pathogen-resistant, hybrid, triploid, all-male or all-female, sex reversed, genetically modified (GM) or bioengineered (BE)
 - Date of deliveries and lot numbers (defined as deliveries from a single tank or culture unit harvested on a single day)
 - Estimated average size and number of harvested animals, total net weight and unit of measure (e.g., kg, mt) for mass balance
 - Movement document number (if relevant)
 - Feed use (commercial brand names, type, and lot numbers)
 - Reports of chemical treatments
 - Testing data for the presence of microbes, antibiotics, and chemicals in product (as applicable)

T11: The hatchery shall keep records of any customer complaints related to its products' compliance with the BAP standards and records of investigations of such complaints and actions taken to address/correct them.

T12: Hatcheries shall record and provide documentation that demonstrates the hatchery's relationship with any BAP-certified facilities to which the hatchery is linked for purposes of star status claims, including:

- The names of all supplying facilities (broodstock, or other stocking material)
- The names of all product receiving facilities (farms or other purchasers), and
- The corresponding annual volume of BAP-certified product exchanged between the named BAP-certified facilities (e.g., numbers of broodstock, eggs or other stocking material).

Note: Auditors must verify this volume data and include summary data in the audit report.

T13: The hatchery, regardless of the star status claims being made for harvested products, shall provide data for the auditor to perform at a minimum one trace-back exercise to the origin of stocking materials, and one trace-forward exercise to a farm or purchaser of harvested products. Results of these exercises shall be in line with expectations.

Note: At the discretion of the auditor, more trace exercises may be conducted.

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. Hatcheries are encouraged to consider implementation of an electronic supply chain traceability system such as blockchain. Where paper records, documents or notebooks are used, if possible, the information should also be transferred to computer database files to allow preparation of data summaries and facilitate electronic transmission. Transition to internal and/or third-party electronic traceability systems is encouraged, e.g., using GDST data recommendations for interoperability. The original files or paper records shall be kept for two-years to allow verification of the electronic data.

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 review the effort at intervals to verify it satisfies BAP requirements.

The hatchery shall keep complete and accurate records of the following:

- Sources of stocking material (broodstock, eggs, post-larvae and fingerlings).
- Feed sources, types and quantities, feed mill owner/business identification, location.
- Therapeutic treatments, with dose, treatment duration, and treatment completion date.
- Chemicals (disinfectants, fungicides, parasiticides, herbicides, algicides and other pesticides/chemicals).

Records must be kept in relation to each production unit for each production cycle. Production unit-related records can be captured on the sample Product Traceability Form (Appendix E). Each form corresponds to the shipment of hatchery products on a particular day from a particular culture unit.

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 ensure 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 to which they sell or deliver products.


The results of trace-forward and trace-back exercises and their mass balance shall be recorded. The auditor shall record the traceability and mass balance data in the audit report.

BAP Logo Use

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

Customer Complaints

The hatchery 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.

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Appendix A – Loading Indices - All Production Systems

This section describes procedures to estimate effluent volume that will be used to calculate a water use index (volume of water used divided by annual fish or shrimp production). Estimations of water use and effluent volume, along with information about effluent water quality and production system time, will be used to calculate nitrogen and phosphorus loads to the environment, expressed as mass per year and mass per fish or shrimp production. This information shall be collected and reported by hatcheries to auditors. The production system scenarios identified below are not intended to be comprehensive, but rather cover the majority of production systems used by BAP-certified hatcheries and nurseries. Other methods of calculating effluent volume and nutrient mass loading may be suitable for systems not identified below, but such alternative methods may only be used with documented prior approval of BAP.

Calculation of Annual Effluent Volume

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

Hatchery Discharge Calculation

Embankment Ponds – Pump Discharge Method

Hatchery discharge (m³/yr) = Pump discharge (m³/min) x Average time of pump operation (hr/day) x 60 min/hr x 365 days/y

Raceways

Effluent volume (m³/yr) = Velocity of flow in raceway (m/sec) x Raceway width (m) x Raceway depth (m) x Annual time of operation (days/yr) x 86,400 sec/day

Tanks

Effluent volume (m³/yr) = Tank volume (m³) x Number of tank water exchanges per day x Annual time of operation (days/yr)

Recirculating Aquaculture Systems

Effluent volume (m³/yr) = System volume (m³) x Fraction (0-1) of system volume replaced with new water per day x Annual time of operation (days/yr).

Other appropriate methods can be used.


Water Use Index

Although not recommended, it is possible to comply with numerical water quality criteria by increasing the amount of water passing through an aquaculture facility to dilute the concentrations of tested variables. Compliance with the water use index assures that facilities meet water quality criteria through good management rather than diluting effluents before they are released into natural waters. A water use index shall be estimated using the following equation.

Water use index (m³/kg fish or shrimp) = Annual effluent volume (m³) ÷ Annual fish or shrimp production (kg)

Calculation of Annual Effluent Loads

Loads of water quality variables are more indicative of the pollution potential of hatchery effluents than separate measurements of concentrations of these variables and effluent volume. Annual loads for total phosphorus and total nitrogen shall be calculated as indicated for each production system type. Information indicated by a line must be provided by the hatchery and recorded on audit reports.

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Fish or shrimp produced per year (kg) _____

Feed used per year (kg) _____

Feed protein in grow-out feed (%) _____

Feed N content (%) = Feed protein (%) x 0.16 = _____

Feed P content (%) = _____ (1% is the default P content, unless value is provided by feed supplier)

Harvested fish or shrimp N content (%) = 2.5 (fish) or 3.0 (shrimp)

Harvested fish or shrimp P content (%) = 0.7 (fish) or 0.3 (shrimp).

Nutrient load indices shall be estimated using the following equations, depending on production system.

Flow-through systems with solids capture in quiescent zones or settling basins

Nitrogen load (kg/yr) = [Total feed (kg) x Nitrogen (% in feed) ÷ 100] – [Harvested aquatic animals (kg) x Nitrogen (% in fish) ÷ 100] x 0.80

Nitrogen load index (kg/mt) = Nitrogen load (kg/yr) ÷ Annual production (mt/yr)

Phosphorus load (kg/yr) = [Total feed (kg) x Phosphorus (% in feed) ÷ 100] – [Harvested aquatic animals (kg) x Phosphorus (% in fish) ÷ 100] x 0.50

Phosphorus load index (kg/mt) = Phosphorus load (kg/yr) ÷ Annual production (mt/yr)

Recirculating Aquaculture Systems

Nitrogen load (kg/yr) = Effluent volume (m³/yr) x NO₃-N concentration (mg/L) ÷ 1000 g/kg

Nitrogen load index (kg/mt) = Nitrogen load (kg/yr) ÷ Annual production (mt/yr)

Phosphorus load (kg/yr) = Effluent volume (m³/yr) x Total P concentration (mg/L) ÷ 1000 g/kg

Phosphorus load index (kg/mt) = Phosphorus load (kg/yr) ÷ Annual production (mt/yr)

Appendix B – Effluent Water Quality Criteria - Ponds, Non-Coastal Flow-through Systems and Recirculating Aquaculture Systems

BAP Effluent Water Quality Criteria

Variable (units)	Ponds and Non-Coastal Flow through Systems	RAS*	Minimum Collection Frequency
pH (unit)	6.0 – 9.5	6.0 – 9.5	Monthly
Total Suspended Solids (mg/L)	Less than 50	Less than 25	Quarterly
Soluble Phosphorus (mg/L)	Less than 0.5	N/A	Monthly
Total Phosphorus (mg/L)	N/A	Less than 10	Quarterly
Total Ammonia Nitrogen (mg/L)	Less than 5	Less than 5	Monthly
Nitrate – N (mg/L)	N/A	Less than 50	Quarterly
5-day biochemical oxygen demand (mg/L)	Less than 50	Less than 25	Quarterly
Dissolved oxygen	More than 5 (mg/L) or \geq 70% saturation**	More than 5 (mg/L) or \geq 70% saturation**	Monthly
Chloride	No discharge above 800 mg/L chloride into freshwater***	No discharge above 800 mg/L chloride into freshwater***	Monthly

* Here RAS are defined as systems 1) with a recirculating flow that is >90% of total water flow and 2) with greater than 1% new water per day of total system volume. Recirculating systems with less than 1% new water per day of total system volume are exempt from effluent monitoring.

** Percent saturation of dissolved oxygen shall be calculated based on temperature and altitude of the facility. Online calculators can be used for the calculations:
<http://www.waterontheweb.org/under/waterquality/DOSatCalc.html>*** Water with less than 1 ppt salinity, specific conductance below 1,500 μ mhos/cm or chloride less than 550 mg/L is considered fresh

Sampling

- Samples shall be collected just prior to locations where effluents enter natural water bodies or exit the hatchery property. Samples shall be collected so that mixing of effluent and water from the receiving body is prevented.
- For hatcheries with multiple effluent outfalls, all or several outfalls shall be sampled to prepare a composite sample for analysis. Where there are four or more 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 sampling bottle. The sample will be placed on ice in a closed, insulated container to prevent exposure to sunlight.
- Samples or direct measurements for dissolved oxygen and pH shall be obtained between 0500 and 0700 hours, and 1300 and 1500 hours on the same day. The average of the two measurements of each variable will be used for verification of compliance.
- Samples for other variables shall be collected between 0500 and 0700 hours.
- The number of ponds or grow-out units being drained for harvest at the time of sampling shall be recorded.
- Samples of source water shall be collected quarterly directly in front of the pump station or from the pump discharge outlet but before pumped water mixes with water in the internal water supply system of the hatchery. Comparing water quality between source and effluent can be used to calculate annual loads and justify an exemption for water quality monitoring of variables that demonstrate no deterioration between source and effluent

Analysis

- Water samples should be processed, and measurements made promptly. Test kits for field or on-site laboratory can be used for analysis of total ammonia nitrogen, soluble phosphorus, nitrate and chloride. Samples should be diluted with deionized or distilled water to bring test samples into the test kit concentration range for individual variables as needed. Total suspended solids, total phosphorus and 5-d biochemical oxygen demand should be measured by laboratories with technical capacity to conduct those tests.
- Measurements for dissolved oxygen and pH shall be taken in situ with portable meters. pH of water samples collected for dissolved nutrients can also be measured in on-site water quality laboratories. Auditors shall verify the correct application of dissolved oxygen and pH meter calibration procedures.

Auditing

- A map of the hatchery layout indicating pumping stations, effluent outfalls and receiving water monitoring points shall be provided to auditors. These areas should be visited and viewed for obvious signs of impaired water quality near outfalls.
- Auditors will inspect and evaluate operation of the on-site water quality laboratory, the water sampling program and the effluent monitoring recordkeeping system. Auditors can reject analytical results if sampling, in situ measurements or water quality laboratory protocols and analytical procedures are deficient.

Appendix C – Ponds, Non-Coastal Flow-through Systems and Recirculating Aquaculture Systems

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	
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
Annual Average				

Sample Effluent Monitoring Form – Total Suspended Solids, 5-Day Biochemical Oxygen Demand

Quarter	Date	Total Suspended Solids (mg/L)	5-Day Biochemical Oxygen Demand (mg/L)	Number of Units Harvested
1				
2				
3				
4				
Annual Average				

Appendix D - Cages and Net Pens in Lakes and Reservoirs

BAP Water Quality Monitoring Criteria

Variable (Units)	Sample Depth	Collection Frequency (minimum)
Secchi Disk Visibility	NA	Every Two Weeks
Dissolved Oxygen (mg/L)	At 50 cm Depth	Every Month
Chlorophyll a (ug/L)	At 50 cm Depth	Every Two Months
Total Phosphorus (ug/L)	At 50 cm Depth	Every Two Months
Phytoplankton abundance and species (% blue-green algae)	At 50 cm Depth	Every Two Months

Sampling

- A minimum of two sampling stations shall be established. One shall be at the approximate center of the cage site or net pen area. The other three station must be from 50 to 100 m away from the cages, in the prevailing down current direction. It is recommended that these sampling stations be geolocated with fixed buoys or geographic positioning systems (GPS).
- The auditor must approve locations of the stations, which shall be set following a study on prevailing surface currents. For methods, refer to: Estimating Surface Currents Using Dyes and Drogues, U.S. Army Corps of Engineers – <http://chl.erdc.usace.army.mil/library/publications/chetn/pdf/chetn-vi-37.pdf>.
- Secchi disk visibility shall be measured on a clear day, around midday, with the sun behind the viewer but not in shadow. The recorded value should be the average of the depth of disappearance and the depth of reappearance of the disk.
- Direct measurements of dissolved oxygen concentration shall be made between 0600 and 0900 hours.
- Water for measurement of total phosphorus and chlorophyll a concentration shall be collected at each sampling station with a Kemmerer or van Dorn water sampler, or by use of a weighted bottle from which the stopper can be removed by yanking on a calibrated line. Samples shall be transferred to clean sampling bottles and placed in ice in a closed, insulated container to avoid exposure to sunlight.
- Water samples from the two sampling stations shall be blended (1:1) to create a composite sample for analysis of total phosphorus and chlorophyll a concentration.

Analysis

- Water samples shall be processed, delivered to a water quality laboratory and measurements made promptly. Analysis of the samples 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.
- Measurements for dissolved oxygen concentration shall be taken in situ with a portable meter. Auditors shall verify the correct application of dissolved oxygen meter calibration procedures.

Auditing

- A map of the water body with the hatchery layout indicating location of cages or net pens, water body inlets and outlets, and water quality monitoring sampling stations shall be provided to auditors. Water quality shall be visually assessed by auditors for obvious qualitative signs of impairment.
- Auditors will evaluate the qualifications of the selected water quality laboratory and the sufficiency of the water sampling program and the water body monitoring recordkeeping system. Auditors can reject analytical results if sampling, in situ measurements or water quality laboratory protocols and analytical procedures are deficient.

Appendix E – All Production Systems

Sample Product Traceability Form

Hatchery Name	Tank or Raceway Number	Volume(M ³)
Broodstock, eggs, nauplii, or other seedstock supply Stocking Date	Feed Feed Type	
Stocking Quantity Species	Manufacturer	
Any Species Specifications (e.g., triploid, G.M.)	Lot Number(s)	
Stocking material provider BAP No. (if applicable)		
Confirmation: No Use of Proactively Prohibited Chemicals Yes No		
THERAPEUTIC DRUG USE Compound 1	Other Treatment Applied (Probiotics, eubiotics, etc.) Compound 1	
Disease Treated	Disease Treated	
Application Rate	Application Rate	
Application Period	Application Period	
Compound 2	Compound 2	
Disease Treated	Disease Treated	
Application Rate	Application Rate	
Application Period	Application Period	
Harvest Harvest Date	Harvest Purchaser Name & Address	
Harvest Quantity (no.)		

Appendix F – All Production Systems

Calculation of Fish In:Fish Out and Forage Fish Dependency Ratios

For calculations of either FIFO or FFDR, fishmeal and fish oil inclusion levels in feed shall include any meal or oil derived from wild-caught fish, krill, mollusks or any other wild marine animals. However, fishmeal and fish oil derived from trimmings, by-products or other processing wastes, or invasive or aquacultured species are NOT included. Thus, if data are available for such ingredients, they can be subtracted from the inclusion levels used in the FIFO or FFDR calculations.

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 shall 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 4.8%, respectively. If feed manufacturers can demonstrate the actual yields of the source fish meal and fish oil in their feeds, those number can be used for this calculation.


Equation 2

Fish in:fish out ratio = Feed fish inclusion factor of feed (from manufacturer) x feed-conversion ratio

Where feed fish inclusion factor = [Percent fishmeal in feed + Percent fish oil in feed] ÷

[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.

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Forage Fish Dependency Ratio

The FFDR is another means of measuring the ecological efficiency of an aquaculture operation. This method separately compares the amount of fishmeal and fish oil used in a given diet fed to the system with the wet weight amount of fish produced. The greater of these two values (fishmeal or fish oil) is then used as the total FFDR for the system. In cases where aquatic animals are provided with feed of relatively high protein and lipid to meet requirements, fish oil derived from forage fish is more limiting than fishmeal. In that case, the FFDR for fish oil is reported. Hatcheries shall calculate and record a final production cycle FFDR as follows:

Equation 3

$$\text{FFDR}_{\text{fishmeal}} = (\text{Percent fishmeal in feed} \times \text{FCR}) / 22.5$$

$$\text{FFDR}_{\text{fish oil}} = (\text{Percent fish oil in feed} \times \text{FCR}) / 4.8$$

$$\text{FFDR} = \text{The greater of } \text{FFDR}_{\text{fishmeal}} \text{ or } \text{FFDR}_{\text{fish oil}}$$

Examples of FFDR calculations where:

- a) fishmeal inclusion level = ____ %
- b) fishmeal from trimmings* = ____ %
- c) fish oil inclusion level = ____ %
- d) fish oil from trimmings* = ____ %
- e) fishmeal yield % = ____ (use 22.5 if value is unknown)
- f) fish oil yield % = ____ (use 4.8 if value is unknown)
- g) eFCR = ____

eFCR = Economic Feed conversion ratio = total annual feed use ÷ (Total harvested fish weight – weight of juveniles initially stocked)

(* obtain from feed supplier; use 0 if unknown; includes by-products, or other processing wastes, or invasive or aquacultured species)

$$\text{FFDR}_m = \frac{(a - b) \times g}{e}$$

$$\text{FFDR}_o = \frac{(c - d) \times g}{f}$$

Example:

Consider a feed that contains 20.0% fishmeal and 12.0% fish oil, and in the example below, the feed mill has provided documentation that states that no fishmeal and fish oil derived from trimmings were used. eFCR was determined for the last year's harvested crops to be 1.2. Assume a yield of fishmeal from wild fish of 22.5% and yield of fish oil from wild fish of 4.8%. FFDR_m and FFDR_o would be calculated as follows:

$$\text{FFDR}_m = \frac{(20) \times 1.2}{22.5} = 1.28$$

$$FFDR_o = \frac{(12) \times 1.2}{4.8} = 3.00$$

In the above example. The $FFDR_o$ would be the figure reported for FFDR since it is the higher of the two values.

Taking again an example of a feed that contains 20.0% fishmeal and 12.0% fish oil, but in the case of the example below, the feed mill has provided documentation that 10% of the fishmeal (meaning 10 out of the 20%) and 10% of the fish oil (meaning 10 out of the 12%) are obtained from trimmings. eFCR was determined for the year-class in grow-out to be 1.2. Assume a yield of fishmeal from wild fish of 22.5% and yield of fish oil from wild fish of 4.8%. $FFDR_m$ and $FFDR_o$ would be calculated as follows:

$$FFDR_m = \frac{(20 - 10) \times 1.2}{22.5} = 0.53$$

$$FFDR_o = \frac{(12 - 10) \times 1.2}{4.8} = 0.50$$

In the above example, $FFDR_m$ would be the figure reported for FFDR since it is the higher of the two values.