PHILIPPINE NATIONAL STANDARD	PNS/BAFS 207:202x
Oyster and Mussel — Good Aquaculture Practices (GAqP) – Code of Practice	**ICS 67.120.30**

1 Scope

This Good Aquaculture Practices (GAqP) for oysters and mussels covers practices that aim to prevent or minimize the risks associated with aquaculture production in brackish and marine waters, addressing food safety, animal health and welfare, environmental integrity, and socio-economic welfare. This standard applies to aquaculture facilities and/or production areas intended for oyster and mussel farming and consists of compliance with technical and legal requirements.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute the requirements of this document. The latest edition of the referenced documents (including any amendments) applies.

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Veterinary Drug Residues in Food — Maximum Residue Limits (PNS/BAFS 48:2022). http://spsissuances.da.gov.ph/index.php/da-philippine-national-standards/1132-pns-bafs-47-distilled-fermented-coconut-sap-coconut-lambanog-2

BAFS-DA. (2024). Live and raw bivalve molluscs — Code of practice (PNS/BAFS 236:2024). [insert link]

Department of Environment and Natural Resources (DENR). (1990). *Revised water usage and classification/water quality criteria* (DENR Administrative Order No. 34). https://emb.gov.ph/wp-content/uploads/2016/04/DAO-1990-34.pdf

DENR. (2019). *DENR Administrative Order No. 2019-09: Updated national list of threatened Philippine fauna and their categories.* https://bmb.gov.ph/downloads/WRD/WC/WC2020/stat_and_lists_of_wildlife/fauna/dao-2019-09.pdf

3 Terms and Definitions

For the purpose of this standard, the following terms and definitions apply:

3.1
aquaculture facilities
include permanent or semi-permanent systems or structures for breeding, treatment, and raising of organisms. Aquaculture facilities may exist both in marine waters, inland water environments, and as terrestrial production systems (Food and Agriculture Organization of the United Nations, n.d.)

3.2
competent authority
official government agency having jurisdiction (Codex Alimentarius Commission [CAC], 2006). Also refers to the bureau or agency mandated by law with responsibility and competence for ensuring and supervising the implementation of sanitary and phytosanitary (SPS) measures, regulations, or standards (DA-BAFS, 2023)

3.3
depuration
reduction of microorganisms to a level acceptable for direct consumption by the process of holding live bivalve molluscs for a period of time under approved, controlled conditions in natural or artificial seawater suitable for the process, which may be treated or untreated (CAC, 2019; BFAS-DA, 2024)

3.4
Harmful Algal Bloom (HAB)
an event associated with the occurrence of microalgae which cause harmful effects to the environment, living organism and to human.

3.5
production area
any sea, estuarine, or lagoon area where oysters and mussels are collected and cultured

3.6
relaying
removal of bivalve molluscs from a microbiologically contaminated growing area to an acceptable growing or holding area under the supervision of the competent authority and holding them there for the time necessary for the reduction of contamination to an acceptable level fit for human consumption (BAFS-DA, 2024)

4 Use

This Standard adheres to the principles outlined in PNS/BAFS 135:20xx (Good Aquaculture Practices — Code of Practice). It specifically establishes requirements for oyster and mussel farming. This document shall be used independently and serves as the basis for inspecting oyster and mussel farms for GAqP certification under Fisheries Administrative Order No. _____.

Other farmed species shall be assessed against existing species-specific GAqP standards. In the absence of such standards, the general provisions of PNS/BAFS 135:20xx shall apply.

5 Site Selection

5.1 Location

5.1.1 Aquaculture facilities and production areas should be located in environmentally suitable and sustainable areas where the risk of contamination is minimized or where sources of pollution can be controlled or mitigated according to national law and regulations. This includes adherence to the provisions set forth under DENR Administrative Order (DAO) No. 34, as well as any subsequent amendments, issuances, or related guidelines.

5.1.2 Proof of compliance with existing environmental regulations by the competent authority shall be available.

5.1.3 Proof of legal rights, privileges or ownership of the farm area (license to operate or business permit from the local government unit) and its location map shall be available.

5.1.4 The use of the production area shall comply with existing laws and regulations on protecting the rights, traditions, and well-being of Indigenous People (IP).

5.1.5 The site should be protected from strong winds and waves, and should not be too far upriver as to be subjected to salinity drops during the rainy season.

5.1.6 The site should have a sufficient tidal range to ensure complete and frequent water exchange, with tidal currents of no less than 2 cm/sec.

5.1.7 The water should contain enough natural food (e.g., phytoplankton) for the oysters and mussels.

5.1.8 The site should be sufficiently enclosed to effectively retain the larvae and have a depth that ensures the stock remains suspended above the bottom even during low tide.

5.1.9 Classification and monitoring of growing areas for oysters and mussels should be in conformance with Clause 4 of PNS/BAFS 236:2024 (Live and Raw Bivalve Molluscs — Code of Practice).

5.2 Layout and design

5.2.1 Wild and domesticated animals should not be allowed in the production area or its vicinity to prevent fecal and other hazardous contaminations. However, they may be permitted under strict conditions, provided that measures are in place to prevent contamination.

5.2.2 Farm design and layout should prevent cross-contamination and damage to existing aquatic habitats.

5.2.3 Drainage system of septic tanks and toilet facilities should be well installed and constructed to prevent contamination of farm facilities.

5.2.4 Equipment, such as containers and vehicles for seed and harvested molluscs, should be designed and constructed to allow for adequate cleaning and disinfection.

5.2.5 Aquaculture facilities should integrate biosecurity measures to prevent cross-contamination and disease outbreak.

5.2.6 For land-based facilities, buffer zone should be observed in accordance with existing regulation.

5.2.7 Aquaculture facilities should be designed, operated, and maintained in ways that prevent contamination from workers, sewage/toilets, domestic animals, machinery oil/fuel, and other possible sources in order to maintain hygienic conditions

5.2.8 Farm operators should use suitable collector materials that are available locally, easy and inexpensive to prepare, durable, and attractive to mussel larvae. Natural/organic materials should be used as spat collectors or cultches for oysters and mussels.

5.2.9 Production area should be designed with proper space allocation for its facilities. Area and space allocation should provide ease of navigation and free flow of intertidal water.

5.2.10 Culture facilities should be designed and constructed to ensure minimal physical damage to oysters and mussels during growing and harvesting.

5.2.11 Breeding stock and spatfall should be sufficient in the area to produce enough young oysters and mussels for the farm.

5.2.12 Materials to be used should be strong enough to support the weight of the mussels, but should not be so heavy to keep the buoys afloat. Ropes made of polypropylene, carbo negro, and abaca may be used.

5.2.13 Structures should not obstruct navigation.

6 Facilities, Sanitation, and Waste Management

6.1 Facilities

6.1.1 Disposal facilities for solid and liquid wastes should be in suitable and confined areas, and waste disposal shall be in compliance with existing regulations.

6.1.2 Fuel and chemical substances (sanitizer, fertilizer, and reagents) should be stored in land-based storage facility and separated according to manufacturer's instructions and as specified on the label.

6.1.3 Regular repair and maintenance should be undertaken to preserve the good physical condition of the facility.

6.1.4 Diseased or dead aquatic animals should be sorted during harvest and disposed of properly through the establishment of a mortality pit.

6.2 Sanitation

6.2.1 Aquaculture facilities and their surroundings should be maintained in a clean and hygienic condition.

6.2.2 Containers, equipment, and farm facilities should be maintained in good condition to avoid contamination.

6.2.3 Adequate procedures for cleaning and disinfection of containers, equipment, and farm facilities should be in place and implemented.

6.2.4 Cleaning materials and disinfectants should be properly handled to prevent contamination or pose no environmental hazards.

6.3 Waste management

6.3.1 Aquaculture facilities construction and waste disposal should be conducted daily and responsibly in accordance with applicable sanitation regulations. The farm should take appropriate measures to: a) dispose of solid wastes and garbage in an environmentally sound way; and b) dispose of dead shellfish in a hygienic manner especially after disease outbreak.

7 Personnel Health and Hygiene

7.1 Workers should be trained on farm level hygienic practices to ensure awareness of their roles and responsibilities for protecting aquaculture products from contamination and deterioration throughout the production cycle. This includes the following protocol:

7.1.1 Workers shall undergo an annual medical examination to ensure they are fit to work.

7.1.2 Workers who have shown signs of medical problems or conditions that may pose health risks shall be excluded from handling fishery products until deemed certified fit to resume work.

7.1.3 Workers should wear suitable and appropriate working clothes and protective gear. In areas and conditions where risk is high, protective gear shall be used.

7.1.4 Workers shall wash their hands each time before commencing work.

7.1.5 Wounds should be covered with waterproof bandages and clean, waterproof gloves or boots.

7.1.6 Smoking, spitting, or drinking alcoholic beverages in the working and storage premises shall not be allowed.

8 Farm Management

8.1 Farm preparation and stock management

8.1.1 Aquaculture facilities preparation practices should minimize risks for cross-contamination.

8.1.2 Prohibited chemicals or biological substances listed in Annex ___ (Prohibited chemicals or biological substances) shall not be used in aquaculture farm preparation.

8.1.3 Stocking density should be optimum to the species and to the culture system involved as specified in Annex ___

8.1.4 Cultures should always be in an off-bottom position to prevent potential predators such as starfish, crabs, snails, and other organisms from crawling up the culture ropes.

8.1.5 Clusters of mussels on a rope should be adequately spaced to avoid any possible contact with each other especially through wave action.

8.1.6 Cultures should be laid perpendicular to wave action and parallel to current flow.

8.1.7 Farms should have an area two or three times larger than the actual culture site. This would allow the farm to be moved from one section of the area to another from year to year as the environment degrades with continued use.

8.1.8 During transplanting operations, the young mussels should be protected from the heat of the sun and from the wind, while they are out of the water.

8.1.9 Collection from the wild and propagation practices in the production area should minimize risks of cross-contamination.

8.1.10 Spats to be used shall come from collectors registered by the competent authority. If available, the hatchery produced spats should be used.

8.1.11 When necessary, spats sourced from other location should undergo depuration to remove contaminants and ensure their safety and quality before further cultivation or stocking.

8.1.12 Harvestable or marketable-sized oysters and mussels should undergo both depuration and relaying to ensure their safety, quality, and compliance with the guidelines set by the competent authority.

8.1.13 Relaying and depuration of oysters and mussels should be in conformance with PNS/BAFS 236:2024 (Live and Raw Bivalve Molluscs — Code of Practice).

8.2 Water management

8.2.1 Water used in land-based aquaculture facilities should be properly filtered, settled, aerated, and maintained as suitable for the production of aquaculture species which is safe for human consumption.

8.2.2 Basic water quality parameters should conform with the existing standards set by the competent authority and be regularly monitored to ensure suitability and safety. The optimum water quality parameters/requirements for milkfish and tilapia are presented in Annex B (Optimum water quality parameters for oysters and mussels).

8.3 Feeds and feeding

8.3.1 Non-commercial feeds such as but not limited to live feeds, farm-formulated feeds, and natural food should be of good quality and suitable for the species.

8.3.2 Feed prepared on the farm should meet the nutrient requirements of oysters and mussels as presented in Annex C (Nutrient requirements for oysters and mussels).

8.3.3 Farmers should administer the appropriate type of feed according to the culture system used and conduct periodic sampling of the stocks for proper feed management.

8.4 Harvesting, postharvesting, and transport

8.4.1 Harvesting and postharvesting

8.4.1.1 Harvesting and postharvesting equipment and paraphernalia should be cleaned and sanitized. Such equipment should be stored properly.

8.4.1.2 Harvesting should be planned in advance and timed to prevent fishery products from being exposed to unduly high temperatures.

8.4.1.3 Harvested aquatic animals should be quickly and hygienically handled, using practices that do not cause contamination and physical damage to the product.

8.4.1.4 Practices should ensure that the viability of live aquatic animals is not unduly affected by extreme temperatures, physical damage or undue stress (if applicable).

8.4.1.5 Water and ice used during harvesting should be of quality suitable for the production of food.

8.4.1.6 Postharvest operations should be carried out quickly, hygienically and without damage to the product.

8.4.1.7 Postharvest wastes should be collected in designated areas and disposed of properly to minimize risk of cross contamination.

8.4.1.8 For postharvest operations, clean and uncontaminated water should be available and used in sufficient amount for handling and cleaning operations.

8.4.1.9 For postharvest operations, ice shall be made from potable water and sourced from approved establishment by the competent authority.

8.4.1.10 For postharvest operations, ice should be received, handled and stored under good sanitary conditions, which minimize risks of contamination.

8.4.1.11 Harvested aquatic animal should be properly chilled and maintained at a temperature range of 0°C to 4°C to preserve freshness, quality, and safety.

8.4.1.12 Fishery products placed on the market for further processing before human consumption should be disease-free.

8.4.1.13 When detaching mussels from the rope, care should be taken not to injure them by pulling out their byssus threads

8.4.1.14 Mussels may be taken off the ropes by grasping their byssal attachment rather than the mussel themselves when pulling them off the rope.

8.4.1.15 At least 10-15% of the mussels should remain after harvest to serve as breeding stock to produce spats for the following season.

8.4.1.16 Harvesting of oysters and mussels should be in conformance with PNS/BAFS 236:2024 (Live and Raw Bivalve Molluscs — Code of Practice).

8.4.3 Transport

8.4.3.1 Oysters and mussels should be transported to market in clusters to conserve moisture and thereby live longer.

8.4.3.2 During transport, oysters and mussels should be kept in moist containers protecting them from the heat of the sun.

8.4.3.3 Transportation of oysters and mussels should be in conformance with PNS/BAFS 236:2024 (Live and Raw Bivalve Molluscs — Code of Practice).

8.4.3.4 Oysters and mussels should be transported in clean, sanitized, and well-maintained materials, with protocols to prevent contamination from environmental sources such as air, soil, water, oil, and chemicals.

8.4.3.5 Live oysters and mussels should be transported under conditions which recognize their welfare and do not adversely affect their viability.

8.4.3.6 Oysters and mussels intended to be sold chilled for human consumption shall be transported in containers designed to maintain a consistent temperature of 0°C to 4°C throughout the entire transport period.

8.4.3.7 Containers used for transporting fishery products with ice should be designed to allow melted water to drain away from the product, ensuring optimal quality and hygiene.

8.4.3.8 All prohibited additives and chemicals shall not be used in contact with the products.

9 Animal Health and Welfare

9.1 Farm operators should develop and implement an aquatic animal health plan, following the existing protocols of the competent authorities for the health and management of aquatic animals.

9.3 Farm operators shall adhere to the risk-based animal health surveillance program, which includes both passive and active schemes conducted by the competent authority, to ensure effective monitoring and management of aquatic animal health.

9.4 Aquatic animals, wild-sourced or captive propagated by registered hatcheries, should be of good quality and clinically healthy, as confirmed through screening and testing by the competent authority and its recognized laboratories before stocking.

9.5 All veterinary drugs and chemicals for use in aquaculture shall comply with national regulations, as well as international guidelines, if applicable. If veterinary drugs and chemical treatment is necessary, farm operators shall follow the instruction on the manufacturers label or as advised by competent authority.

9.6 Substances requiring prescription shall only be used under supervision by a qualified expert. Non-prescription substances should be used according to manufacturer's instructions and as specified on the label.

9.7 Veterinary drugs, medicated feeds, chemicals and biological substances should be properly stored according to instructions.

9.8 Veterinary medicines should be used in a responsible manner and in accordance with applicable national legislation or relevant international agreements/guidelines that ensure effectiveness for animal health with consideration of public safety and protection of the environment.

9.9 Treatment and control of diseases with authorized veterinary drugs should be carried out only on the basis of a proper diagnosis.

9.10 Withdrawal periods and residues should be verified by adequate testing.

9.11 A quarantine protocol should be established and implemented for the treatment and containment of diseased aquatic animals.

9.12 Proper handling and disposal procedures for diseased aquatic animals shall be implemented to ensure effective disease control and prevent the spread of pathogens.

9.13 For farms administering chemicals, withdrawal period shall be followed. Veterinary drug residues shall be within the limits set in the PNS/BAFS 48:2022 (Veterinary Drug Residues in Food — Maximum Residue Limits).

9.14 Movement of aquatic animals and aquatic animal products should take place in accordance with existing national regulations to prevent introduction or transfer of diseases and infectious agents pathogenic to aquatic animals while avoiding unwarranted sanitary measures.

9.15 Farm operators should formulate and implement biosecurity measures, in adherence to the recommended protocol of the competent authority, to

prevent introduction of disease into the farm and/or control its spread within the farm.

9.16 Farm operators should maintain a suitable culture environment throughout the production cycle of the species being raised to promote aquatic animal welfare.

9.17 Farm operators should develop and implement handling protocols during sampling, harvesting, quarantine, and disease treatment to promote aquatic animal welfare.

9.18 Use of species in polyculture or integrated multitrophic aquaculture should be carefully considered in order to reduce potential risk of disease transmission.

10 Environmental Integrity and Sustainability

10.1 Aquaculture activities shall be limited within the designated area for aquaculture use based on the approved zoning plan to ensure sustainable resource utilization and maintain the carrying capacity of the ecosystem.

10.2 The use of lethal methods to eradicate predators, particularly those classified as vulnerable, threatened, or endangered under DENR Administrative Order No. 2019-09 (Updated National List of Threatened Philippine Fauna and their Categories), and relevant international conventions, including the International Union for Conservation of Nature (IUCN) Red List, shall be prohibited.

10.3 Environmental Impact Assessments (EIA) should be conducted, as prescribed by the national and local regulations, prior to the approval of establishment of aquaculture facilities.

10.4 The site of aquaculture facilities shall be evaluated and permitted based on its proximity to ecologically sensitive or protected areas such as mangrove forests, coral reefs, and other biodiversity hotspots. The farm shall also adhere to zoning laws set by local government units (LGUs).

10.5 Rehabilitation and recovery of damaged natural surroundings caused by aquaculture operations should be encouraged

10.6 Effective mitigation measures should be taken if the current practices are damaging habitat/environment.

10.7 Regular monitoring of farm environmental quality should be carried out.

10.8 Measures should be adopted to promote efficient water management and use, as well as proper management of effluents to reduce impacts on surrounding land, and water resources.

10.9 Where possible, good quality, hatchery-produced stocks should be used for culture. When wild-sourced stocks are used, they should be collected using responsible practices or in accordance with national laws and regulations where they exist.

10.10 Exotic species of molluscs cultured in controlled conditions may only be used when the competent authority has conducted a science-based risk assessment and determined that their introduction poses an acceptable level of risk to the natural environment, biodiversity, and ecosystem health.

10.11 Any exotic species of molluscs shall be disposed of in a manner that prevents their release into the natural environment

10.12 Where genetic material of an aquatic organism has been altered in a way that does not occur naturally, the competent authority should conduct science-based risk assessment to address possible risks.

10.13 Farm workers and managers should be trained in environmental management and mitigation of impact to ensure awareness of their responsibilities in protecting the environment.

10.14 Design and materials (e.g. bamboo stakes) shall not cause siltation of the area and negative environmental impacts.

11 Socio-Economic Aspects

11.1 Workers should receive fair treatment, salaries, mandatory benefits, and incentives consistent with national rates and in accordance with existing laws, regulations, and any related agreements or arrangements between the employer and the workers.

11.2 Living quarters of stay-in labor should be safe, clean, good, habitable, and convenient condition.

11.3 Potable water in adequate supply and appropriate suitable toilet facilities should be available and properly maintained.

11.4 Aquaculture facility operations should observe the rights of host local community minimizing potential adverse impacts on public land, infrastructures, fishing grounds, and water resources following existing laws and regulations.

11.5 Workers should not be discriminated against on the basis of gender, race, religion, culture, age, etc.

11.6 Training on Occupational Health and Safety (OH&S) should be conducted for the workers to ensure safer farm work conditions.

11.7 An adequate quantity of first aid kits should be available and easily accessible at the production area, and laborers should be able to demonstrate awareness of and apply various first aid measures.

11.8 Harmonious, productive, and mutually beneficial relationship with the local community should be maintained to foster responsible business social responsibility.

11.9 Proactive anti-child labor policy should exist in the farm and shall be compliant with the existing regulation and other applicable regulations.

12 Traceability and Record Keeping

12.1 Records keeping of the following records should be kept and maintained for at least 24 months for traceability purposes:

a) source of stocks
b) movement of animals
c) occurrences of diseases
d) harvesting
e) buyers of final products
f) production unit activities
g) water quality monitoring
h) use of feeds and feed ingredients, and fertilizers.
i) habitat rehabilitation
j) environmental monitoring

Annex A
(Normative)

Optimum Water Quality Parameters for Oysters and Mussels

Table a.1 Water quality requirements of oysters (FAO, n.d.)

Parameters	Range
pH	6.5-8.5 (PHILMINAQ, as cited in Lebata-Ramos et al., [2022])
Temperature	Not less than 23℃
Salinity	17-35 ppt 17-26 ppt (BFAR)

Table a.2 Water quality requirements of mussels (Aypa, n.d.)

Parameters	Range
Water current	17-25 cm per second (flood tide) 25-35 cm per second (ebb tide)
Temperature	27℃-30℃ 25℃-32℃ (PCAARRD, 2019)
Salinity	27-35 ppt

Bibliography

Aypa, S. M. (n.d.). *Mussel culture*. Food and Agriculture Organization of the United Nations. Retrieved January 9, 2025, from https://www.fao.org/4/ab737e/ab737e04.htm

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2024). Live and raw bivalve molluscs — Code of practice (PNS/BAFS 236:2024). [insert link]

Department of Environment and Natural Resources. (1990). *Revised water usage and classification/water quality criteria* (DENR Administrative Order No. 34). https://emb.gov.ph/wp-content/uploads/2016/04/DAO-1990-34.pdf

European Commission. (n.d.). *Aquaculture facilities (AF)*. INSPIRE. Retrieved January 9, 2025, from https://inspire.ec.europa.eu/theme/af#:~:text=Aquaculture%20facilities%20only%20include%20permanent,and%20as%20terrestrial%20production%20systems

Food and Agriculture Organization of the United Nations. (n.d.). *Chapter 5: Nutritional requirements of fish*. Retrieved January 9, 2025, from https://www.fao.org/4/r2032e/R2032E05.htm

Lebata-Ramos, M. J. H. L., Dionela, C. S., Solis, E. F. D., Mediavilla, J. P., Sibonga, R. C., & Novilla, S. R. M. (2022). Settlement of oyster *Magallana bilineata* (Röding, 1798) spat in the natural environment: Seasonality and substrate texture preference. *Molluscan Research, 42*(2), 135–145. https://doi.org/10.1080/13235818.2022.2073651