



COMPARATIVE ANALYSIS OF CURRENT FARMING PRACTICES IN OYSTER AND MUSSEL PRODUCTION IN THE PHILIPPINES AND ASIA

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Executive Summary

The global demand for bivalve shellfish is increasing, creating a significant opportunity for the archipelagic Philippines to expand its shellfish business, given its abundant oyster and mussel farming sites (Asia Farming, n.d.; Food and Agriculture Organization [FAO], 2018; Statista, 2022a, 2022b). To maximize this potential, there is a need to enhance quality control and sanitation practices for commercial viability in local and international markets (Department of Agriculture - Bureau of Fisheries and Aquatic Resources [DA-BFAR], 2021). Global marine bivalve production surpasses 15 million metric tons (MT) annually, with 89% from aquaculture and 11% from wild-caught (Mao et al., 2019). Asia dominates global production accounting for 85% of total global production (IMARC Group, 2023; & Mao et al., 2019) with China accounting for more than 90% of bivalve production (DA-BFAR, 2022; Mao et al., 2019). Other significant producers in Asia are Japan, South Korea, Indonesia, and Thailand (DA-BFAR, 2022; Mao et al., 2019). Although the Philippines is not currently a significant producer, it has been exporting oyster and mussel products to countries including the USA, Taiwan, Singapore, Korea, Japan, and Hong Kong from 2011 to 2020 (DA-BFAR, 2022). On the other hand, the Philippines imports oysters from Korea and Japan, while mussel imports were highest from New Zealand and Chile for the period (DA-BFAR, 2022). Oysters and mussels are valued as they are good sources of nutrients such as omega-3 fatty acids,



essential micronutrients, amino acids, and vitamins (Expert Market Research, 2023; Mititelu et al., 2021; Yaghubi, 2021). Beyond its established nutritional value, oysters and mussels have food safety risks associated with their consumption. With their filter-feeding nature, they accumulate not only nutrients but also microbial and chemical contaminants (DA-BFAR, 2022; The Mussel Technical Committee, 2018; and Yaghubi, et al., 2021). These can concentrate in the tissues of oysters and mussels and can present a significant risk to food safety (Centers for Disease Control and Prevention, n.d.; The Mussel Technical Committee, 2018; Yaghubi, et al., 2021). The DA-BFAR identified the pressing need to improve quality control and sanitation practices to enhance the commercial viability of fresh mollusks in both local and international markets (DA-BFAR, 2022).

In 2014, the Department of Agriculture - Bureau of Agriculture and Fisheries Standards (DA-BAFS) developed the Philippines National Standards (PNS) on Code of Good Aquaculture Practices (GAQP) (PNS/BAFS 135:2014). This standard outlined general requirements for aquaculture commodities in hatcheries, nurseries, fish cages, fish pens, fishponds, seaweed farms, and mollusk farms to minimize the risks associated with aquaculture production (DA-BAFS, 2014). Building upon this foundation, DA-BAFS established the Code of Good Aquaculture Practices for Oyster and Mussel (PNS/BAFS 207:2017) in 2017 (DA-BAFS, 2017). This specialized Code provides practices to prevent or reduce hazards during the aquaculture production, harvesting, and postharvest handling of oysters and mussels. Considering the age of the PNS/BAFS 207:2017, the DA BAFS Standards Development Division (SDD) included a table review of the PNS in its work program for 2025. The PNS/BAFS 207:2017 is set to be amended in the same year to include current recommended practices in the Philippines and Asia.

To aid in the evaluation for potential amendments of the PNS/BAFS 207:2017, the DA- BAFS Standards Research Division (SRD) conducted this study to obtain information on current Philippine and Asia recommended practices that would identify potential gaps or areas for improvement in the existing PNS/BAFS 207:2017. Specifically, this study aimed to compare and contrast the prescribed farming practices

in the PNS/BAFS 207:2017 against more recent literature for the Philippines and Asia. The key areas of examination were based on the provisions of PNS/BAFS 207:2017, namely:

- a. Site selection
- b. Facilities and sanitation
- c. Management
- d. Oyster and mussel diseases
- e. Harvesting and handling
- f. Personnel health and hygiene
- g. Traceability and record keeping
- h. Labor and Community

To achieve the objective, this study employed secondary research where information on Philippine and Asian recommended farming practices for oysters and mussels were obtained from standards, regulations, guidelines, and published materials in the Philippines and Asia. The collected information was examined to identify alignment, deviations, or the presence of additional requirements when compared against the PNS/BAFS 207:2017. The points of commonalities and divergence were drawn out.

Overall, PNS/BAF 207:2017 requirements for oyster and mussel farming were generally aligned with the current Philippine and Asian practices. References consulted offered more insights and detailed specifications. A summary of detailed specifications or additional requirements that are not currently found in the PNS/BAF 207:2017 is provided below.

a) Site Selection

Location: The requirements for location in the PNS/BAFS 207:2017 were consistent with Philippine and Asian practices. The following list outlines recommended practices on suitable location sites for oyster and mussel production that were not

reflected in the existing PNS or provided more detailed specifications to the general requirements of the PNS:

1. Not polluted, or with minimal pollution risks, or located where pollution can be controlled or is in well-protected areas;
2. Far from river mouths or sources of freshwater;
3. With a suitable salinity range (e.g. 27-35 ppt for green-lipped mussels; 2-30 ppt for Charru blue mussels);
4. With a temperature range of 27-30 degrees Celsius;
5. With the presence of spats;
6. With a high amount of primary-produced or natural food;
7. Absence or minimum predators and fouling organisms;
8. Protected from strong wind and wave action, but must have adequate water movement to bring in natural food and dissolved oxygen and remove metabolic wastes;
9. Muddy-sandy substratum; and
10. Accessible and with adequate transportation and communication facilities.

The Department of Environment and Natural Resources (DENR) specified that the water body to be used when the shellfish harvested is to be eaten raw should be Class SA, while the body of water for general shellfish propagation should be Class SB (DENR, 2016). Water quality guidelines for Class SA and Class SB included primary parameters, which were as follows: color, dissolved oxygen, fecal coliform, nitrate as NO₃-N, pH (range), phosphate, temperature, and total suspended solids. They also covered secondary parameters namely inorganic, metals, and organic contaminants (DENR, 2016).

Layout and Design: The PNS/BAFS 207:2017 requirements on layout and design considered a broader scope but were less detailed compared to Philippine and Asian recommended practices. Layout and design requirements on culture facilities specifically for raft and longline methods, considered eco-friendly and sustainable,

were discussed in The Mussels Technical Committee 2018 (2019). They were as follows:

For Raft: The raft consisted of plastic drums, styrofoam blocks, or used black plastic containers used as flotation materials which were tied under a bamboo platform, and connected to concrete anchors with a 20-mm diameter PP rope.

For Longline: The longline consisted of a 20–100 m main line made of 20-mm diameter PP rope depending on available resources and the size of the culture area. Recycled black plastic containers (40 cm x 35 cm x 19 cm), were used as floats and tied to the main line at 1–3-m intervals using an 8-mm diameter PE rope. Each end of the main line was tied to a cylindrical concrete anchor approximately half the size of an oil drum to secure the longline structure.

The longline method, the primary aquaculture technique for oyster and mussel culture in China, was described by Mao. et al. (2019). This was considered a recommended practice for Asia. The details were as follows:

For Oyster Cultivation: The raft rope length was about 150 m in total, about 80–100 m of which was used for cultivation. There were about 25 m at each end attached to the fixed pile. The space between two consecutive longlines was 7 m wide. Float number was gradually increased according to the oyster growth. Polyethylene rope with 0.4 cm diameter and 3.0 m long was used for hanging oysters, hanging space between each rope was about 1 m. In longline oyster cultivation, the direction of the longline stake rope should follow the current.

For Mussel Cultivation: The longline raft set up for mussels was similar to that of oysters. The major differences were in the longline and float distances. The raft rope length was about 63 m in total, the raft was set every 17 m along the rope. The longline length was about 65 meters, hanging rope was every 4 m on the longline, and was attached to a float. Distances between each longline were about 17 m and 7 longlines form a culture unit.

h) Management

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Production Management: The PNS/BAFS 207:2017 requirements on minimizing the risk of cross-contamination found support in Philippine and Asian recommended practices in production management but on different aspects of production. The PNS/BAFS 207:2017 focused on propagation practices. The Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) (2022b) suggested maintaining a portion of the grown mussel in the area as a source of broodstock thus preventing cross-contamination. The ASEAN GAqP Experts Working Group (EWG) recommended sourcing broodstock in a way that reduces the risk of carryover of potential human health hazards (ASEAN Secretariat, 2022).

Water Quality Management: The PNS/BAFS 207:2017's requirement on water quality monitoring adhered to Philippine and Asian recommended practices. On the other hand, the recommendations indicated in the DENR Administrative Order No. 2016-08 and the ASEAN GAqP EWG were more exhaustive indicating specific physico-chemical and microbial parameters (ASEAN Secretariat, 2022). They also differentiated the parameters for minimum regular monitoring and the parameters for baseline assessment of the water body

c) Oyster and Mussel Diseases

PNS/BAFS 207:2017 and Asia's recommended practices discussed prevention of disease outbreaks and promotion of healthy aquaculture practices. The latter also emphasized the importance of stress reduction and overall animal welfare. The PNS/BAFS 207:2017 and Asia's recommended practices also highlighted the importance of prompt notification and expert consultation in response to aquatic animal diseases. The ASEAN GAqP EWG required routine monitoring of stock and environmental conditions for early detection of aquatic animal health problems (ASEAN Secretariat, 2022).

d) Harvesting and Handling

The handling and transport requirements described in the PNS/BAFS 207:2017 and the Philippine and Asian recommended practices were complementary. The ASEAN GAqP EWG provided the following supporting requirements on harvesting: appropriate harvesting and post-harvest handling of aquaculture products within the farm should be practiced to minimize contamination and physical damage (ASEAN Secretariat, 2022). In addition, it mentioned that water and ice used during harvesting and grading should be of quality suitable for the production of food that is safe for human consumption. The Philippines Recommends for Mussel provided a set of recommended practices for the live handling and transport of mussels with the same goal of minimizing contamination and damage to the products (for details, refer to The Mussel Technical Committee 2018 (2019)). The ASEAN GAqP EWG provided only a general requirement on harvesting and postharvest handling of aquaculture products (ASEAN Secretariat, 2022).

Based on these findings, the following are the recommendations:

General

1. Uphold the existing standards outlined in PNS/BAFS 207:2017; and
2. Conduct further investigation to evaluate the adoption of supporting and complementary requirements or specifications in Philippine and Asian recommended practices.

Specifically consider the following in amending the PNS/BAFS 207:2017:

a. Site Selection

1. Incorporating the DENR Administrative Order 2016-08 classification of water bodies for shellfish production which are Class SA when harvested product is to be eaten raw, or Class SB when the body of water is for general shellfish propagation (DENR, 2016);
2. Integrating the DENR Administrative Order 2016-08 specifications on Water Quality Guidelines for Class SA and Class SB which include (a) the Water

Quality Guidelines for Primary Parameters: color, dissolved oxygen, fecal coliform, nitrate as Nitrate-Nitrogen (NO₃-N), pH (range), phosphate, temperature and total suspended solids, and (b) the Secondary Parameters: inorganic, metals, and organic contaminants (DENR, 2016); and

3. Adopting the raft and longline specifications of the The Mussels Technical Committee 2018 (2019) and Mao et al. (2019), subject to further validation.

b. Management

1. Integrating the recommendation of PCAARRD (2022b) to maintain a portion of the grown mussel in the area as a source of broodstock thus preventing cross-contamination;
2. Adopting the ASEAN GAqP EWG recommendations to source broodstock in a way that reduces the risk of carryover of potential human health hazards (ASEAN Secretariat, 2022); and
3. Compliance monitoring of physico-chemical and microbial parameters provided in the DENR Administrative Order No. 2016 08 (DENR, 2016) and the ASEAN GAqP EWG recommendations (ASEAN Secretariat, 2022).

c. Oyster and Mussel Diseases

1. Adopting the ASEAN GAqP EWG requirement for routine monitoring of stock and environmental conditions for early detection of aquatic animal health problems (ASEAN Secretariat, 2022).

d. Harvesting and Handling

1. Integrating the recommended practices of the Philippines Recommends for Mussel on the live handling and transport of mussels (The Mussel Technical Committee 2018, 2019).

The PNS has more comprehensive requirements than the Philippine and Asian recommended practices in Facilities and Sanitation, Personnel Health and Hygiene, Traceability and Record Keeping, and Labor and Community. Thus, the SDD may consider the requirements in the PNS for these categories to be maintained without revision