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Grouper – Code of Good Aquaculture Practices (GAqP)

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Foreword

Since 2014, the Bureau of Agriculture and Fisheries Standards-Department of Agriculture (BAFS-DA) has developed various Philippine National Standards (PNS) on the Code of Good Aquaculture Practices (GAqP) specific for finfish, crustaceans, molluscs, and aquatic plants. In 2020, the Southeast Asian Fisheries Development Center (SEAFDEC) requested for a specific PNS on GAqP for grouper considering grouper's high demand and market potentials. In 2021, BAFS commenced the development of this PNS which aims to set recommended minimum requirements that will help the farmers to have a common understanding on the production practices in rearing groupers. In addition, this standard will also help in achieving the desired safety and quality parameters set out in PNS/BAFS 73:2021 (Live, chilled, or frozen grouper).

The Technical Working Group (TWG) tasked to develop the PNS was created through Special Order (SO) No. 103, series of 2022 (Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machinery, Tools, and Equipment). The TWG was composed of representatives from the relevant government agencies, academe/research institution, private sector, and Civil Society Organization (CSO). The draft PNS underwent a series of TWG meetings and stakeholder consultations conducted physically and via online platforms before its endorsement to the DA Secretary for approval.

This document was drafted in accordance with the editorial rules of the BAFS Standards Development Division Standardization Guide No. 1: Writing the Philippine National Standards.

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1 Scope

This Code of Good Aquaculture Practices (GAqP) for Grouper aims to prevent or minimize the risks associated with the production of grouper (*lapu-lapu*) in land-based (brackishwater ponds and tanks) and sea-based (cages and pens) facilities and promote sustainable grouper farming. This Code covers specific aspects of aquaculture production. It also addresses practices on food safety and quality, animal health and welfare, environmental integrity, and socio-economic welfare.

This Code consists of minimum compliance 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). (2014). Philippine National Standard (PNS) on the code of Good Aquaculture Practices (GAqP) (PNS/BAFS 135:2014). http://bafs.da.gov.ph/bafs_admin/admin_page/pns_file/PNSBAFS135_2014CodeofGAqP%20(1).pdf

BAFS-DA. (2021). PNS on Live, fresh chilled, or fresh frozen grouper (PNS/BAFS 73:2021). http://bafs.da.gov.ph/bafs_admin/admin_page/pns_file/2021-09-29-PNSBAFS%2073-2021%20Grouper.pdf

World Organisation for Animal Health (OIE). Aquatic animal health code. https://rr-europe.woah.org/wp-content/uploads/2020/08/oie-aqua-code_2019_en.pdf

3 Terms and Definitions

For the purpose of this standard, the following definitions shall apply:

3.1
competent authority
official organization/agency having jurisdiction (Codex Alimentarius Commission [CAC], 2009)

3.2
feeding fish
cultured or captured fish and other aquatic animals that are utilized as feeds for farmed high-value aquatic animals

3.3
grouper
common name of fish, either cultured or wild-caught, belonging to any genera in the sub-family Epinephelinae of the family Serranidae, in the order Perciformes (BAFS-DA, 2021)

3.4
grouper farm
a grouper culture facility, in brackish and marine waters, either land-based or sea-based, usually consisting of holding facilities (e.g., tanks, pens, ponds, raceways, cages), structures (e.g., on-site farm shelter, sorting/harvesting area, quarantine area, storage areas), nursery area, service equipment, and culture stocks (BAFS-DA, 2021, *modified*)

3.5
veterinary drug
any substance applied or administered to any food-producing animal, whether used for therapeutic, prophylactic, or diagnostic purposes or for modification of physiological functions or behavior (CAC, 2020)

4 Overarching Principles of Good Aquaculture Practices

The relevant or applicable principles and minimum requirements stated in the PNS/BAFS 135:2014 (Code of GAqP) including site selection, farm management, personnel health and hygiene, labor and community, and relevant environmental laws and regulations should be complied with. The PNS/BAFS 135:2014 (Code of GAqP) should be used as complementary document to this standard.

The following good practices and minimum requirements specific to grouper are as follows:

5 Site Selection

5.1 Location

5.1.1 General

5.1.1.1 Site should be relatively free from any source of pollution (e.g., industrial, agricultural, and domestic) and protected from environmental hazards such as typhoons, floods, erosions, etc. It should be accessible and secure from possible acts of vandalism and poaching (SEAFDEC, 2001).

5.1.1.2 Grouper farms should be in designated areas (e.g., mariculture zones, brackish water areas, land-based facilities) as approved by the competent authorities.

5.1.1.3 Site should be situated in areas where supply of aquaculture inputs are available and accessible.

5.1.2 Sea-based facilities

5.1.2.1 Net cages should be set up in calm waters. Grouper farm should be protected from strong winds and current, and storm surges. An ideal grouper farm should be a protected bay, sheltered cove or inland sea (Baliao et al., 2000).

5.1.2.2 "Site should have good water exchange to maintain good water quality" (Baliao et al., 2000, p.3).

5.1.2.3 Site should not transect navigational lanes, Marine Protected Areas (MPA), and designated fishing grounds.

5.1.2.4 The distance between the bottom of the net cage and the sea floor should be at least 3 meters during the lowest low tide and away from seagrasses and coral beds (Baliao et al., 2000).

5.1.3 Land-based facilities

5.1.3.1 Seawater and brackish water supplies should be sufficient to meet the optimum requirements of cultured grouper (Baliao et al., 1998).

5.1.3.2 Freshwater supply should be sufficient to support operations and treatment of diseases (SEAFDEC, 2001).

5.1.3.3 The site should provide effluent pond/s for water re-use or treatment of pond wastes, especially for intensive culture systems (SEAFDEC, 2001).

5.1.3.4 Ponds should be at least 1.5m deep.

5.2 Lay-out and design

5.2.1 Cages and pens should be set up in calm waters with adequate water flow. An access and space for navigation should be provided (SEAFDEC, 2001).

5.2.2 Materials for net cages and pens should be durable, weather-resistant, pest-proof, and with non-abrasive surfaces (SEAFDEC, 2001).

5.2.3 The design should meet the standard culture requirements of the grouper from grow-out to harvest.

6 Culture Management

6.1 Source of seed stock

6.1.1 Seed should be of good quality, healthy, and may come from registered grouper hatcheries or from the wild (ASEAN, 2015).

6.1.2 Collection of seed stocks from the wild should be done in a sustainable manner (ASEAN, 2015).

6.1.3 Seed stock shall be screened for bacterial, parasitic, viral, and fungal pathogens prior to stocking.

6.1.4 Caution should be taken in using imported seed stocks as they may pose risks to the natural stocks and the environment. Introduction of imported seed stocks should be approved by the competent authorities.

6.2 Stocking density

6.2.1 The stocking density should be optimum to the species and the culture system as specified in Annex A (Recommended stocking density for grouper culture).

6.3 Feeds and feeding

6.3.1 Aquaculture operations should follow national laws and regulations established by the competent authorities and/or applicable international standards to prevent feed contamination (ASEAN, 2015).

6.3.2 Aquaculture operations should only use feeds and feed materials that are free from unsafe levels of physical, chemical, and biological pollutants. All materials used in farm-produced or manufactured feed shall have no prohibited substances (ASEAN, 2015).

6.3.3 Farmers shall only purchase commercial feeds from registered producers which complies with the requirements of the competent authority, including labeling requirements (ASEAN, 2015).

6.3.4 All veterinary drugs and substances used in all culture operations shall comply with national standards and regulations established by the competent authorities and/or international standards. Only registered veterinary drugs and chemicals shall be used when they are necessary, following manufacturers or competent authority’s instructions (ASEAN, 2015).

6.3.5 The recommended nutritional and dietary specifications for grouper are presented in Annex B (Nutritional and dietary requirement for grouper culture). For farms using pelleted feeds, it is recommended to use feeds specifically formulated for groupers.

6.3.6 Storage of feed should be in a cool, dry, and clean area. It should be elevated from the floor (e.g., placed on a pallet) and ventilated by providing space between the feed bags and the walls of the storage area (Ismi et al., 2012). Storage areas should be cleaned regularly to avoid attracting pests. As much as possible, feeds should be stored in their original packaging.

6.3.7 Feeds should be stored in an enclosed space to prevent access by vermin (e.g., birds, insects, and rodents) (Ismi et al., 2012).

6.3.8 Systematic stock rotation plan (e.g., first in, first out [FIFO]) should be applied. Label feeds with the dates they are stored and apply the FIFO system in releasing stored feeds. The farm should keep records on the inventory and usage of feeds.

6.3.9 If feeding fish is used as feed source, it should be used within a few hours or stored frozen for future use. Fish stored at -30°C may be kept up to 3 months (Ismi et al., 2012).

6.4 Water and soil quality

6.4.1 Water quality used for aquaculture should be suitable for grouper production (ASEAN, 2015).

6.4.2 Grouper farms should have good water quality as presented in Annex C (Optimum water quality parameters for grouper culture) and good soil quality (for ponds) as presented in Annex D (Optimum soil quality parameters for grouper culture). Water and soil quality should be monitored regularly.

6.5 Health management and biosecurity

6.5.1 Health status of cultured grouper should be monitored regularly.

6.5.2 Grouper species used in polyculture or integrated multitrophic aquaculture should be carefully considered to minimize the risk of disease transmission (ASEAN, 2015).

6.5.3 Grouper farms should integrate biosecurity measures to prevent potential entry and spread of diseases (BAFS-DA, 2014).

6.5.4 Adequate procedures for cleaning and disinfection of vehicles, containers, equipment, boots, and farm facilities should be established and implemented as part of the biosecurity measures (BAFS-DA, 2014).

6.5.5 In cases of disease occurrence, operators should immediately inform the competent authority. Operators should implement suggested treatment and necessary biosecurity measures to prevent its spread (BAFS-DA, 2019).

6.5.6 The pertinent provisions of the OIE Aquatic Animal Health Code related to aquatic animal health management program and movement of aquatic animals and aquatic animal products should be followed to prevent the introduction or transfer of diseases and pathogenic infectious agents while preventing unnecessary sanitary measures (ASEAN, 2015).

6.6 Harvesting, post-harvest handling and transport

6.6.1 Grouper should be handled properly during and after harvest to reduce contamination and physical damage (ASEAN, 2015).

6.6.2 When transported live, the following conditions should be considered (Baliao et al.,1998):

a) The operation should be properly planned to minimize delays in transit; and
b) Live groupers should be kept well-aerated and mildly sedated.

6.6.3 Procedures for transport of live, chilled, or frozen grouper should be in accordance with PNS/BAFS 73:2021 (Live, fresh chilled, or fresh frozen grouper).

7 Animal Welfare

7.1 A culture environment adaptive to grouper species raised should be maintained at all stages of the production cycle to promote grouper health and welfare and minimize the risks of introducing and spreading diseases (ASEAN, 2015). In particular, maintaining this culture environment involves the following (ASEAN, 2015):

a) Regular monitoring of stocks and environmental conditions to early detect aquatic animal health problems and guarantee growth and survival of grouper stocks; and
b) Implementation of management practices that minimize the probability of disease transmission within and between grouper farms and to the natural aquatic fauna and optimize grouper health by reducing their stress.

7.2 Veterinary medicines should be used judiciously and in compliance with applicable national regulations or international agreements, standards, and guidelines that ensure their effectiveness for animal health while taking public health, environmental protection, and animal welfare into account (ASEAN, 2015).

7.3 Operators, farm workers, and managers should be trained on good aquatic animal health and welfare management practices, giving emphasis on their

duties and responsibilities in safeguarding aquatic animal health and welfare throughout the production cycle (ASEAN, 2015).

7.4 Grouper that are diseased or dead should be collected immediately and disposed of properly through the establishment of a mortality pit and fish cemetery, among others.

8 Personnel Health and Hygiene

8.1 Operators, farm workers, and managers should be trained on farm level hygienic practices with emphasis on their duties and responsibilities in preventing contamination and deterioration of grouper throughout the production cycle (ASEAN, 2015).

9 Environmental Management

9.1 Environmental impact assessments should be carried out as required by the competent authority prior to the approval of the establishment of the grouper farm (ASEAN, 2015).

9.2 Regular monitoring of farm environmental quality should be done in conjunction with good record keeping and use of appropriate methods (ASEAN, 2015).

9.3 Measures to promote efficient water management and use, as well as proper management of effluents, should be implemented to minimize impacts on the surrounding land and water resources (ASEAN, 2015).

9.4 Hatchery-produced seed stock should be used for culture whenever possible (ASEAN, 2015). When wild seeds are used, they should be harvested responsibly and in compliance with relevant laws and regulations issued by the competent authorities (ASEAN, 2015).

9.5 When the genetic material of a grouper stock has been artificially altered, risk assessment should be done to address potential problems (ASEAN, 2015). Risk-based decisions should be made in strict compliance with the biosafety standards established by the competent authorities (ASEAN, 2015).

9.5.1 In the case of genetically modified organisms, they should only be cultured in land-based facilities. Screens and barriers should be provided to prevent escapees from being unintentionally introduced to the natural environment.

9.6 Construction of grouper farm and waste disposal system should be done in a responsible manner (ASEAN, 2015).

9.7 Feeds, feed additives, chemicals, veterinary drugs, including antimicrobials and fertilizers, should be used responsibly to minimize their adverse environmental impacts (ASEAN, 2015).

9.8 Operators, farm workers, and managers should be trained in environmental management and mitigation of impact with emphasis on their duties and responsibilities in protecting the environment (ASEAN, 2015).

10 Traceability and Record Keeping

10.1 Food safety data should be recorded, kept (at least 24 months after a production run), maintained, and made accessible (ASEAN, 2015).

10.2 Records of animal health and movement should be kept (at least 24 months after harvest) and maintained for traceability purposes (ASEAN, 2015).

Annex A
(Informative)

Recommended stocking density for grouper culture

Table A.1 Recommended stocking density for nursery culture (Ismi et al., 2012, *modified*)

Total length (cm)	Density (fish/m^3)	
	Tanks	Cages
2.5-4	1,000-1,500	1,500-2,000
4-5	750-1,000	1,000-1,500
5-7	500-750	750-1,000
7-9	400-500	500-750
NOTE The stocking density varies between species. The recommended density provided above applies only to tiger grouper (*Epinephelus fuscoguttatus)* fingerlings in nursery tanks and in nursery cages (1x2m) in ponds.		

Table A.2 Recommended stocking density of grouper in grow-out net cages (BFAR 8, 2017, *modified*)

Initial body weight (g)	Fish body length (cm)	Stocking density (fish/m$^{3)}$
20-30	8-2	50-60
30-100	12-16	40-50
100-200	17-22	30-40

Annex B
(Informative)

Nutritional and dietary requirement for grouper culture

Table B.1 Dietary requirements for juvenile (<20g) grouper (Ismi et al., 2012)

Component	Recommended level
Protein	50-52% dry matter basis
Lipid	<12-13% dry matter basis
Protein: energy ratio	30 g crude protein: 1MJ gross energy
n-3 Highly Unsaturated Fatty Acids (HUFA)	>1%
Docosahexaenoic acid (DHA)	>0.75%
Ascorbic Acid	50 mg/kg ascorbic acid equivalent as a heat-stable product

Table B.2 Nutritional requirements of moist feed for humpback grouper (Sim et al., 2012)

Nutritional composition	(%)
Dry matter	≤ 40
Crude protein	18.0
Digestible protein	16.2
Gross energy	8.8
Digestible energy	6.1
Lipid	4.8
Ash	4.4

Table B.3 Recommended feeding rate for nursery culture (Madrones-Ladja et al., 2012)

Days of culture	Feed rate (% of average body weight per day)	
	Stocking size of fish, 2.5cm body length	Stocking size of fish, 5cm
0-15	12-10	10-8
16-30	10-8	8-6
31-45	8-6	6-5
46-60	6-5	5-4
61-75	5-4	<4
76-90	<4	-

Table B.4 Recommended feeding rate for grow-out culture

Days of culture	Size of fish (grams)	Feeding rate (% of average body weight per day)
0-30	50-100	6-5
31-60	101-150	5-4
61-90	151-200	4-3
91-120	201-250	3-2
121-150	251-300	3
151-180	301-350	2
181-210	351 and above	2-1

Table B.5 Feeding regimen of dry pellets to grouper (Ismi et al., 2012)

Fish size (g)	Daily feeding rate (% average body weight)	Feeding frequency
1-5	10-4	3-5
5-20	4-2	2-3
20-100	2-1.5	2
100-200	1.5-1.2	1-2
200-300	1.2-1.0	1
>300	1.0-0.8	1

Annex C
(Normative)

Optimum water quality parameters for grouper culture

Parameters	Levels
pH[1]	7.5-8.3
Temperature[1]	25-32 °C
Salinity[1]	20-32 ppt
Dissolved oxygen[1]	4-8 ppm
NO_2-N (Nitrite nitrogen)[1]	0-0.05 ppm
Unionized ammonia (NH_3-N)[1]	<0.02 ppm
Total Suspended Solids (TSS)[2]	80 ppm
Water transparency	>30-50cm for ponds[3] >30cm for cages[4]

[1] Southeast Asian Fisheries Development Center (SEAFDEC). (2001). Husbandry and health management of grouper. https://repository.seafdec.org.ph/handle/10862/1054

[2] Department of Environment and Natural Resources (DENR). (2016). Water quality guidelines and general effluent standards of 2016 (DENR No. 2016-08). https://emb.gov.ph/wp-content/uploads/2019/04/DAO-2016-08_WATER-QUALITY-GUIDELINES-AND-GENERAL-EFFLUENT-STANDARDS.pdf

[3] Madrones-Ladja, J. A., Opiña, N., Catacutan, M., Vallejo, E., & Cercado, V. (2012). Cage nursery of high-value fishes in brackishwater ponds: Seabass, grouper, snapper, pompano. Aquaculture Extension Manual. https://repository.seafdec.org.ph/handle/10862/2419

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Annex D
(Normative)

Optimum soil quality parameters for grouper culture (Nursery and grow-out pond)

Parameters	Value
Area[1]	0.50-1.0 ha
Pond bottom soil[1]	Clay Clay loam Sandy clay loam
Soil pH[1]	6.5-7.5
Organic matter (OM) content[1]	≤3%

[1] Madrones-Ladja, J. A., Opiña, N., Catacutan, M., Vallejo, E., & Cercado, V. (2012). Cage nursery of high-value fishes in brackishwater ponds: Seabass, grouper, snapper, pompano. Aquaculture Extension Manual. https://repository.seafdec.org.ph/handle/10862/2419

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