

**Good Aquaculture Practice—
Integrated multi-trophic aquaculture
(IMTA) of fish, bivalve and seaweed in
coastal ecosystem**

Control points and compliance criteria

Preamble

- Rules on which the standard is written
- This standard was proposed by YSLME/UNDP.....
- YSFRI and ... developed the standard
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Introduction

Integrated multi-trophic aquaculture (IMTA) is the farming of species from different trophic levels and with complementary ecosystem functions in a way that allows one species' uneaten feed and wastes, nutrients and by-products to be recaptured and converted into fertilizer, feed and energy for the other crops, and to take advantage of synergistic interactions among species while biomitigation takes place. Farmers combine fed aquaculture (e.g., fish, shrimp) with inorganic extractive (e.g., seaweed) and organic extractive (e.g., shellfish) aquaculture to create balanced systems for environment remediation (bio-mitigation), economic stability (improved output, lower cost, product diversification and risk reduction) and social acceptability (better management practices).

Integrated multi-trophic aquaculture (IMTA) of finfish *Sparus macrocephalus*, bivalve *Crassostrea gigas* and seaweed *Sacharina japonica* (and *Gracilaria lemaneiformis*) in coastal ecosystem is one kind of IMTA, which have the following characteristics: the culture area is in coastal area, the farming environment will have directly influence on aquaculture activity; farming mode including different species (fish, bivalve and seaweed) and different aquaculture facility and technique (cage culture, longline culture); Coastal culture is mainly water operation, and the safety requirements for employees are strict. Acting as a practical manual for any aquaculture producer, ensuring food safety, minimal environmental impact, compliance with animal welfare and workers' health and safety, and reducing social practices risk, this specification, proposes the following requirements:

- a) The G.A.P. IMTA of fish, bivalve and seaweed Standard provide the guidelines of IMTA system design.
- b) In addition to complying with the GAP specifications for single cultured species (finfish, molluscs) (Edition 5.1-1_AQ_Nov17, Global G.A.P. of All Farm Base-Aquaculture Module), key control points and operational specifications have been proposed for IMTA. The G.A.P. IMTA of fish, bivalve and seaweed Standard covers the certification of the whole aquaculture production process from finfish,

bivalve and seaweed seedlings enter the aquaculture coastal seawater to harvest process. The production chain verification including: site selection, seedlings, feed to harvest operations.

- c) The IMTA module including:
 - 1) Workers' Health, Safety and Welfare
 - 2) Site selection and Management
 - 3) Feed and chemical compounds
 - 4) Farming process management
 - 5) Environmental and Biodiversity Management
 - 6) Social criteria

Good Aquaculture Practice— Integrated multi-trophic aquaculture (IMTA) of fish, bivalve and seaweed in coastal ecosystem

1. Scope

- This code sets out the basic requirements for GAP of fish, bivalve and seaweed IMTA.
- This code applies to the compliance certification of the basic requirements for GAP of fish, bivalve and seaweed IMTA.

2. Legislation relevant

The terms in the following documents become the provisions of this code by reference to this standard. All subsequent amendments or revisions to dated references do not apply to this code. However, parties to agreements based on this code are encouraged to study whether to use the most recent versions of these documents. For undated references, the latest edition applies to this code.

- Edition 5.1-1_AQ_Nov17, Global G.A.P. of All Farm Base-Aquaculture Module
- ASC-MSC Seaweed (Algae) Standard v1.01
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3. Terminology and definitions

3.1 Integrated multi-trophic aquaculture (IMTA)

Integrated multi-trophic aquaculture (IMTA) is the farming of species from different trophic levels and with complementary ecosystem functions in a way that allows one species' uneaten feed and wastes, nutrients and by-products to be recaptured and converted into fertilizer, feed and energy for the other crops, and to take advantage of

synergistic interactions among species while biomitigation takes place. Farmers combine fed aquaculture (e.g., fish, shrimp) with inorganic extractive (e.g., seaweed) and organic extractive (e.g., shellfish) aquaculture to create balanced systems for environment remediation (bio-mitigation), economic stability (improved output, lower cost, product diversification and risk reduction) and social acceptability (better management practices).

3.2 Ecological Carrying capacity

Ecological carrying capacity is broadly defined as the level of mariculture that can be supported without leading to significant changes to ecological processes, species, populations, or communities in the growing environment.

3.3 Net cage

Box-shaped facility for animal farming made of suitable materials

3.4 Cage culture

Aquaculture animal farming in cages

3.5 Longline culture or hanging culture

Floating facilities are set up in the ocean, and the production methods of aquatic economic animals and plants are hanged on the facilities.

4. IMTA system design

4.1 Core principles

4.2 species, size, density, ratio

4.3 spatial scales

5. Requirement of the GAP

5.1 Workers' Health, Safety and Welfare

	Control point	Compliance Criteria	Level
5.1.1	Have the basic knowledge and skills of cages and longline farming, should not suffer from night blindness and should have good swimming skills.	Provide relevant certificates, on-site inspection	Major must
5.1.2	Protective clothing should be worn when operating at sea. Proficiency in the use of life-saving facilities and self-rescue methods for emergencies.	Check records, ask employees	Major must
5.1.3	Get weather information from different sources, take appropriate safety measures according to weather conditions, and evacuate before storm surge or flood.	Check records, ask employees	Major must
5.1.4	An employee medical examination plan should be established, a health record should be established, and employees should obtain a health certificate before they can be employed. All employees should have an annual physical examination for infection with aquatic parasites.	Workers health certificates shall be provided.	Major must
5.1.5	Workers should be trained or have relevant practical experience in cages and longline farming, and regularly conduct training on culture techniques, management requirements, and industry practices for operations.	Training records or proof of relevant practical experience shall be provided.	Major must
5.1.6	Do workers have access to clean food storage areas, designated rest areas, hand-washing facilities, and drinking water?	A place to store food and a place to eat shall be provided to the workers if they eat on the farm. Hand washing equipment and drinking water shall always be provided.	Major must

5.2 Site selection and Management

	Control point	Compliance Criteria	Level
5.2.1	Site selection and Management		
5.2.1.1	Legislative framework		
	The farm should be located in the waters allowed by the state, and has mariculture license for cage culture and longline culture.	License shall be provided.	Major must
5.2.1.2	The cage and longline culture area should in the marine functional zoning, away from the port, and there is no pollution around.	Site demonstrate	Major must
5.2.1.3	Cages and longline should be selected in the waters with less wind and waves.	Site demonstrate	Major must
5.2.1.4	The cages and longline culture areas should be investigated in advance, especially flow rate, flow direction, dissolved oxygen, water depth, and sediment quality.	Monitoring records shall be available	Major must
5.2.1.5	The environment of IMTA area is in compliance with the requirements of GB/T 18407.4, and the water quality and substrate should be monitored at least once a year.	records	Major must
5.2.1.6	Considering conditions requirement of cages and longline- the water depth at low tides: Flow rate: Water temperature: Dissolved oxygen:	Site demonstrate	Major must
5.2.2	Facility layout		
5.2.2.1	The scientific planning of the aquaculture waters, the layout of the cages and longline should be reasonable, and the distance between the facility and the total area of the cages and	License shall be provided.	Major must

	longline should be determined according to culture species, the environmental conditions.		
5.2.2.2	The layout and location of the cage and longline should be drawn.	blueprint	Major must
5.2.2.3	The cage and longline settings should based on the results of carrying capacity to reduce disease occurrence and reduce environmental impact (see 4.2): For integrated culture areas, the cage area does not exceed ##% of the total area; The distance between each group of cages is not less than ## m, between the longlines is not less than##m; between the cage and the logline is not less than ##m; The waterway of the channel should be kept more than 50m between each culture unit.	Site demonstrate	Major must
5.2.3	Facility and equipment		
5.2.3.1	All materials used in the cages and longline should be non-toxic, harmless and corrosion resistant.	records	Major must
5.2.3.2	Net washing machine, automatic feeding machine, underwater monitoring equipment, etc., which should comply with relevant standards and ensure that there is no harm or pollution to the cultured species and environment.	records	Major must
5.2.4	Site management		
5.2.4.1	The farm shall draw a blueprint, showing the location and boundary the culture area, and number them.	records	Major must

5.3 Feed and chemical compounds

5.3	Chemical Compounds		
5.3.1	The feeding amount should be determined according to the water temperature, eating, weather condition. Adjust the amount of feed according to the growth of the cultured species.	Provide feeding record	Major must
5.3.2	It is advisable to use artificial compound feed.	Provide record	Minor must
5.3.3	Chemical compounds that control diseases should not have toxic and side effects on all organisms in the integrated culture system.	Detect chemical residues and organisms health condition.	Major must

5.4 Farming process management

5.4.1	Stocking density		
5.4.1.1	The stocking density and size of seeding should be determined according to carrying capacity.	Provide record	Major must
5.4.1.2	The stocking density and size should meet the requirement of the cultured species and meet the requirements of 4.2 of this standard.	on-site inspection	Major must
5.4.2	Daily management of farming		
5.4.2.1	Removal and control of biofouling and pests should not affect other cultured organisms in IMTA system.	Ask workers if they understand the terms.	Major must
5.4.2.2	Net clothing and lantern net should be inspected regularly to reduce escape of farmed organisms.	Ask workers that they should understand the terms.	Major must
5.4.2.3	Keeping records, including the type and quantity of the feed, the activity of the farmed animals, the growth, and the treatment of dead animals.	on-site inspection	Major must
5.4.2.4	Regular monitoring of environmental parameters, shall	Provide water sampling plans, related records	Major must

	include at least: microorganism, dissolved oxygen, temperature, salinity, etc.	and water quality inspection reports.	
5.4.3	Harvest		
5.4.3.1	The harvesting tools and operation processes should not cause harm to cultured aquatic products and other cultured organisms in IMTA system.	On-site inspection	Major must
5.4.3.2	Farms should have species identification and traceability plans and maintain records, including harvest date and area.	Provide plans and records to segregate from any seaweed, bivalve and finfish products not included in the IMTA system.	Major must
5.4.3.3	Fishing should be carried out by licensed and numbered fishing vessels.	On-site inspection. Traceable back to the harvesting or culturing facilities of the IMTA from the point of first sale.	Major must

5.5 Environmental and Biodiversity Management

	Control point	Compliance Criteria	Level
5.5.1	Is a continuously updated biodiversity inclusive environmental impact assessment (EIA) and risk assessment (ERA) in place?	EAI and ERA shall be done, which shall be updated following relevant changes in the farm operations with respect to environmental threats. Minimum requirements for an EIA may be, but are not restricted to, the following processes that are inherent to regular farming: effluent Nitrogen load; effluent phosphorus load; effluent suspended solids load; disposal of solid waste and litter; use and legal disposal of all chemical compounds.	Major must

5.5.2	Does the EMP include a contingency plan and a standard operating procedure to avoid escape of farmed stock into the sea?	The EMP includes a contingency plan. Procedures to avoid escapes shall be in place. The contingency plans and records of all escaped fish for the previous twelve months and confirmation that they have all been reported to the authorities for all sites shall be in place.	Major must
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5.6 Social criteria

	Control point	Compliance Criteria	Level
	Community impacts		
	Conflict resolution		

Glossary and abbreviations

Annex

Carrying capacity assessment model