



Network of Aquaculture
Centres in Asia-Pacific



World Organisation
for Animal Health
Founded as OIE

**Collection and Evaluation of Existing Guidelines and
Awareness Materials on Aquaculture Biosecurity for Small-
scale Farms in the Asia-Pacific Region**

Final Report

Prepared by:

Network of Aquaculture Centres in Asia-Pacific

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I. INTRODUCTION

Aquaculture is one of the important sectors in the economy of most Asia-Pacific countries. However, the majority of aquaculture farms are small-scale and the farmers most often lack the necessary infrastructure and competency to comply with biosecurity measures, or they are not well informed of the measures imposed by concerned authorities, especially for international trade. The World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) formally recognises the role of the WOAHA as the international standard setting organisation for animal health and zoonotic diseases. According to the SPS Agreement, WTO Members should align their import requirements with the recommendations in the relevant standards of the World Organisation for Animal Health (WOAH; founded as OIE). The Aquatic Code is thus a key part of the WTO legal framework for international trade. To provide recommendations on the development and implementation of biosecurity measures primarily to mitigate the risk of the introduction of specific pathogenic agents into aquaculture establishments, and if pathogenic agents are introduced, to mitigate the risk of further spread within or release from the aquaculture establishment, the WOAHA drafted the new Chapter on Biosecurity for aquaculture establishments which was adopted in 2021.

For many countries in the region, compliance to these standards is not easy and straightforward. Only those countries that have well established national aquatic animal health strategies can ensure full compliance to OIE standards on aquatic animal health, biosecurity and food safety, when it comes to responsible trade of live aquatic animals.

The continuous globalization in the aquaculture trade has increased the potential of disease introduction and spread to new areas. Spread of important aquatic animal diseases that can cause serious economic losses, as well as some social and ecological consequences, have been reported among major aquaculture producing and exporting countries. In shrimp as an example, epidemiological investigations showed that most major disease outbreaks were associated with the movement of live animals (broodstock, nauplii and postlarvae). Many aquatic animal diseases, once established, are often difficult to treat or to eradicate.

Biosecurity, as defined by the OIE, is a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population (including aquaculture). Pre-requisites for biosecurity programmes in aquaculture include: understanding of the overall aquaculture operations; general principles of disease development and transmission; and knowledge on fish/shellfish species cultured and maintained in an aquaculture environment. In general, the primary goal of a biosecurity program in aquaculture is to prevent the introduction of any pathogenic infectious organisms into the culture facilities. However, this is more difficult in practice, thus the goal may have to be modified to as a minimum eliminate or control

infectious diseases within the facility, prior to any movement and trade. Potential sources of pathogenic infectious organisms that can be introduced to any aquaculture facility include:

- Introduction of new stocks (including eggs, fry, fingerlings, juveniles, broodstock);
- Contaminated water or feed (especially unprocessed natural food);
- Human and animal interventions;
- Contaminated fomites;
- Intermediate carriers and vectors.

Proper evaluation and assessment of each of these sources are needed for effective biosecurity measures to prevent entry of infectious organisms into the facility. Thus, a sound biosecurity programme for aquaculture facility would incorporate:

- Risk assessments;
- Disease prevention;
- Disease monitoring, surveillance and reporting;
- Proper cleaning/disinfection between production cycles;
- Disease eradication

With the increasing incidence in transboundary spread of emerging and important aquatic animal diseases, aquaculture biosecurity is increasingly important. Although many Members in the Region still are lacking regulations on aquaculture biosecurity, some have made progress in formulating guidelines (e.g. Australia, Bangladesh, P.R. China, India, Indonesia, Malaysia, New Zealand, Thailand, and Viet Nam). However, considering the dominance of small-scale farmers in the industry which are considered a “weak link” in biosecurity, many Members still face a number of challenges in implementation of guidelines, especially at the farm level.

II. OBJECTIVES:

1. To collect and collate available information, existing regulations, biosecurity plans, industry standards/guidelines and awareness materials on aquaculture biosecurity from selected Members of OIE and/or NACA in the Asia-Pacific region;
2. To identify gaps and challenges in the implementation of such documents, especially at the farm level; and,
3. To develop a report to support Members in the Region in understanding how to utilise available resources and information to further improve their regulation, awareness materials and technical guidelines.

III. NOMINATION OF COUNTRY FOCAL POINTS

OIE and NACA sought nomination of Focal Points for this project from the eight selected countries in the region: Australia, Bangladesh, P.R. China, India, Indonesia, Malaysia, New

Zealand, Thailand and Viet Nam. Sample of the official letter is attached in Annex 1. The nominated Focal Points are listed in Table 1.

Table 1. Country Focal Points.

Country	Officer(s)
Australia	Dr. Yuko Hood Principal Science Officer, Aquatic Pest and Health Policy Section Animal Health Policy Branch Department of Agriculture, Water and the Environment Canberra
Bangladesh	Dr. Md. Nowsher Ali Assistant Director Department of Fisheries Matshabhaban, Ramna, Dhaka
PR China	Dr. Xuan Dong Associate Professor Yellow Sea Fisheries Research Institute Chinese Academy of Fishery Sciences Qingdao
India	Dr. Neeraj Sood (Principal Scientist) Dr. Anutosh Paria (Scientist) ICAR-National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh
Indonesia	Dr. Arif Taslihan Senior Researcher Main Center of Brackishwater Aquaculture Development Centre Jepara Jl. Cik Lanang, Rw. IV, Bulu, Jepara District, Central Java
Malaysia	Ms. Raja Yana Meleessa binti Raja Haroon Arashid Senior Fisheries Officer Fisheries Biosecurity Division Department of Fisheries Malaysia Ms. Anis Mazidah binti Abd Samad Senior Fisheries Officer Aquaculture Development Division Department of Fisheries Malaysia
New Zealand	Ms. Giulia Raponi Senior Advisor, Surveillance and Incursion Investigation (Aquatic Animal Health) P.O. Box 40742, Wallaceville 5140
Thailand	Mr. Nutthapong Wannapat Inland Aquaculture Expert Inland Aquaculture Research and Development Division Department of Fisheries

	<p>Ms. Nattakan Saleetid Fisheries Biologist Coastal Aquaculture Research and Development Division Department of Fisheries</p> <p>Ms. Jaree Polchana Aquatic Animal Health Research and Development Division Department of Fisheries</p>
Viet Nam	<p>Dr. Nguyen Ngoc Tien Chief, Aquatic Animal Health Management Division Department of Animal Health MARD, Hanoi</p>

IV. COLLECTION OF AQUACULTURE BIOSECURITY INFORMATION, REGULATIONS AND AWARENESS MATERIALS

The Focal Points were requested to collect and submit all relevant documents related to national and farm-level aquaculture biosecurity in their respective countries. Documents received and considered in this project are summarized in Table 2, except for Bangladesh wherein published materials were used, including: *Best Management Practices in Aquaculture in Bangladesh* (Azam and Chowdhury, 2017; in Giri, S.S. (editor) SAARC, p.116-138); and *Present Status of Good Aquaculture Practices (GAP) in Shrimp Farms of South-Western Coastal Area, Bangladesh* (Mondal *et al.*, 2013. Middle-East Journal of Scientific Research 14 (6): 873-878). Moreover, some of the important documents from P.R. China, Thailand and Viet Nam were translated into English.

Table 2. Selected regulations and awareness materials from the documents submitted by the participating countries.

Country	Regulations, Awareness Materials
Australia	<ul style="list-style-type: none"> • Aquaculture Farm Biosecurity Plan Generic Guidelines and Template • National Aquaculture Industry Biosecurity Survey • National Biosecurity Plan Guidelines for Land Based Abalone Industry • National Biosecurity Plan Guidelines for Barramundi Farms • National Biosecurity Plan Guidelines for Australian Oyster Hatcheries
P.R. China	<ul style="list-style-type: none"> • Biosecurity Law of the People's Republic of China (2020) • Law of the People's Republic of China on Animal Disease Prevention Act 2008 (updated 2021) • Specification for Biosafety Disposal of Animals Died of Diseases and Sick Animals (2017).
India	<ul style="list-style-type: none"> • Aquatic Exotics and Quarantine Guidelines/National Strategic Plan for Aquatic Exotics and Quarantine (2002) • Import of Livestock and Livestock Products (1962?)

	<ul style="list-style-type: none"> • The Prevention and Control of Infectious and Contagious Diseases in Animals Act 2009 • Biosecure Shrimp Farming Technology (2010) • Biosecurity and Quarantine Measures for Aquaculture Health Management (2015) • BMP in Shrimp Farming with Special Reference to West Bengal (2013) • Hand Book on Biosecurity Measures for Shrimp Farming (2010)
Indonesia	<ul style="list-style-type: none"> • National Strategy on Aquatic Animal Health and Environment • On-farm Biosecurity and Best Management Practices (BMPs) • Emergency Response Measures and Fish Disease Control
Malaysia	<ul style="list-style-type: none"> • Fisheries Act 1985 (updated 2012) • Malaysian Quarantine and Inspection Services Act 2011 • Feed Act 2009 (updated 2014) • Fisheries (Inland Fisheries Aquaculture) (Johor) Rules 2020 • Malaysian Quarantine and Inspection Services act 2011 • National Fish Health Strategy for Malaysia (2018-2022) • MyGAP Guidelines: Aquaculture Sector
New Zealand	<ul style="list-style-type: none"> • Biosecurity Act (1993) • Freshwater Fish Farming Regulations (1983) • National environmental standards for marine aquaculture (NES-MA) (2020) • Biosecurity handbook for farmers (2016) • Technical Guidance Document: High Level Biosecurity Management Plans Finfish (Land-based and Ocean Facilities) (2020) • Technical Guidance Document: High Level Biosecurity Management Plans Shellfish (Land-based and Ocean Facilities) (2020)
Thailand	<ul style="list-style-type: none"> • Good Aquaculture Practices for Ornamental Freshwater Animals Farm (2012) • Good Aquaculture Practices for Marine Shrimp Farm: Disease Free Marine Shrimp Production (2009) • Good Aquaculture Practices for Marine Shrimp Farm (2019) • Good Aquaculture Practices for Marine Shrimp Hatchery and Nursery (2018) • Good Aquaculture Practices for Hatchery of Disease Free Pacific White Shrimp (<i>Litopenaeus vannamei</i>) (2015) • Good Aquaculture Practices for Marine Bio-shrimp Farm (2011) • Good Aquaculture Practices for Freshwater Animal Hatchery and Nursery (2018) • Good Practices for Aquatic Animal Disease Control in Aquaculture Establishment (2012) • Guidelines on Biosecurity for Shrimp Culture (2011)
Viet Nam	<ul style="list-style-type: none"> • Fisheries Seed Production – Conditions of Food Safety, Bio-security and Environment (2009)

	<ul style="list-style-type: none"> • Establishment of Aquaculture for Human Consumption: Condition for Veterinary Hygiene (2011) • Aquatic Seed Production and Business Establishments - Condition for Veterinary Hygiene (2011) • Guidance on Integrated Measures for Control of Diseases in Shrimp (2010) • Guidance on Disease Prevention and Treatment in Shrimp • Guidance on Prevention and Treatment of Some Major Diseases in <i>Pangasius catfish</i> • Hepatopancreatic Microsporidiosis caused by <i>Enterocytozoon hepatopenaei</i> (EHP) in Shrimp • Guidance on Establishment of Disease-free Facilities of Aquatic Animals • Guidance on Shrimp Disease Surveillance at Shrimp Aquaculture Farm • Guidance on Prevention and Control of TiLV in Tilapia (2017) • Guidance on Prevention and Control of Disease Caused by DIV1 in Shrimp (2017)
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Overall, most countries do not have a single regulation which address aquaculture biosecurity in general. Specific biosecurity measures are included in various national regulations addressing disease prevention and control, best management practices, strategies on animal health and the environment, transboundary movement of live animals, and emergency response measures. Commodity and farm-level specific regulations are also available in most countries including Australia, India, Indonesia, Malaysia, New Zealand, Thailand and Viet Nam. All of the documents listed above were individually assessed, and important biosecurity measures were extracted and consolidated based on the following, and are summarized in Table 3:

- Risk Assessment;
- Record keeping;
- Training;
- Management measures to reduce disease transmission;
- Emergency procedures;
- Monitoring and audit;
- Disease reporting; and,
- Control measures after disease outbreak

Table 3. Summary of aquaculture biosecurity regulations from selected Asia Pacific countries.

Biosecurity Category	Country regulations AU -Australia; BD -Bangladesh; CN -P.R. China; IN -India; ID -Indonesia; MY -Malaysia; TH -Thailand; VN -Viet Nam
Risk Assessment	<ul style="list-style-type: none"> • Assessment of potential biosecurity risks of all inputs to the farm (animals, people, water, equipment and vehicles) for the purpose of animal disease prevention (AU, CN; NZ). • Assessment of biosecurity risk of waste products (dead animals, water, effluents (AU; NZ). • All proposals for introduction of exotic aquatic animal species must undergo two pre-import risk analysis including ecological and disease risks assessment (IN; ID)
Record Keeping	<p><u>Movement</u></p> <ul style="list-style-type: none"> • Keeping and provision of all movement records all animals onto the farm, within the farm and from the farm (AU; NZ) • Movement Document (MD) for all cultured aquatic animals (all stages: fry; fingerlings; adults) should be provided and kept for at least three years for traceability purposes (TH). • Broodstock and/or fry shall be accompanied by Aquatic Animal Purchasing Document (APD) or evidence of broodstock and/or fry source shall be made available (TH).
	<p><u>Health</u></p> <ul style="list-style-type: none"> • Keeping health monitoring records for different stock populations (disease, mortality, treatments, disease testing and relevant environmental information) (AU; NZ) • Regular monitoring of aquatic animal health including disease diagnosis, mortality, use of veterinary drugs, farm visits (by competent authority), result of targeted surveillance (if any, for specific disease(s)), and overall farm hygiene. Records should be kept for at least two years (TH; VN; ID). • Make and keep records on seed quality including certificates of quarantine, origin, quantity and quality of broodstock, production time, quantity and type of food, health status, and disease control measures. Records must be kept on file and must be longer than one production cycle of each species (VN; ID).
	<p><u>Production Operations</u></p> <ul style="list-style-type: none"> • Records of business registration and of every production step including source of feed, feeding, other production inputs (including drugs, their use and treatment protocols), water

	<p>quality, feed conversion ratio, harvest and sales (TH, CN; NZ, VN). Records should be kept for at least two years (TH; VN)</p> <ul style="list-style-type: none"> Records on isolation and disinfection and routine inspection of the farm premises (CN)
Training	<ul style="list-style-type: none"> Designation of a responsible person/staff for overseeing farm biosecurity; participation in training to understand disease risks to the farm and how to implement biosecurity and health management measures and farm emergency procedures (AU; NZ). Training for farm workers, government officials, veterinary inspectors, staff of national research laboratories and other relevant parties to acquire knowledge and skill on farm management such as the use of production inputs, record keeping, harvesting, awareness on relevant laws and regulations, general farm level disease diagnosis, epidemiology and prevention measures, aquatic animal health management and welfare, disease surveillance, emergency response, and prudent use of chemicals (TH; NZ; VN; ID; MY). Facility staff should be trained in the application of waste collection and disposal procedures to have relevant knowledge on proper cleaning protocols, disinfection of tools and work places, proper waste disposal, and water quality testing (TH; NZ). Special trainings on disease prevention should be given to staff responsible for collection, temporary storage, transportation and safe disposal of diseased animals and infected products (CN). Technical staff of aquaculture establishment have to be trained to meet the government requirements, including general and farm level biosecurity (VN; IN; ID). Capacity building for fish quarantine officers, fish disease, fish medicines, and monitoring residue inspectors, as well as fish vaccinators and field extension officers to support national fish health management (ID).
Management Measures to Reduce Disease Transmission	<p><u>Property Management</u></p> <ul style="list-style-type: none"> All farms, exporters and importers shall be duly registered with the Competent Authority and shall be involved in the implementation of the official control of fish health at the farm level, and designed and built to ensure biosecurity, efficiency and cost-effectiveness (MY; ID; BD) Installation of a secure perimeter fence or otherwise well-defined boundary and lockable entrances for the farm, unique and permanent identifiers for all production units (for example, sheds, ponds, tanks, raceways), and other appropriate features to prevent entry of wild animals into and escape of farmed animals from all production units (AU; NZ; VN; IN; ID).

	<ul style="list-style-type: none"> • Production units should be managed separately to reduce the risk of pest and pathogen spread within the farm. Staff should be assigned to production units based on risk (NZ). • All ponds and operation areas shall be labelled with numbers and types of usage for the convenience of farm management and effective prevention of disease spread (TH). • Farms shall be able to prevent entries of unauthorized visitors and vehicles (lock all entries during non-visitor hours), aquatic animal pests, and disease carrier animals (e.g. separate entry and exit gates; provision of disinfectants for vehicles and people entering the farm premises; no pets allowed in production areas) (TH; NZ; ID). • For establishments involved in importing activities of aquatic seeds, they must have isolation and quarantine places which must be separated from farming areas and easy to zone when disease outbreaks occur (VN). • Aquaculture farm site should be in an area where certain diseases are not enzootic, and proper pond preparation employed including removal of bottom sludge, ploughing of soil when wet, drying and liming. (IN; ID)
	<p><u>Personnel and Visitors</u></p> <ul style="list-style-type: none"> • Management of farm access for staff and visitors through provision of relevant signages and biosecurity measures prior to entry/exit (farm footwear, foot bath, hand washing facility); designation of personnel-in-charge for each production unit (AU; ID; MY). • Movement of people inside the farm should be restricted, and the number of workers during stocking, sampling and harvest should be minimized (IN). • All visitors should be briefed regarding on-farm biosecurity (AU; NZ). • Management of farm access for staff and visitors, and implementation of good personnel hygienic practices (farm footwear, hand/feed washing) in the culture facilities. Any staff or visitors who visited a farm (or any high risk visitors) shall not be allowed entry into the farm for at least one day, and for at least three days for those who visited a high-risk farm (TH; NZ; IN).
	<p><u>Animals (Introduction)</u></p> <ul style="list-style-type: none"> • Introduction of animals with known health status which is of equal or better status than animals on the farm, following a

	<p>documented consideration of pest and disease risks and should meet both national and international standards (AU; CN; NZ; ID).</p> <ul style="list-style-type: none"> • Live animals inspection prior to export at registered exporter premises or exit points before issuance of health certificate, and post-import inspection at importer premises (MY). • Mandatory quarantine for all imported live fish to prevent entry and spread of exotic and dangerous fish pest and diseases. Aquatic animals with unknown disease status and those that are found to be of high risk should be isolated in a dedicated quarantine facilities for monitoring, disease diagnosis and treatment, and only those with quarantine certificates (signed by licensed veterinarian) could enter the area or zone (AU; CN; NZ; IN; ID). • Live fish without a permit or in breach of any condition in a permit shall be prohibited for movement or introduction. State of cleanliness of fish (exported, imported or transported) and measures to avoid disease spread or release into natural environment shall be strictly followed (MY). • Clear origin of healthy and outstanding phenotype broodstock for production of high health fry/fingerlings; certified healthy and disease-free fry/fingerlings (e.g. SPF; SPR; genetically improved) should be introduced into the farm and only procured from registered hatcheries. Proof or evidence showing that the animals are disease-free shall be obtained from the laboratory approved by the relevant competent authority. Introduced animals should be acclimated and should have quarantine certificate issued by the competent veterinary authority (TH; VN; IN; ID; BD). <p><u>Animals (Movement)</u></p> <ul style="list-style-type: none"> • Movement of animals between different farm populations following consideration of the disease risks. If there is any disease outbreak (known or unknown pathogen), precautionary measures (prevent escape of cultured animals; control/exclusion of predatory animals; removal and proper disposal of dead animals) should be implemented to avoid contact with other farm populations (AU, NZ; IN). • In case of disease presence, movement of aquatic animals across the protected area shall be accompanied with documents as required by laws, and should be in line with the relevant provisions of the OIE Aquatic Animal Health Code (TH). • Specifically for shrimps, cultured animals shall be tested for the specified diseases prior to selling, and proof or evidence of the test shall be obtained from the laboratory approved by the relevant competent authority (TH).
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	<p><u>Equipment and Vehicles/Vessels</u></p> <ul style="list-style-type: none"> • Cleaning and disinfection of equipment, vehicles or vessels and other fomites prior to movement between units should be carried out and documented (AU, NZ; IN; MY) • Proper designation of delivery and loading areas in the farm (AU; NZ). • Ponds, equipment, materials and tools shall be properly prepared and disinfected periodically, every before and after use, and regularly maintained to prevent the introduction of aquatic animal diseases (TH; CN; VN; IN; ID). • Where possible, tools and equipment should be used exclusively in each production system, especially in case of sick or quarantined aquatic animals wherein the usage and storage of equipment and tools shall be separated from those used for healthy aquatic animals to prevent the spread of disease (TH; CN; NZ; VN). • Used disposable protective materials should be destroyed and properly disposed (CN).
	<p><u>Water</u></p> <ul style="list-style-type: none"> • For land-based farms, management of water inflow and outflow within the farm to avoid cross-contamination. For sea-based farms, proper site selection to maintain epidemiological separation of populations with different health status (AU; NZ). • Water shall be obtained from non-polluted sources with good quality for culture operations. There should be functional water inlet and outlet for efficient farm management and prevention of contamination. If necessary, water (and pond bottom) should be filtered and disinfected to eliminate carriers and pathogens prior to use in culture operation (TH; VN; IN; ID; BD). • Provision of water reservoir for stocking of culture water prior to use in culture ponds (e.g. shrimp grow-out). The use of filtration materials and disinfectants (e.g. chlorine) can be applied in reservoirs and culture ponds to eliminate unwanted organisms and pathogens. Reservoirs should be regularly cleaned and dried after each production cycle (TH, NZ; VN; ID). • Maintenance and monitoring of good water quality throughout the culture period (use of probiotics, provision of aerators, etc.) (IN) • Maintenance of infrastructures for decontamination/treatment of culture water (AU; NZ). • During the rearing process, water exchange should be minimized to reduce the risk of entry of infectious pathogens through water supplies (VN; IN).

	<p><u>Feeds</u></p> <ul style="list-style-type: none"> • Fish feed must be properly marketed in packet with all the necessary information (e.g. proximate composition, safety and quality parameters, production and expiry dates, quantity and quality indexes) (BD). • Preference on formulated feeds of high quality and sourced from approved manufacturer than live or unprocessed feeds, for better management of biosecurity risk (AU; TH; VN; IN; BD). • Proper storage of feeds and regular monitoring of feed consumption should be done (IN). • Live/natural foods when used shall be tested for specific disease (as they can be potential carriers of pathogens) and adequately treated (pasteurized, irradiated or otherwise processed to a standard) to ensure safety of the product; direct feeding of fresh feeds should not be practiced (TH; NZ; VN; IN; ID). <p><u>Waste</u></p> <ul style="list-style-type: none"> • Appropriate containment, handling and disposal of wastes (according to regulatory requirements) to minimize disease/pathogen transmission risk (AU; NZ). • Proper management of waste collection and disposal (including dead fish) shall be in place at all time. • Wastewater treatment ponds must have lower pond bottom than the culture ponds to avoid reverse osmosis, and must be separated from the farming areas and groundwater to avoid cross-infection (VN). • Proper wastewater and sludge treatment (e.g. application of burnt lime (CaO) at 100 ppm, followed by exposure of the pond bottom to sunlight until it dries and cracks) and disposal should be applied. In case of disease outbreak, wastewater shall be disinfected, with approved chemicals and proper duration of treatment, before discharge to prevent the risk of disease spread (TH; VN; IN; ID; MY).
<p>Emergency Procedures</p>	<ul style="list-style-type: none"> • Documentation of procedures for response to suspected emergency biosecurity incidents (AU). • Farm operations and management manual (signed by the owner or responsible personnel) should be made available and properly implemented. The farm should be prepared with relevant measures to effectively control, prevent and respond to emergencies (including diseases) (TH). • Farm biosecurity plans should include contingencies for direct (e.g. disease outbreak) and indirect (e.g. storms, earthquakes) incidences that may influence on-farm biosecurity (NZ). • All facility staff should understand the facility's contingency plans and their own role in the event of an emergency (NZ).

	<ul style="list-style-type: none"> Emergency harvesting (by cast net to avoid discharge of pond water) is recommended if mortality rate is increasing rapidly and if shrimps (or fish) are not feeding (IN).
Monitoring and Audit	<ul style="list-style-type: none"> Routine monitoring/review and audit (internal and third party) of farm/facility biosecurity plans and measures (AU; NZ). Audit on compliance to good aquaculture practices at the farm level by Compliance Auditors for approval of farm certification and re-certification. Registered farms should prepare GAP documents. The audit will be reviewed by the Fisheries Biosecurity Audit Committee (MY).
Disease Reporting	<ul style="list-style-type: none"> SOP for staff/farm technicians to notify the responsible manager and/or relevant authorities within 48 hours in the event of abnormalities, mortalities and outbreak of disease in the farm, for appropriate analysis and diagnosis, and rapidly take isolation and other control measures to prevent any spread of animal diseases (AUS; NZ; TH; CN; VN; IN; MY). Monthly evaluation of submitted disease reports at district and national levels, and published online through SSMPI (Software of Fish Disease Monitoring System) (ID). Implementation of disease surveillance programme to create awareness about major diseases, their management, reporting of major incidents of mortality, and the method of transporting diseased fish samples to nearby laboratories (IN). Inform neighboring farms on any disease outbreak in the farm, emergency harvest (if done), and the date and time of water discharge, and advise them not to intake water from canals (VN; IN; ID).
Control Measures after a Disease Outbreak	<ul style="list-style-type: none"> Removal and disposal of diseased animals, shutdown of movement of animals and materials, and disinfection of equipment and wastewater (AU). If disease outbreak occurs, production systems should be isolated from each other and the surrounding environment, and precautions should be taken to avoid contact with other facility populations until the cause is known and the situation resolved (NZ). Infected/dead animals should be removed, burned, boiled or buried in limed pits, ponds/tanks should be disinfected with approved chemicals (for at least one month), and wastewater properly treated and retained in ponds for at least 7 days prior to disposal (TH; CN; VN; IN; ID; MY). Slaughtering, trading and transportation of infected or suspected to be infected animals, or dead animals due to diseases or unknown causes, are prohibited (CN). Prohibition of people going in and out of areas having disease outbreak (VN).

	<ul style="list-style-type: none"> Specifically for harvestable sized shrimps/fish with suspected clinical signs, the farms have to notify the competent authorities, and then harvested (thru netting) and handled under the guidance of the competent authorities, and remain fallow for a period determined by the fisheries officer (VN; ID; MY).
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V. RECOMMENDED FARM-LEVEL AQUACULTURE BIOSECURITY MEASURES, APPLICABLE TO SMALL-SCALE FARMS

From the summarized aquaculture biosecurity measures above, appropriate farm-level measures were synthesized which can be adopted by aquaculture farms including small-scale farms, depending on their capacity to implement such measures. These can also be used as guidance in formulating farm-level aquaculture biosecurity measures by most countries in the region. It should be noted that, it is not obligatory for the farmers to implement every measure listed below if they are not capable, but this can serve as “guidelines” on what biosecurity measures they can implement based on their existing capacity (or when their capacity is enhanced in the future).

The following measures follow the abovementioned biosecurity criteria, from overall risk assessment to the implementation of control measures after a disease outbreak.

1. Risk Assessment

- Assessment of potential biosecurity risks of all transmission pathway inputs to the farm (animals, people, water, equipment and vehicles), vehicles and waste products (e.g. dead animals, wastewater, effluents), and mitigation measures for the purpose of animal disease prevention.

2. Record Keeping

- Keeping records on seed quality including certificates of quarantine, origin, quantity and quality of broodstock, production time, quantity and type of food, health status, and disease control measures. Records must be kept on file and must be longer than one production cycle of each species.
- Keeping health monitoring records of the cultured stocks (disease diagnosis, treatments/use of veterinary drugs, disease surveillance, farm visits by the CA, and overall farm hygiene); records should be kept for at least 2 years.

3. Training

- Designation of a responsible person/staff for overseeing farm biosecurity, and who should be trained to understand disease risks to the farm and how to implement:
 - biosecurity and health management measures;
 - farm level disease diagnosis and prevention;

- prudent use of chemicals;
- farm emergency procedures; and,
- collection and disposal of diseased animals and wastes.

4. Management Measures to Reduce Disease Transmission

4.1. Property management

- Installation of a secure perimeter fence or otherwise well-defined boundary and lockable entrances/exits for the farm and unique/permanent identifiers/labels for all production units (for example, sheds, ponds, tanks, raceways); and,
- Installation of other appropriate features to prevent entry of wild animals (including pets) into and escape of farmed animals from all production units.

4.2. Personnel and visitors

- Management of farm access for staff and visitors through provision of relevant signages and biosecurity measures prior to entry/exit (farm footwear, foot bath, hand washing facility; and,
- All visitors should be briefed regarding on-farm biosecurity. Any staff or visitors who visited another farm shall not be allowed entry into the farm for at least one day, and for at least three days for those who visited a high-risk farms.

4.3. Introduction of animals

- Only healthy and disease-free fry/fingerlings should be introduced into the farm, with proof or evidence obtained from the laboratory approved by the relevant competent authority; and,
- For broodstock, only those with known health status, which is equal or better than the animals in the farm and following a documented consideration of pest and disease risk (including quarantine certificate), should be used.

4.4. Movement of animals

- Movement of animals between different farm populations should highly follow consideration of disease risks; animals shall be tested for specific diseases, and proof or evidence of the test shall be obtained from the laboratory approved by the relevant competent authority; and,
- In case of disease presence (known or unknown pathogen), precautionary measures should be implemented to avoid contact with other farm populations, while movement across protected area shall be accompanied with documents as required by laws and in line with the relevant provisions of the OIE Aquatic Animal Health Code.

4.5. Equipment and vehicles/vessels

- Equipment, materials and tools shall be properly prepared and disinfected periodically or every before and after use, and regularly maintained to prevent the introduction of aquatic animal diseases;

- Where possible, tools and equipment should be used exclusively/separately in each production system especially when there is disease outbreak; and,
- Cleaning and disinfection of vehicles or vessels prior to movement between units should be carried out and properly documented.

4.6. Water

- Water shall be obtained from non-polluted sources with good quality for culture operations. If necessary, water (and pond bottom) should be disinfected and filtered to eliminate pathogens and unwanted organisms prior to use;
- There should be functional water inlet and outlet for efficient farm management and prevention of contamination; and,
- Provision of water reservoir for stocking of culture water prior to use in culture ponds (specifically for shrimp grow-out), where the use of filtration materials and disinfectants (e.g. chlorine) can also be applied to eliminate unwanted organisms and pathogens. Reservoirs should be regularly cleaned and dried after each production cycle.

4.7. Feeds

- Preference on formulated feeds of high quality and sourced from approved manufacturer than live or unprocessed feeds, for better management of biosecurity risk. Fish feed must be properly marketed in packet with all the necessary information (e.g. proximate composition, safety and quality parameters, production and expiry dates, quantity and quality indexes);
- Live/natural foods, when used, shall be tested for specific disease (as they can be potential carriers of pathogens) and adequately treated (pasteurized, irradiated or otherwise processed to a standard) to ensure safety of the product; direct feeding of fresh feeds should not be practiced.

4.8. Waste

- Proper management of waste containment, collection and disposal (including dead fish) shall be in place at all time and in accordance with regulatory requirements;
- Proper wastewater and sludge treatment and disposal should be applied; in case of disease outbreak, wastewater shall be disinfected, with approved chemicals and proper duration of treatment, prior to discharge in order to prevent the risk of disease spread.

5. Emergency Procedures

- Farm operations and management manual/document (signed by the owner or responsible personnel) should be made available and properly implemented; the farm should be prepared with relevant measures to effectively control, prevent and respond to biosecurity emergencies (including diseases); and,
- All staff should understand the facility's contingency plans and their own role in the event of an emergency.

6. Monitoring and Audit

- Where applicable, routine monitoring/review and audit (internal and third party) of farm/facility biosecurity plans and measures should be done.

7. Disease Reporting

- Staff/farm technicians should notify (as an SOP) the responsible manager and/or relevant authorities in the event of abnormalities, mortalities and outbreak of disease in the farm for appropriate analysis and diagnosis, and rapidly take isolation and other control measures to prevent any spread of animal diseases; and,
- Where appropriate, inform neighboring farms on any disease outbreak in the farm.

8. Control Measures after a Disease Outbreak

- Production systems should be isolated from each other and the surrounding environment, and precautions should be taken to avoid contact with other facility populations until the cause is known and the situation resolved;
- Infected animals should be properly removed and disposed (burned, boiled or buried in limed pits), and movement of animals and materials from the infected farm should be prohibited;
- Ponds/tanks should be disinfected with approved chemicals (for at least one month), and wastewater properly treated prior to disposal;
- Prohibition of people going in and out of areas having disease outbreak; and,
- Specifically for harvestable sized shrimps/fish with suspected clinical signs, the farms have to notify the competent authorities for guidance in undertaking emergency harvesting of cultured stocks.

VI. FARM-LEVEL AWARENESS MATERIALS RELATED TO AQUACULTURE BIOSECURITY

The implementation of different aquaculture biosecurity measures at the farm level has been facilitated in most countries through provision of farm-level awareness materials including:

- Species-specific guidelines (Australia, India and New Zealand; Refer to Table 2)
- Extension bulletins (P.R. China and India)
- Leaflets (P.R. China, Indonesia, Malaysia and Viet Nam)
- Guidebooks or farmers' handbook (P.R. China, Indonesia and New Zealand)
- Posters (P.R. China, Malaysia and Viet Nam)
- Fact sheets and reports (New Zealand)

India, in response to important emerging diseases, has published extension bulletins in 2016 on: Prevention and management of white spot disease of shrimps; Acute hepatopancreatic necrosis syndrome/early mortality syndrome (AHPND/EMS); and, Managing Hepatopancreatic Microsporidiosis.

P.R. China has published leaflets on several fish and shrimp diseases (in the local language) which are made available to farmers as handy references for disease identification and diagnosis (Figure 1).



Figure 1. Awareness leaflets on important diseases of cultured fish and shrimps in P.R. China.

Leaflets on shrimp viral diseases were also made available to the farmers in Indonesia (Figure 2; in local language) making them aware of these important biosecurity threats in shrimp aquaculture, and to apply relevant preventive measures. In Malaysia, a leaflet on good aquaculture practices (Figure 3) summarizes the relevant information for the aquaculture sector, including some aquaculture biosecurity measures.



Figure 2. Awareness leaflet on important diseases of cultured shrimps in Indonesia.



Figure 3. Awareness leaflet on Good Aquaculture Practices in Malaysia.

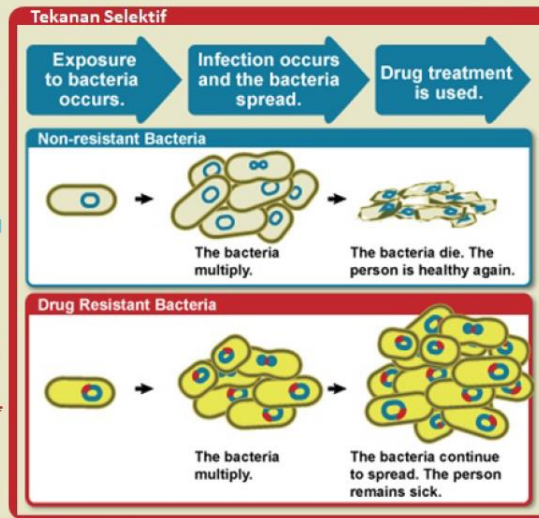
For Viet Nam, several leaflets were produced for fish and shrimp farmers covering different management and biosecurity measures. These include: Managing EHP at the farm; Disease surveillance in shrimps; Prevention and treatment of shrimp diseases; Prevention and treatment of pangasius disease; and, Attaining disease freedom (Figure 4). These leaflets were all published in their local language and contains all the contact numbers of the local CA for each province. Posters on antimicrobial use and resistance were produced by Malaysia (Figure 5) and Viet Nam (Figure 6), both in English and local languages. These posters guide the farmers on how AMR develops and on what antimicrobials to use and to avoid, which help them in the overall prevention and management of disease outbreaks, which is one important component of aquaculture biosecurity.

BAGAIMANA KERINTANGAN ANTIMIKROBIAL TERJADI?

Mikrob seperti bakteria, virus, fungal (kulat) dan parasit adalah organisma hidup yang berevolusi dari masa ke semasa. Fungsi utama mikrob adalah untuk membiak dan menyebarkan dengan cepat dan cekap. Oleh demikian, mikrob mengadaptasi kepada persekitarannya dan berubah untuk kemandiriannya (kelangsungan hidup). Sekiranya terdapat sesuatu yang menghalangya untuk membiak seperti **ANTIMIKROBIAL**, mikrob akan merubah genetiknya untuk kekal hidup. Apabila antimikrobia digunakan secara tidak bertanggungjawab dan tidak terkawal ia akan meningkatkan dan mempercepatkan kadar pembentukan kerintangan antimikrobia dalam mikrob.

Sumber:
<https://www.niaid.nih.gov/research/antimicrobial-resistance-causes>

- Terdapat beberapa kaedah perubahan genetik boleh berlaku:
- 1 Tekanan Selektif
 - 2 Mutasi
 - 3 Pindahan Gen



Highly Important Group
C11H12Cl2N2O2
 Amphenicols:
Chloramphenicol

Important Group
C6H7NO3
 Nitrofurans:
Nitrofurans derivatives

Critically Important Group
C23H27ClN9O31
 Glycopeptides:
Avoparcin

Important Group
C6H8N2O2
C7H8N2O2
 Nitroimidazoles:
Dimetridazole/ Metronidazole

WE NEED YOU
 TO HANDLE ANTIMICROBIALS WITH CARE

HANDLE ANTIMICROBIALS WITH CARE

Antimicrobials that are **BANNED** in Malaysia from use in aquatic animals for prevention and treatment purposes

Sources: [1] Poison Act 1952, [2] Feed Act 2009, [3] Food Act 1983, [4] DCF SOP Antibiotic Usage in Aquaculture Farm, [5] <https://pubchem.ncbi.nlm.nih.gov/compound/>

Figure 5. Awareness posters on antimicrobial resistance (top) and antimicrobial use (bottom) in Malaysia.

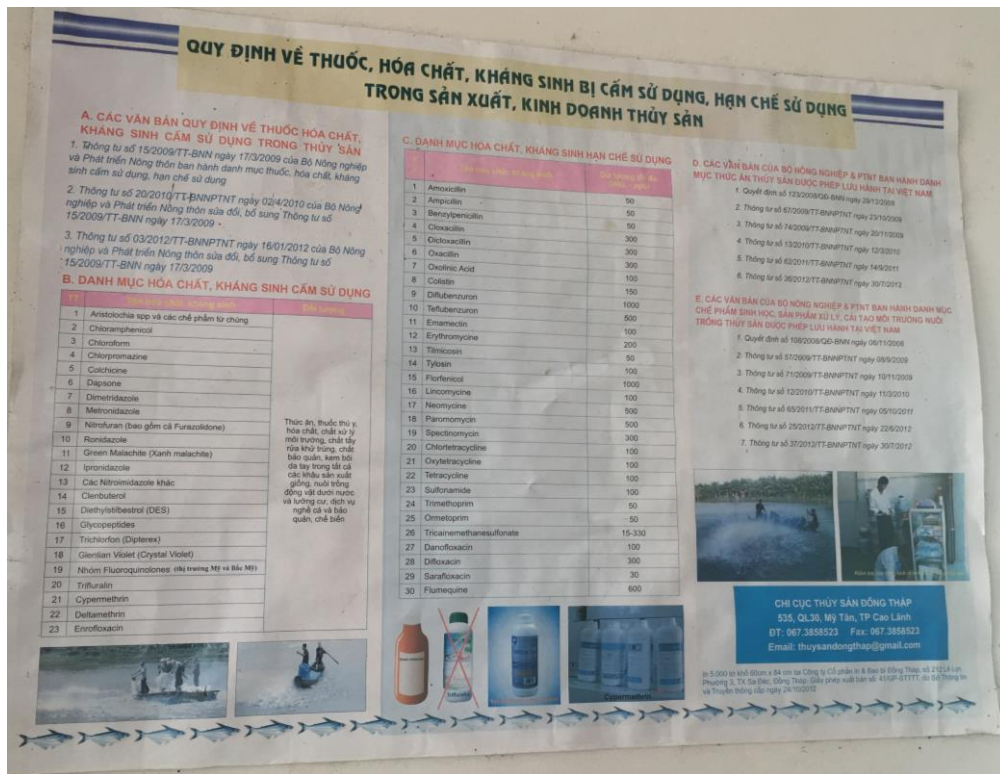


Figure 6. Awareness poster on antimicrobial use in Viet Nam.

For New Zealand, the Aquaculture Readiness Data (ARD) project looked at the country's readiness if an unwanted aquatic pest or disease was introduced. From 2010 to 2011, the Ministry of Primary Industries (MPI) collected information on marine and freshwater farm locations, stock, and water movements. The information was used to model how aquatic pests and diseases might spread over time. Identification of areas where pests and diseases could spread (called defined dispersion areas) will help in the management of future biosecurity threats. Several fact sheets were published for farmers' use in this regard including: Aquaculture biosecurity preparedness; Defining dispersion areas for aquatic pests and diseases; The need for quality data; and, Aquaculture readiness data project reports. All of these documents are downloadable at MPI website (www.mpi.govt.nz).

Based on the information presented above, it is highly recommended that farm-level awareness materials (in local languages) should be prepared for efficient implementation of the recommended biosecurity measures and other best farm management practices which can enhance the overall biosecurity of the farms. This is especially important due to the fact that there is no single national regulation (in most countries) that covers all important farm-level aquaculture biosecurity measures. The provision of awareness materials will definitely make the local farmers comprehend most of the important regulations, and help them implement basic aquaculture biosecurity measures at the least, that are appropriate for their respective farms.

VII. CASE STUDY ON HYBRID CATFISH FARMERS IN THAILAND ON THE IMPLEMENTATION OF FARM-LEVEL AQUACULTURE BIOSECURITY MEASURES

To assess the implementation of farm-level biosecurity measures, a simple survey questionnaires was developed in English (Table 4), and translated into Thai language by the staff of the Department of Fisheries Thailand (DOF; Annex 2). The farmers' survey was undertaken to partially fulfil objective number 2 of this project, that is on identifying gaps and issues (if any) in the implementation of farm-level biosecurity regulations and measures. The questions formulated were based on the summary information on biosecurity measures in Section III. A total of 22 hybrid catfish farmers were interviewed in the local language, with the assistance of DOF staff (Figure 7). Farmers' responses to the questions are also summarized in Table 4. All farmers practice monoculture of hybrid catfish, mostly under extensive culture system and few practicing semi-intensive (1 farm) and intensive (2 farms) systems. Majority of the farmers (81%) implement disease monitoring and surveillance and overall farm management measures, while only 63% practice disease prevention and control measures. Ninety percent (90%) of the farmers based their management practices on Thai Good Aquaculture Practices (GAP), which is one of the requirements for compliance for all registered aquaculture farms in Thailand. Around 60% of the farms have Farm Operation Manual which they implement during culture operations. Most of the farms are also located in an area where a particular reportable disease is non-endemic.



Figure 7. Selected farmers during the AMU/AMR workshop (by DOF Thailand) who were asked to fill-up the farm-level aquaculture biosecurity questionnaires with the assistance of DOF staff (left); farmer interview by DOF staff during one of the farm visits at Udon Thani (right). Photo by DOF-Thailand (left) and E.M. Leaña (right).

Table 4. Farm-level aquaculture biosecurity questionnaires and farmers' response (N=22).

	YES No. (%)	NO No. (%)
1) Do you implement any farm level plan or measures for: <ul style="list-style-type: none"> Disease prevention and control? Disease monitoring and surveillance? Overall farm management? 	14 (63.6) 18 (81.8) 18 (81.8)	4 (18.1) 1 (4.5)
2) From which these plans/measures are based on? <ol style="list-style-type: none"> Thai Good Aquaculture Practices Good Aquaculture Practices for Aquatic Animal Disease Control Guidelines on Biosecurity for Shrimp Culture Others (Please specify): 	20 (90.0) 11 (50.0) 0	
3) Do you keep records on: <ol style="list-style-type: none"> All movements of aquatic animals in the farm (e.g. fry, fingerlings, broodstock)? Seed/broodstock quality including certificates of quarantine, origin, and quantity? Health status of animals (disease, mortality)? Disinfection and routine inspection of the farm facilities? Use of drugs and chemicals? Visiting logs (vehicles, visitors, personnel) <p>If the answer to the above is "NO":</p> <ul style="list-style-type: none"> Do you think it is necessary to implement these? What are the issues for its non-implementation in the farm? <ul style="list-style-type: none"> Lack of regulations Lack of capacity Not needed in farm operation Others (Please specify) 	13 (59.1) 13 (59.1) 16 (72.7) 15 (68.2) 3 (13.6) 20 (90.0) 10 (45.4) 2 (9.0) 2 (9.0)	7 (31.8) 6 (27.2) 3 (13.6) 4 (18.1) 15 (68.2) 1 (4.5) 2 (9.0)
4) Do the farm staff receive training on: <ul style="list-style-type: none"> Farm management such as the use of production inputs, record keeping, harvesting, awareness on relevant laws and regulations? General farm level disease diagnosis, epidemiology and preventive measures? Disease risks to the farm and how to implement biosecurity and health management measures and farm emergency procedures? Waste collection and disposal procedures? Other trainings (Please specify): <p>If the answer to the above is "NO, do you think it is necessary to have these staff trainings</p>	19 (86.4) 17 (77.3) 19 (86.4) 18 (81.8)	1 (4.5) 1 (4.5) 1 (4.5) 1 (4.5)
5) Does the farm: <ul style="list-style-type: none"> Has a secure perimeter fence, lockable entrances, signages, and other appropriate features to prevent entry of wild animals into, and escape of farmed animals from all production units? Regulates entry of visitors and vehicles? Located in an area where a particular reportable disease is endemic? Implements good personnel/visitor hygienic practices (farm footwear, hands/feet washing) in the culture facilities? Use certified healthy seeds (with health certificate) for stocking? Remove dead aquatic animals and properly dispose them? Regularly clean and disinfect vehicles, farm equipment and materials, and other fomites before and after use? Properly disinfect wastes (sludge and wastewater) before discharge? <ul style="list-style-type: none"> Two farms do not release culture water at all. <p>If the answer to the above is "NO":</p>	20 (90.0) 13 (59.1) 2 (9.0) 10 (45.4) 15 (68.2) 17 (77.3) 15 (68.2) 14 (63.6)	1 (4.5) 6 (27.2) 19 (86.4) 11 (50.0) 6 (27.2) 5 (22.7) 7 (31.8) 7 (31.8)

<ul style="list-style-type: none"> • Do you think it is necessary to implement these? • What are the issues for its non-implementation in the farm? <ul style="list-style-type: none"> ○ Lack of regulations ○ Lack of capacity ○ Not needed in farm operation ○ Others (Please specify) <ul style="list-style-type: none"> ▪ Following the guidelines and recommendations of fish biologist (CA) and policy of the company 	7 (31.8)	
6) Does the farm use: <ul style="list-style-type: none"> • Non-polluted water with good quality for culture operations? • Filtration and/or disinfection of water before use? • Water reservoir as water source for culture ponds? • Fresh/raw feeds? <ul style="list-style-type: none"> ○ If YES, are the feeds treated (e.g. freezing, pasteurization) before use? • Formulated feeds? 	21 (95.5) 15 (68.2) 16 (72.7) 1 (4.5) 21 (95.5)	6 (27.2) 5 (22.7) 19 (86.4)
7) Does the farm has and implementing “Farm Operation Manual”?	13 (59.1)	3 (13.6)
8) Does the farm perform emergency procedures when there is disease outbreak? <ul style="list-style-type: none"> • Emergency harvesting • Killing/discarding of infected stocks • Disinfection of equipment, water and wastes • Drying of ponds/tanks • Other emergency procedures (Please specify): <ul style="list-style-type: none"> ○ One farm notifies veterinarian or fish health expert. ○ One farm did not experience any disease problem <p>If the answer to the above is “NO”:</p> <ul style="list-style-type: none"> • Do you think it is necessary to implement these? • What are the issues for its non-implementation in the farm? <ul style="list-style-type: none"> ○ Lack of regulations ○ Lack of capacity ○ Not needed in farm operation ○ Others (Please specify): <ul style="list-style-type: none"> ▪ Two farms follow the recommendations of the company. 	11 (50.0) 14 (63.6) 12 (54.5) 16 (72.7) 5 (22.7) 2 (9.0)	8 (36.3) 6 (27.2) 6 (27.2) 2 (9.0)
9) Does the responsible farm technician: <ul style="list-style-type: none"> • Report any mortality, abnormalities or disease outbreaks to the competent authority? • Inform neighboring farms on any disease outbreak in the farm? <p>If the answer to the above is “NO”:</p> <ul style="list-style-type: none"> • Do you think it is necessary to implement these? • What are the issues for its non-implementation in the farm? <ul style="list-style-type: none"> ○ Lack of regulations ○ Lack of capacity ○ Not needed in farm operation ○ Others (Please specify) 	21 (95.5) 15 (68.2) 3 (13.6) 1 (4.5) 2 (9.0)	1 (4.5) 5 (22.7)

Although most farms are practicing extensive culture system, majority keep records on aquatic animal movements, health certificates, health status of cultured animals, disinfection and routine inspection of farm facilities, as well as visitors log. Few farms, however, keep record on drug use due to the fact that most farmers do not use drugs during their culture operations. Most farm technicians and personnel also received relevant trainings (mostly

from DOF) on overall farm management, disease diagnosis, monitoring and control, farm-level biosecurity, and waste management. Moreover, farmers implement basic on-farm biosecurity measures including installation of perimeter fences/nettings around the farm (Figure 8), regulating entry of visitors, use of healthy/certified seeds, regular cleaning of farm materials/equipment/vehicles, use of non-polluted water, water disinfection (if needed), drying of ponds (after culture operation), and proper removal and discharge of dead fish and wastes.



Figure 8. Perimeter nettings around a catfish farm in Udon Thani, one of the basic farm-level biosecurity measures applied by the farmers during culture operations. Photo by DOF-Thailand.

Farm technicians (95%) also report any abnormality, mortality or disease presence to the CA, but only 68% inform neighboring farms of any disease outbreak in their respective farm. One important characteristics of the hybrid catfish farmers is their non-usage of raw/fresh feeds (almost all of the respondents use formulated feeds). Although raw/fresh feeds are good for growth of cultured catfish (as they are carnivores), its use in catfish ponds often result to adverse effect on water quality which can enhance disease incidence. It also entails higher cost compared to formulated feeds, and not readily available in inland areas. Moreover, raw/fresh feeds might also be contaminated with some toxic substances which can eventually affect the quality of the produced catfish (T. Laoprasert, pers. comm.).

For the biosecurity measures that are not implemented by the farmers, many think that such measures are important and should be implemented when necessary. Some of the reasons

for the non-implementation are the lack of capacity for the farm/farmers, and the non-necessity of some of the measures for the current farm's culture operation.

Overall, although the survey undertaken was limited to just one type of aquaculture farm in Thailand, it is noteworthy that basic farm-level aquaculture biosecurity measures are being practiced by most farms following the recommended GAP by the DOF. For other aquaculture commodities (e.g. shrimps hatchery and grow-out) in Thailand which are produced mostly under semi-intensive and intensive systems, it can be deduced from this survey that more strict farm-level biosecurity measures are being implemented by concerned farmers, especially for the purpose of preventing outbreaks of important diseases which will have a great impact on the overall production. It is, therefore, recommended that a similar survey be undertaken in selected countries in the region, to properly assess the farm-level aquaculture biosecurity measures that are implemented, especially by small-scale farmers.

VIII. NATIONAL AQUACULTURE INDUSTRY BIOSECURITY SURVEY: AN ASSESSMENT OF ENTERPRISE LEVEL BIOSECURITY IN AUSTRALIA



This report is based on the powerpoint presentation of Dr. Olivia Liu (Aquatic Pest and Health Quality, Australian Government Department of Agriculture, Water and Environment) during the 5th Australasian Scientific Conference on Aquatic Animal Health & Biosecurity (2019). The document was provided to the current project by Dr. Yuko Hood (Focal Point of Australia). A total of 122 farm owners and managers were surveyed from August to November 2018, which aimed to support farmers to implement biosecurity plans in a manner that is fit for purpose and balances practicality, cost and regulatory priorities. The survey was undertaken through computer assisted telephone interviews (CATI) as well as online responses. The survey included farms culturing abalone, barramundi, oysters (edible and pearl), prawns, salmonids, southern bluefin tuna and yellowtail kingfish.

The survey focused on: Awareness, understanding and attitudes towards biosecurity; Aquatic animal disease monitoring and reporting behaviours; Biosecurity tools and practices currently used on farm; Understanding and uptake of on-farm biosecurity plans; Preferred support tools to develop and implement on-farm biosecurity plans; and, Preferred information sources and requirements.

Self-assessment showed that 84% of the farmers believed that their awareness on aquaculture biosecurity had grown in the past 3 years. This was primarily due to: disease incursions; training; awareness of surveillance; and, awareness of trade requirements of specific sectors. Most respondents also indicated that record keeping tools and biosecurity management practices are commonly used on farms. Majority of the respondents also indicated that they have farm biosecurity plans which are reviewed and audited at least once a year. Overall, key findings of the survey were:

- Increase education about shared responsibility for biosecurity.
- Maintain positive attitudes towards improvement of biosecurity measures at aquaculture farms.
- Continue efforts in communicating biosecurity measures both pre-border and at the border.
- Support and strengthen the first actions of farmers.
- Develop support tools or mechanisms to improve on-farm biosecurity plans:
 - sector-specific biosecurity plans;
 - on-farm biosecurity plan writing workshops; and,
 - auditor training.

Annex 1. Sample of official letter requesting nomination of country focal points for the project.



20 January 2021

Dr. Ir Slamet Soebjakto
Director General
Directorate General of Aquaculture
Ministry of Marine Affairs and Fisheries
INDONESIA

Subject: Collection and Evaluation of Existing Guidelines and Awareness Materials on Aquaculture Biosecurity for Small-Scale Farms in the Asia-Pacific Region

Dear Dr. Ir Slamet Soebjakto

The World Organisation for Animal Health (OIE) and the Network of Aquaculture Centres in Asia-Pacific (NACA) are undertaking the abovementioned project in selected countries in the Asia Pacific Region with aquaculture production. The project aims to:

1. Collect and collate available information, existing regulations, and awareness materials on aquaculture biosecurity from the selected countries;
2. Identify gaps and challenges in the implementation of such documents, especially at the farm level; and
3. Develop a report to support Members in understanding how to utilise the available resources or further improve their regulations, awareness materials, and technical guidelines.

In this regard, we are requesting your organization to kindly direct us to the relevant officer(s) in your country responsible for the formulation and implementation of relevant biosecurity regulations and technical guidelines related or referring to the aquaculture sector. Note that any unpublished information provided to us by your country will be for the sole use of the OIE and NACA for reference. Moreover, a copy of relevant reports prepared under this project will be shared to all the participating countries.

We would appreciate your full support to nominate/direct to the officer in charge and share his/her contact details with us.

Thank you very much and looking forward to your positive reply and support to this project.

Sincerely,

釘田博文

Dr. Hirofumi Kugita
Regional Representative
OIE Regional Representation
for Asia and the Pacific



Dr. Jie Huang
Director General
NACA

cc: Dr. Nasrullah Nasrullah, OIE Delegate, Indonesia
Dr. Christina Retna Handayani, OIE Focal Point for Aquatic Animals, Indonesia

Annex 2: Farm-level biosecurity questionnaires translated into Thai language.

แบบสอบถามความปลอดภัยทางชีวภาพระดับฟาร์ม

ข้อมูลฟาร์ม

ชื่อฟาร์ม (ผู้ตอบแบบสอบถาม):

ที่อยู่:

สัตว์น้ำชนิดหลักที่เพาะเลี้ยง:

สัตว์น้ำชนิดอื่นๆ ที่เพาะเลี้ยง:

ระบบการเลี้ยง (ทำเครื่องหมายในช่องที่เหมาะสม): การเลี้ยงแบบชนิดเดียว การเลี้ยงแบบหลายชนิด

การเลี้ยงแบบผสมผสาน การเลี้ยงแบบธรรมชาติ

การเลี้ยงแบบกึ่งพัฒนา การเลี้ยงแบบพัฒนา

	ใช่	ไม่
<p>10) ท่านใช้แผนความปลอดภัยทางชีวภาพหรือมาตรการระดับฟาร์มสำหรับ:</p> <ul style="list-style-type: none"> ● การป้องกันและควบคุมโรค ● การติดตามและเฝ้าระวังโรค ● การจัดการฟาร์มโดยรวม 		
<p>11) แผนความปลอดภัยทางชีวภาพหรือมาตรการเหล่านี้ยึดตามมาตรฐานอะไร</p> <p>5. มาตรฐานการปฏิบัติทางการเพาะเลี้ยงสัตว์น้ำที่ดี (GAP)</p> <p>6. การปฏิบัติที่ดีสำหรับการควบคุมโรคสัตว์น้ำในสถานประกอบการ</p> <p>7. แนวทางในการรักษาความปลอดภัยทางชีวภาพในการเพาะเลี้ยงกุ้งทะเล</p> <p>8. อื่น ๆ (โปรดระบุ):</p>		
<p>12) ท่านเก็บบันทึก:</p> <p>7. การเคลื่อนย้ายสัตว์น้ำในฟาร์ม (เช่น ลูกปลา, ปลานิว, พ่อแม่พันธุ์)</p> <p>8. ลูกพันธุ์/พ่อแม่พันธุ์ พร้อมใบรับรองการกักกัน แหล่งกำเนิด และปริมาณ</p> <p>9. สุขภาพของสัตว์น้ำ (โรค, การตาย)</p> <p>10. การฆ่าเชื้อและการตรวจสอบสิ่งอำนวยความสะดวกภายในฟาร์ม</p> <p>11. การใช้ยาและสารเคมี</p> <p>12. บันทึกการเข้าฟาร์ม (ยานพาหนะ ผู้เยี่ยมชม บุคลากร)</p> <p>หากคำตอบข้างต้นคือ “ไม่”:</p> <ul style="list-style-type: none"> ● ท่านคิดว่าจำเป็นต้องดำเนินการเหล่านี้หรือไม่ ● ปัญหาของการไม่ดำเนินการในฟาร์ม <ul style="list-style-type: none"> ○ ขาดข้อบังคับ ○ ขาดความสามารถ ○ ไม่จำเป็น ○ อื่น ๆ (โปรดระบุ): 		

	ใช่	ไม่
<p>13) เจ้าหน้าที่ฟาร์มได้รับการอบรมเรื่อง:</p> <ul style="list-style-type: none"> ● การจัดการฟาร์ม เช่น การใช้ปัจจัยการผลิต การเก็บบันทึก การเก็บเกี่ยว การตระหนักในกฎหมายและข้อบังคับที่เกี่ยวข้อง ● การวินิจฉัยโรคทั่วไประดับฟาร์ม ระบาดวิทยา และมาตรการป้องกัน ● ความเสี่ยงต่อโรคในฟาร์มและวิธีการใช้มาตรการรักษาความปลอดภัยทางชีวภาพ การจัดการสุขภาพและขั้นตอนฉุกเฉินฟาร์ม ● ขั้นตอนการรวบรวมและกำจัดของเสีย ● อื่น ๆ (โปรดระบุ): <p>หากคำตอบข้างต้นคือ “ไม่” ท่านคิดว่าจำเป็นต้องมีการฝึกอบรมพนักงานเหล่านี้หรือไม่</p>		
<p>14) ลักษณะฟาร์ม:</p> <ul style="list-style-type: none"> ● มีรั้วรอบขอบชิดที่ปลอดภัย ประตูทางเข้าที่ล็อกได้ ป้าย และคุณลักษณะที่เหมาะสมอื่นๆ เพื่อป้องกันไม่ให้สัตว์เข้าออกจากหน่วยการผลิตทั้งหมด ● ควบคุมการเข้าของผู้เข้าชมและยานพาหนะ ● ตั้งอยู่ในพื้นที่ที่มีโรคประจำถิ่น ● ปฏิบัติตามแนวทางปฏิบัติด้านสุขอนามัยของบุคลากรและผู้เยี่ยมชม (รองเท้าในฟาร์ม การล้างมือ และทำ) ในสถานประกอบการเพาะเลี้ยงสัตว์น้ำ ● ใช้ลูกพันธุ์ที่ผ่านการรับรอง (มีการรับรองสุขภาพ) ในการเพาะเลี้ยง ● กำจัดสัตว์น้ำที่ตายแล้วและกำจัดทิ้งอย่างเหมาะสม ● ทำความสะอาดและฆ่าเชื้อยานพาหนะ อุปกรณ์และวัสดุในฟาร์ม และพาหะอื่นๆ อย่างสม่ำเสมอและหลังการใช้งาน ● ฆ่าเชื้อของเสีย (ตะกอนและน้ำเสีย) อย่างเหมาะสมก่อนปล่อยออก <p>หากคำตอบข้างต้นคือ “ไม่”:</p> <ol style="list-style-type: none"> 1. ท่านคิดว่าจำเป็นต้องดำเนินการเหล่านี้หรือไม่? 2. ปัญหาของการไม่ดำเนินการในฟาร์ม <ol style="list-style-type: none"> 2.1 ขาดข้อบังคับ 2.2 ขาดความสามารถ 2.3 ไม่จำเป็น 2.4 อื่น ๆ (โปรดระบุ): 		
<p>15) ฟาร์มใช้:</p> <ul style="list-style-type: none"> ● การรักษาคุณภาพของน้ำด้วยการจัดการการเลี้ยงที่ดี ● การกรองและการฆ่าเชื้อน้ำก่อนใช้งาน ● อ่างเก็บน้ำเป็นแหล่งน้ำสำหรับบ่อเพาะเลี้ยง ● อาหารสดหรือดิบ <ul style="list-style-type: none"> ○ ถ้า ใช่ มีการจัดการอาหาร (เช่น การแช่แข็ง การพาสเจอร์ไรส์) อาหารก่อนใช้ ● สูตรอาหาร 		

	ใช่	ไม่
16) ฟาร์มมีการดำเนินการ “คู่มือการใช้งานฟาร์ม” หรือไม่?		
<p>17) ฟาร์มดำเนินการตามขั้นตอนฉุกเฉินเมื่อมีโรคระบาดหรือไม่</p> <ul style="list-style-type: none"> • การเก็บเกี่ยวฉุกเฉิน • การทำลายสัตว์น้ำที่ติดเชื้อ • การฆ่าเชื้ออุปกรณ์ น้ำ และของเสีย • การตากบ่หรือถัง • ขั้นตอนฉุกเฉินอื่นๆ (โปรดระบุ): <p>หากคำตอบข้างต้นคือ “ไม่”:</p> <ol style="list-style-type: none"> 1. ท่านคิดว่าจำเป็นต้องดำเนินการเหล่านี้หรือไม่? 2. ปัญหาของการไม่ดำเนินการในฟาร์ม <ol style="list-style-type: none"> 2.1 ขาดข้อบังคับ 2.2 ขาดความสามารถ 2.3 ไม่จำเป็น 2.4 อื่น ๆ (โปรดระบุ): 		
<p>18) นักวิชาการประจำฟาร์ม:</p> <ul style="list-style-type: none"> • รายงานการตาย ความผิดปกติ หรือการระบาดของโรคต่อเจ้าหน้าที่ที่รับผิดชอบ • แจ้งฟาร์มใกล้เคียงเมื่อมีโรคระบาดในฟาร์ม <p>หากคำตอบข้างต้นคือ “ไม่”:</p> <ol style="list-style-type: none"> 1. ท่านคิดว่าจำเป็นต้องดำเนินการเหล่านี้หรือไม่? 2. ปัญหาของการไม่ดำเนินการในฟาร์ม <ol style="list-style-type: none"> 2.1 ขาดข้อบังคับ 2.2 ขาดความสามารถ 2.3 ไม่จำเป็น 2.4 อื่น ๆ (โปรดระบุ): 		