

COMMITTEE ON INLAND FISHERIES AND AQUACULTURE OF AFRICA

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FISH DISEASE AND ENVIRONMENTAL CONSTRAINT: INTRODUCTION TO THE PROGRESSIVE MANAGEMENT PATHWAY FOR IMPROVING AQUACULTURE BIOSECURITY (PMP/AB)

Executive Summary

This information document introduces a new initiative, the Progressive Management Pathway for improving aquaculture biosecurity (PMP/AB), its concept, principles, and benefits described. The PMP/AB focuses on building management capacity through combined bottom-up/top-down approaches with strong stakeholder engagement to promote the application of risk management at the producer and sector levels as part of the national approach. The planning processes bring stakeholders together and provide the basis for the national public and private co-management of biosecurity. It establishes risk ownership and promotes active engagement and long-term commitment to risk management. The PMP/AB harnesses the opportunity of aquaculture production in a sustainable manner that is sufficiently responsive to environmental and anthropological challenges through enabling policy environments to foster the adoption of sound aquaculture production practices.

The process for the development of the PMP/AB included several steps, namely: (1) understanding the drivers, factors and pathways to aquatic animal disease emergence categorized into four major areas; (2) three multi-stakeholder consultants that involved the participation of governments, producers and the academe that debated and clarified the concepts, principles, benefits and application; and (3) presentation as an agenda during the 10th session of the Sub-Committee on Aquaculture of the Committee on Fisheries (COFI/SCA 10) held in Trondheim, Norway in August 2019.

The COFI/SCA 10 endorsed the PMP/AB and supported the requested action to develop a long-term, multi-donor supported programme on Aquaculture Biosecurity.

CIFAA and its members are encouraged to support the decisions of the COFI/SCA 10 on improving aquaculture biosecurity and to: (1) discuss how to further understand and raise awareness about PMP/AB, (2) discuss the five major pillars of the planned Aquaculture Biosecurity programme, determine which among the five pillars are most relevant to African aquaculture and can be prioritised at the short-, medium- and long-term; and (3) discuss mechanisms how resources can be mobilized in order to support the aspirations for a sustainable aquaculture through the PMP/AB and the long-term programme on Aquaculture Biosecurity. Consider the recommendations associated with the Progressive Management Pathway for Improving Aquaculture Biosecurity and deliberate its context for regional inland fisheries and aquaculture.

The committee is invited to: Consider the recommendations associated with the Progressive Management Pathway for Improving Aquaculture Biosecurity and deliberate its context for regional inland fisheries and aquaculture.

I. INTRODUCTION

1. Biosecurity is recognized as a major aquaculture challenge and has thus received great attention both at SCA and COFI levels.
2. Biosecurity, as defined by FAO, is a strategic and integrated approach that encompasses both policy and regulatory frameworks aimed at analysing and managing risks relevant to human, animal and plant life and health, including associated environmental risks. It covers food safety, zoonoses, introduction of animal and plant diseases and pests, introduction and release of living modified organisms (LMOs) and their products (e.g. GMOs), and the introduction of invasive alien species.
3. Biosecurity is a core concept to prevent and control the occurrence and spread of infectious diseases and needs to be incorporated into governmental regulations as well as farm operational plans. Effective governance at all levels (i.e. at both policy/ legislation and farm levels) determines the sustainability of the aquaculture sector. Biosecurity is also a major player in the “One Health” concept towards reducing antimicrobial resistance and zoonotic diseases from farmed aquatic animals and their environment.
4. Disease challenges must be properly handled for the aquaculture industry to be truly sustainable. The number of disease outbreaks, responses, and economic losses reflect the immaturity of the aquaculture industry and the current gaps in governance of aquatic animal health. Estimates of economic losses due to diseases in aquaculture exist but, due to a lack of systematic methods for assessing economic impacts of aquatic animal diseases, are difficult to validate. Table 1 shows some information on the economic impacts of aquatic animal diseases, available from the literature.

Table 1. Some information available in the literature on the economic impacts of aquatic animal diseases

Period	Species	Disease	Losses (USD)	Reference ¹
1987-1994	Shrimp	Several pathogens	3 019 million	Israngkura and Sae-Hae, 2002
1998-1999	Salmon	Infectious salmon anaemia	39 million	Hastings <i>et al</i> 1999
2010-2017	Shrimp	Acute hepatopancreatic necrosis disease (AHPND)	12 billion	Shinn <i>et al</i> 2018
2015	Shrimp	AHPND	>26 million	Shinn <i>et al</i> 2018
2017	Tilapia	Several pathogens	450 million	Annual Report on Aquatic Animal Health in China 2017
2017	Shrimp	Several pathogens	1.6 billion	Annual Report on Aquatic Animal Health in China 2017
2017	Oysters	Several pathogens	540 million	Annual Report on Aquatic Animal Health in China 2017
2017	Seaweed	Several pathogens	180 million	Annual Report on Aquatic Animal Health in China 2017

5. Disease remains an economic and societal challenge. If disease challenges are not properly handled, an aquaculture industry will not be sustainable. Focusing on disease prevention is a sign of a maturing industry, but this needs to be supported by governance and innovation.
6. A systematic way of assessing the economic and social impacts of aquatic animal diseases provides a better picture of their adverse impacts and economic consequences, thus giving

¹ Israngkura, A., Sae-Hae, S., 2002. A review of the economic impacts of aquatic animal diseases, pp. 253–286. In: Arthur, J.R., Phillips, M.J., Subasinghe, R.P., Reantaso, M.B., MacRae, I.H. (Eds.). Primary Aquatic Animal Health Care in Rural, Small-Scale, Aquaculture Development. FAO Fish. Tech. Pap. No. 406; Hastings, T.S., Olivier, G., Cusack, R., Bricknell, I.R., Nylund, A., Binde, M., Munro, P., Allen, C., 1999. Infectious salmon anaemia. Bull. Eur. Assoc. Fish. Pathol. 19, 268–288; Shinn, A.P., Pratoomyo, J., Griffiths, D., Trong, T.Q., Vu, N.T., Jiravanichpaisal, P., and Briggs, M. 2018. Asian shrimp production and the economic costs of disease. Asian Fisheries Science 31S: 29-58; Annual Report on Aquatic Animal Health in China (2017)

decision makers (at the policy, production and service provider levels) an indication of the extent to which poor health status can disrupt economic production.

7. Understanding the economic impact of disease is essential for calculating opportunity costs and potential savings of biosecurity and preventive measures, and providing guidance on where best to channel limited resources as well as investment opportunities.

II. DRIVERS, FACTORS and PATHWAYS to AQUATIC ANIMAL DISEASE EMERGENCE

8. Globally, the trend in aquaculture is that serious TAAD emerge, spread rapidly and cause major production losses approximately every three to five years. There is often a long time lapse (usually years) from the time that a serious mortality event caused by an unknown and emerging pathogen is observed in the field, to its subsequent identification and confirmation, to global awareness, the establishment and implementation of surveillance and reporting/notification systems and cost-effective risk management measures.
9. The long list of drivers/factors/pathways for aquatic disease emergence in aquaculture can be considered in four general categories:
 - *trade and movement of live animals and products.* Fish is a highly traded commodity, especially internationally, and many forms of live animals (e.g. larvae, fry, adults) or their products (live, fresh, frozen) are traded; invasive animals and pathogens can be transferred at the same time.
 - *knowledge of pathogens and their hosts:* Due to the unique aquatic medium, the health of a cultured population is not readily apparent. The large number of species kept in a variety of culture systems (almost 600 species farmed globally in 2016) implies that knowledge on new diseases and host susceptibility will always be lagging behind aquaculture development. There is slow collective awareness of new threats, a lack of basic pathogen data (e.g. transmission routes), and a lack of basic host data (e.g. immunity, genetics). Diagnostics are usually focused on known/listed diseases. Breeding strategies with AAH management elements are not in place for many species.
 - *aquatic animal health (AAH) management:* Factors that limit effectiveness of biosecurity measures include: multiple institutions involved in aquaculture production and AAH management (i.e. fisheries/aquaculture and veterinary authorities); lack of, inadequate or poorly implemented biosecurity strategies at the farm, sector and national levels; low capacity for response to emergencies; weak implementation of international standards; weak regulatory framework and enforcement; mismatch between research agendas and farmer/commodity sector needs; and weak public-private sector partnerships.
 - *ecosystem changes:* Aquatic ecosystems change through direct human activity (dams, community expansion, etc.) and indirect impacts (climate change, global pollution, etc.). Farming in these situations is complicated by the physiology of the animals, e.g. poikilothermic constraints to adaptation, emergence of pathogens, and changing geographic ranges of wild stocks, microbes and parasites as environmental factors change near the tolerance levels for hosts and disease agents.
10. Understanding the above has led FAO to develop a new paradigm, a new thinking, a new initiative to reverse the aforementioned global trend on aquatic animal disease emergence driven by the four major categories as discussed above.

III. THE PROGRESSIVE MANAGEMENT PATHWAY TO IMPROVE AQUACULTURE BIOSECURITY: A new initiative

11. The Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB) is an extension of the 'Progressive Control Pathways' (PCP) used for controlling major livestock and

zoonotic diseases. It focuses on building management capacity through combined bottom-up/top-down approaches with strong stakeholder engagement. It aims at promoting the application of risk management at the producer and industry levels, as part of a coordinated national approach. PMP/AB is thus a new initiative that FAO and partners are promoting after a consensus was reached during two multi-stakeholder meetings held at World Bank headquarters in Washington D.C. (April 2018²) and at OIE headquarters in Paris (January 2019³), and a Technical Working Group meeting held at FAO headquarters (March 2019⁴).

12. The above events provided solid evidence of wide ranging consensus and a better understanding of the pathway, clear definitions of PMP/AB and aquaculture biosecurity, expectations of various stakeholders, the use of a ‘step-wise’ approach, principles and benefits, examples of country entry points and examples of PMP/AB tools.
13. The PMP/AB refers to a pathway aimed at enhancing aquaculture biosecurity capacity by building on existing frameworks, developing capacity in the application of appropriate tools and risk-based approaches, and public-private partnerships.
14. The PMP/AB is expected to result in *sustainable*:
 - a. *reduction* of burden of disease
 - b. *improvement* of health at farm and national levels
 - c. *minimization* of global spread of diseases
 - d. *optimization* of socio-economic benefits from aquaculture
 - e. *attraction* of investment opportunities into aquaculture; and
 - f. *achievement* of One Health goals
15. In the context of PMP/AB, *aquaculture biosecurity* refers to the cost-effective management of risks posed by pathogenic agents to aquaculture through a strategic approach at enterprise, national and international levels with shared public-private responsibilities.
16. The PMP/AB consists of four stages (see Figure 1), namely:
 - a. Stage 1 – biosecurity strategy developed using a risk-based approach;
 - b. Stage 2 – biosecurity measures/systems implemented;
 - c. Stage 3 – biosecurity and preparedness enhanced; and
 - d. Stage 4 - sustainable biosecurity and health management systems established to support national aquaculture sector.
17. At Stage 1, key considerations and outcomes include: production chain mapping; description of the current situation and identification of priority commodities and diseases, threats and vulnerabilities; identification of critical control points to mitigate key threats/vulnerabilities; basic capacity in emergency management; development of enabling environment (e.g. Competent Authority identified, draft national pathogen list (NPL), public-private PMP taskforce, legislative review); and national and sector-level strategies. These strategies are written documents (also referred to as gateway passes) required to move to Stage 2.
18. At Stage 2, key considerations and outcomes include: implementation of the strategies developed in Stage 1; monitoring/assessment of effectiveness of biosecurity management (audits and certification); surveillance; further development of the enabling environment (laboratory capacity to support surveillance, aquatic animal health information system, legislation, NPL

² <http://www.fao.org/fishery/nems/41063/en>; in collaboration with Mississippi State University (MSU) and the World Bank (WB); FAO. 2019. Report of the FAO/MSU/WB First Multi-Stakeholder Consultation on a Progressive Management Pathway to Improve Aquaculture Biosecurity (PMP/AB), Washington, D.C., United States of America, 10–12 April 2018. FAO Fisheries and Aquaculture Report No. 1254. Rome. 76 pp.

³ In collaboration with MSU, Norwegian Agency for Development Cooperation (NORAD), Norwegian Veterinary Institute (NVI), the WB; hosted by the OIE

⁴ In collaboration with NORAD, Canadian Food Inspection Agency; MSU, NVI; NAQUA and Kingdom of Saudi Arabia; Nitte University; Yellow Sea Fishery Research Institute of the Chinese Academy of Fisheries Science

adopted, and reporting of notifiable diseases to the Competent Authority and OIE); revision and strengthening of the national strategy (e.g. strong port/border controls, rapid detection and response). This revised strategy (gateway pass) is required to move to Stage 3.

19. At Stage 3, key considerations and outcomes include: implementation of revised strategy and policies; efficient, effective outbreak management; continuous surveillance of existing, exotic and emerging hazards; reduction of disease incidence and their impact; enhancement of enabling environment (cost-benefit analysis, national multi-agency taskforce, legislation allows full implementation of strategy and enforcement of policies, laboratory capacity for rapid detection, emergency preparedness and response audit); commitment from public and private stakeholders including investors to safeguard progress. Demonstrated commitment from key stakeholders (gateway pass) is required to move to Stage 4.
20. At Stage 4, key considerations and outcomes include: sustained activities from previous stages and evidence-based improvement; continuous improvement of enabling environment (legislation reviewed and updated, zones/compartments recognized by the OIE (if applicable), support other countries in biosecurity development); robust socio-economic situation for all (including small-scale producers, food security); national and international stakeholder confidence in the national aquaculture and ecosystem health; safe trade and transparency.

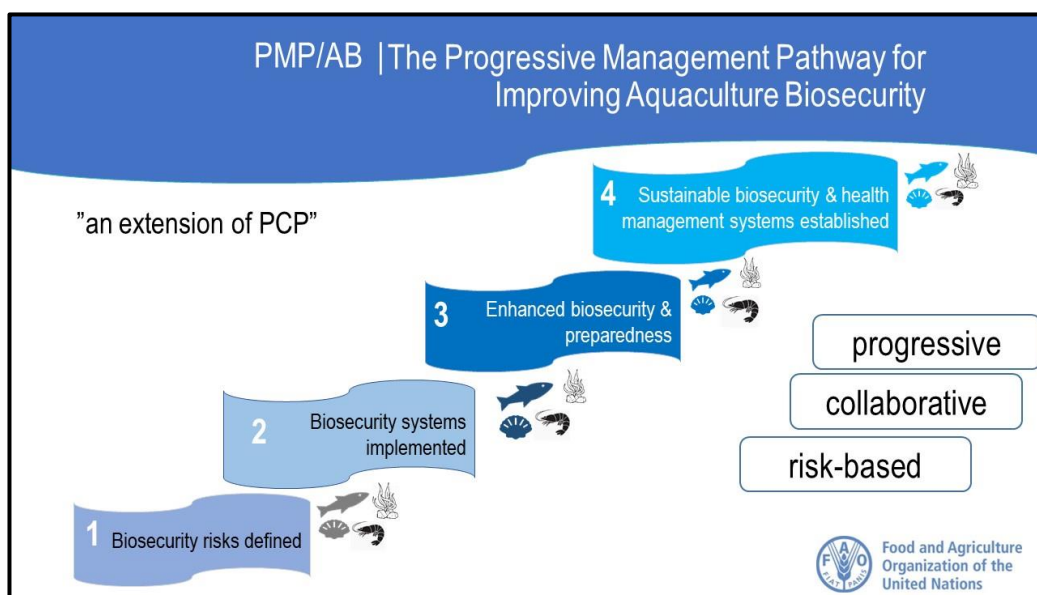


Figure 1. The PMP/AB consists of four stages and follows the principles of being risk-based, collaborative and progressive.

Entry points for PMP/AB

21. Countries at different stages of aquaculture development will have the opportunity and flexibility to initiate the PMP/AB. Several scenarios have been identified, as follows:
 - *Scenario 1:* Country with no aquaculture biosecurity strategy (AB) nor National Strategy on Aquatic Animal Health (NSAAH) but with aquaculture or initiating aquaculture development
 - *Scenario 2:* Country with NSAAH or other strategies from FAO projects or other assistance projects, at various levels of implementation where it can be investigated how best these strategies can be used, revised and/or expanded to fit the context of PMP/AB
 - *Scenario 3:* Country with advanced biosecurity strategies where these strategies can be reviewed and revised/expanded/updated to fit the context of PMP/AB; identification of bottlenecks/lessons and good practices that can be used
 - *Scenario 4:* Countries sharing water bodies and regions with regional biosecurity strategies are prime candidates for the transboundary and other elements of the PMP/AB.

Benefits of PMP/AB

22. The PMP/AB addresses the lack of effective national plans through a focus on national aquaculture biosecurity strategy development processes (mid- to long-term) and by promoting a co-management approach to actively engage stakeholders. Specifically, the PMP/AB enhances awareness and adoption of appropriate biosecurity governance at the producer and sector levels, which can lead to reduction in the incidence and impact of targeted priority diseases; and thus promotes greater recognition of the important role of biosecurity.
23. The PMP/AB provides a solid platform for public-private sector partnership, as PMP/AB's strategic and implementation plans should be jointly developed by industry stakeholders and governance authorities. This ensures buy-in and best-fit for each country, whilst providing a template that delivers a degree of consistency between participating countries or regions.
24. Ongoing monitoring, evaluation, self-assessment (e.g. FAO self-assessment tool), gap and pathway analysis (e.g. OIE Performance of Veterinary and Aquatic Animal Health Services) are essential parts of the process. They are needed to develop national ownership of the principles, responsibilities, and coordination with other activities necessary for biosecurity management.
25. The PMP/AB is applicable to improve biosecurity for all forms of aquaculture production scope and objectives – small to large; local to international traders. Each stage provides a tangible benefit to stakeholders, and it will be part of the work within each stage to demonstrate, communicate and advocate for activities that solve the challenges inherent in retaining commitment. Co-management principles at each stage should ensure that problems are well recognized and management solutions are identified.

IV. CONCLUSIONS

26. Aquaculture is a highly complex sector with many farmed species under many production systems and practices, and in different aquatic environments. People engaged in aquaculture are diverse, ranging from small-scale backyard producers to sophisticated large-scale industrial aquaculturists. To date, the majority of aquaculture production originates from small-scale farms and farmers who are relatively resource poor and in dire need of technical support. The high volume of international trade of aquaculture product further drives emerging diseases into regional or global outbreaks.
27. Biosecurity measures have been applied at the farm level in many countries. Technical assistance to governments and other stakeholders has been provided. Various levels of success in improving biosecurity and reducing disease-related losses have been seen in some places. However, there have also been failures and breaches of biosecurity at both the farm and national levels.
28. New diseases are continuously emerging, and previously known diseases are reappearing in different places. Disease outbreaks related to movement of pathogens have become even more prominent in some regions, causing serious production and economic losses, even after two decades of continuous biosecurity applications.
29. Harnessing the opportunity of aquaculture production in a sustainable manner that is sufficiently responsive to environmental and anthropological challenges requires the establishment of enabling policy environments. The PMP/AB offers this opportunity.

V. WAY FORWARD FOR IMPROVING AQUACULTURE BIOSECURITY TO SUPPORT SUSTAINABLE AQUACULTURE IN AFRICA

30. Biosecurity measures are less expensive when put in place proactively and preventatively, and are more expensive as solution-based, reactionary responses to outbreaks. Biosecurity should be in place and parallel to any aquaculture development by all producing countries. Reducing the response time following an outbreak is an essential basic step for efficient biosecurity.
31. Now that the mandate to develop a long-term, multi-donor supported programme on Aquaculture Biosecurity has been given by COFI/SCA 10th session, there is timely opportunity for CIFAA to: (1) discuss how to further understand and raise awareness about PMP/AB, (2) discuss the below five major pillars of the planned Aquaculture Biosecurity programme, determine which among the five pillars are most relevant to African aquaculture and can be prioritised at the short-, medium- and long-term; and (3) discuss mechanisms how resources can be mobilized in order to support these aspirations. The five major pillars are:
 - (i) *strengthening disease prevention at farm level* through responsible fish farming (including reducing AMR in aquaculture and the application of suitable alternatives to antimicrobials) and other science-based and technology-proven measures;
 - (ii) *improving aquaculture biosecurity governance* through implementing PMP/AB, enhancing interpretation and implementation of international standards and strengthening the One Health approach by bringing together state and non-state actors (producers, value chain stakeholders), international and regional organizations, research, academia, donor and financial institutions to design and implement mandated biosecurity measures;
 - (iii) *expanding understanding of aquaculture health economics* (burdens and investments, opportunity cost);
 - (iv) *enhancing emergency preparedness* (e.g. early warning and forecasting tools, early detection, early response) at all levels; and
 - (v) *actively supporting pillars 1-4* with several cross-cutting issues (e.g. capacity development, disease intelligence and risk communication, education and extension, targeted research and development and innovation).