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COMMITTEE ON FISHERIES

SUB-COMMITTEE ON AQUACULTURE

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PREVENTING AND MANAGING AQUATIC ANIMAL DISEASE RISKS IN AQUACULTURE THROUGH A PROGRESSIVE MANAGEMENT PATHWAY

Executive Summary

This document takes a historical view of the attention given to aquaculture health issues from the lens of the Committee on Fisheries Sub-committee on Aquaculture (COFI/SCA) sessions and other developments in the field. It then discusses the drivers, factors and pathways to aquatic animal disease emergence categorized into four major areas, namely: (i) trade in and movement of live aquatic animals and products; (ii) knowledge of pathogens and their hosts; (iii) aquatic animal health management; and (iv) ecosystem changes. Emphasis is given on the need to understand aquaculture health economics (burden and investments). This is essential for seeing preventive and biosecurity measures as opportunity costs that can provide guidance on where best to channel limited resources as well as investment opportunities.

A new initiative, the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB) is introduced and 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.

On the basis of previous requests and endorsement by Members, efforts have been under way in FAO to frame a global aquaculture sustainability programme as part of the Blue Growth Initiative. It is

proposed here to set-up a multi-donor assisted, long-term, global component under this programme towards improving aquaculture biosecurity at all levels. This component consists of five major pillars:

(i) strengthening disease prevention at farm level through responsible fish farming (including reducing antimicrobial resistance (AMR) in aquaculture and 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 (producers and value chain stakeholders) actors, international and regional organizations, research, academe, donor and financial institutions to design and implement mandated biosecurity measures;

(iii) expanding understanding of aquaculture health economics (burden and investments);

(iv) enhancing emergency preparedness (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 and competence development, disease intelligence and risk communication, education and extension, targeted research and development and innovation).

Suggested action by the Sub-Committee

- Review and discuss concrete mechanisms and provide guidance on the aquaculture biosecurity component including its five major pillars;
- Call upon Members, partners and donors to collaborate and/or take a lead on the aquaculture biosecurity component of the global aquaculture sustainability programme;
- Call upon Members and funding institutions to support a multi-donor assisted, long-term global programme component towards improving aquaculture biosecurity at all levels.

INTRODUCTION

1. At the fifth session of the COFI Sub-Committee on Aquaculture (COFI/SCA V) held in Phuket, Thailand (from 27 September to 1 October 2010), an introductory discussion paper[1] on major biosecurity concerns affecting modern aquaculture was presented. Issues such as transboundary aquatic animal diseases (TAADs), food safety, public health risks related to the use of veterinary medicinal products, biological invasions, issues pertaining to aquatic genetically modified organisms (GMOs) and some aspects of climate change were presented. A brief background on the above risk sectors was provided together with specific examples. Since the biosecurity risks from some of these sectors are recognized and, in many cases, risk pathways are known and clearly understood, a serious concern exists as to how they may be reduced or mitigated.

2. The COFI/SCA V recognized that biosecurity is a key matter for sustainable aquaculture development, and also for human health and rural livelihoods. Such considerations should therefore be addressed at all levels targeting policy-makers, farmers and all relevant stakeholders along the value chain, especially the small-scale producers and fishers. The Sub-Committee also recognized that

[1] http://www.fao.org/3/k7580e/k7580e.pdf

biosecurity involves many sectors; thus it requires a better understanding of the risk factors involved when taking action in an integrated manner.

3. The Conference on Aquaculture in the Third Millennium (September 2010, Bangkok) reaffirmed the importance of aquatic animal health (AAH) through the Bangkok Declaration and Strategy for Aquaculture Development[2]. Managing AAH is identified as one of the strategic priority elements in the Declaration that should be incorporated into the national strategies for aquaculture development by governments.

4. At subsequent COFI/SCA sessions (i.e. SCA VI/2012, SCA VII/2013, SCA VIII/2015 and SCA IX/2017) numerous Member requests were put forward for technical assistance on TAADs, for capacity development support on biosecurity governance, risk analysis and best practice guidance and for greater emphasis to small-scale producers. The most commonly requested TAADs include, Epizootic ulcerative syndrome (EUS) in Africa, White spot disease (WSD) in Latin America and the Caribbean (LAC), early mortality syndrome (EMS, now known as Acute hepatopancreatic necrosis disease - AHPND), Infectious myonecrosis (IMN) virus in Asia, Tilapia syncytial hepatitis (caused by Tilapia lake virus, TiLV) in Africa, Asia and LAC; and most recently outbreaks of carps caused by koi herpesvirus in Iraq. The importance of working with producers and promoting public-private partnerships was also emphasized.

5. Due to limited funding opportunities, support to Members was provided within FAO's Technical Cooperation Programme (TCP) modalities. It was only during the last three years that extra-budgetary and multi-donor funding mechanisms were made available to support aquaculture biosecurity governance projects. During 2009-2019, AAH technical assistance projects supported through TCP and extra-budgetary funds amounted to approximately USD 6.9 million for some 50 countries in Africa, Asia and the Pacific, Eastern Europe, and Latin America and the Caribbean. Continued technical and financial assistance is being provided to Members through national, regional and inter-regional TCPs, as well as via emergency assistance through the FAO Crisis Management Center.

6. The eighth session of the Sub-Committee (SCA VIII/2015)[3] also agreed on seven priorities for its future work, one of which being biosecurity.

7. Each of the six consecutive sessions of COFI held between 2009 and 2018 recognized the importance of aquatic animal health and biosecurity. The 33rd session of COFI in 2018 also recognized the importance of antimicrobial resistance (AMR) and recommended that FAO continues its work with the World Organisation for Animal Health (OIE). The development of the PMP/AB was noted, as well as the need to build the capacity of Members to better manage biosecurity issues[4].

8. Based on the above, it is clear that biosecurity is recognized as a major aquaculture challenge and has thus received great attention both at SCA and COFI levels. Despite limited funding availability, FAO has provided support to the high demand for technical assistance requested by Members. Many awareness-raising, consensus-building, scientific events, expert meetings, training courses and disease investigations in the field were delivered[5]. In addition, educational, technical and other communication

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[2] http://www.fao.org/3/i2734e/i2734e.pdf
[3] http://www.fao.org/3/a-i5191t.pdf
[4] Report of the 33rd Session of the Committee on Fisheries (Rome, 9-13 July 2018); link: http://www.fao.org/fileadmin/user_upload/bodies/Conference_2019/MX970_23/MX970_C_2019_23_en.pdf
[5] Selected examples: On TiLV: http://www.fao.org/fishery/nems/41072/zh; http://www.fao.org/fishery/nems/41135/zh; http://www.fao.org/3/CA2864EN/ca2864en.pdf; On AMR: http://www.fao.org/fishery/nems/41098/zh; http://www.fao.org/fishery/nems/40953/en; http://www.fao.org/fishery/nems/40956/en; http://www.fao.org/fishery/nems/41001/ar

materials on various aspects of AAH and biosecurity governance have been disseminated during the past three decades[6].

9. The AAH and biosecurity challenges affecting aquaculture sustainability continue. It is now time to take stock and critically reconsider the drivers of aquatic animal disease emergence identified since the 2010 COFI/SCA V session and the sustainability implications, in order to find novel and innovative ways to deal with them in a cost-effective and sustainable way.

DRIVERS, FACTORS AND PATHWAYS TO AQAUTIC ANIMAL DISEASE EMERGENCE

10. 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.

11. There is a long list of drivers/factors/pathways for aquatic disease emergence in aquaculture. They 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.

- 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;

[6] Selected examples: On responsible movement of live aquatic animals: http://www.fao.org/3/X8485E/X8485E00.htm; http://www.fao.org/3/a-a1108e.html; on strategy development: http://www.fao.org/3/ca2764en/CA2764EN.pdf; on risk analysis: http://www.fao.org/3/i2571e/i2571e00.htm; http://www.fao.org/3/i0490e/i0490e00.htm; on diagnostics: http://library.enaca.org/NACA-Publications/ADG-complete.pdf; http://www.fao.org/3/a-i6848e.pdf; on surveillance: http://www.fao.org/3/y5325e/y5325e00.htm; on emergency preparedness: http://www.fao.org/3/a0090e/a0090e00.htm; http://www.fao.org/3/ca2705en/CA2705EN.pdf; on emergency disease investigation: http://www.fao.org/3/i0778e/i0778e00.htm; http://www.fao.org/3/a-i6596e.pdf; on quarantine: http://www.fao.org/3/i0095e/i0095e00.htm; on prudent use of veterinary medicines: http://www.fao.org/3/ba0056e/ba0056e.pdf; on biosecurity and zoning: http://www.fao.org/3/a-i6834e.pdf

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.

AQUACULTURE HEALTH ECONOMICS

12. If disease challenges are not properly handled, an aquaculture industry will not be sustainable. One example is the global impacts caused by White Spot Disease. The numerous disease outbreaks in aquaculture are a reflection that the governance of AAH is immature. Equitable division of operational costs and long-term investment in prevention, management, control and treatment of diseases requires robust governance frameworks, and is thus one of the most important elements in terms of performance of the industry.

13. Disease impacts have been estimated in socio-economic terms (e.g. losses in production, income, employment, market access or market share, investment and consumer confidence; food shortages; industry failure or closure of business or industry)[7]. Even in the absence of systematic methods for assessing disease impacts, due to the low frequency of occurrence and the magnitude of spread and effects, many entities are now providing some estimates.

14. Regional estimates of farm production losses in 15 developing Asian countries due to Epizootic Ulcerative Syndrome (EUS), penaeid shrimp diseases, and a variety of other diseases in freshwater fish pond and marine cage culture was USD 1.36 million in the 1990s[8]. At the global level, combined estimated losses in production value due to shrimp diseases from 11 countries during the period 1987-1994 were in the order of USD 3 019 million.[9]

15. At the national level, the emergence of infectious salmon anaemia (ISA) cost the Scottish farming industry GPB 20 million in the 1998/1999 outbreak and resulted in a continued annual cost to the Norwegian and Canadian industries of USD 11 million and USD 14 million, respectively[10]. More recent estimates of economic loss from decreased production and export caused by AHPND were USD 12 billion and >USD 26 million in Thailand (2010-2017 period) and Viet Nam (2015), respectively[11].

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[7] Bondad-Reantaso, M.G., Subasinghe, R.P., Arthur, J.R., Ogawa, K., Chinabut, S., Adlard, R., Tan, Zilong & Shariff, Mohammad. 2005. Disease and health management in Asian aquaculture. Veterinary Parasitology 132: 249-272.

[8] ADB/NACA, 1991. Fish health management in Asia-Pacific. Report of a Regional Study and Workshop on Fish Disease and Fish Health Management. ADB Agricult. Dep. Rep. Ser. No. 1, Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand, 627 pp.

[9] 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.

[10] 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.

[11] 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.

16. Looking at the experience of the People's Republic of China, the world's biggest aquaculture producer, the range of losses due to diseases officially reported[12] indicates that economic losses are substantial and show an increasing trend. For example, in 2017, disease-related losses were approximately USD 5.3 billion, an increase of USD 1.2 billion more than the losses registered in 2016[13] and these losses involved 62 cultured species and 96 diseases. Of the losses related to fish production (33.8 percent of total), tilapia diseases (caused by several pathogens) ranked first, with an estimated loss of USD 450 million. Of the losses related to crustacean production (40.7 percent of total), *Penaeus vannamei* suffered the largest losses (USD 1.6 billion estimated loss), from various pathogens. Of the shellfish losses (13.2 percent of total), oysters had the largest (USD 540 million estimated loss). Other species represented 12.3 percent of all losses; of these, sea cucumber loss ranked first (USD 460 million estimated loss), followed by seaweed (USD 190 million estimated loss).

17. Focusing on disease prevention is a sign of a maturing industry, but this needs to be supported by governance and innovation. Disease remains an economic and societal challenge. 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 decision makers (at the policy, production and service provider levels) an indication of the extent to which poor health status can disrupt economic production. 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.

18. Even though animal diseases have always heavily influenced human health, production, welfare and international trade, efforts to use interdisciplinary approaches are very recent, thus creating new disciplines such as animal health economics, veterinary public health and preventive veterinary medicine. The aquatic sector can learn much from both the terrestrial and human health sectors, and it is now timely to include aquaculture health issues in the ongoing Global Burden of Animal Disease (GBAD), a comprehensive regional and global research programme of disease burden that assesses mortality and disability from major diseases, injuries and risk factors.

THE PROGRESSIVE MANAGEMENT PATHWAY TO IMPROVE AQUACULTURE BIOSECURITY: A NEW INTIATIVE

19. 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.

20. 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 AMR and zoonotic diseases from farmed aquatic animals and their environment.

21. The 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

[12] Annual Report on Aquatic Animal Health in China (2017).
[13] Annual Report on Aquatic Animal Health in China (2016).

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 the World Bank headquarters in Washington D.C. (April 2018)[14] and at OIE headquarters in Paris (January 2019),[15] and a Technical Working Group meeting held at FAO headquarters (March 2019)[16].

22. The PMP/AB is expected to result in sustainable:

- reduction of burden of disease;
- improvement of health at farm and national levels;
- minimization of global spread of diseases;
- optimization of socio-economic benefits from aquaculture;
- attraction of investment opportunities into aquaculture; and
- achievement of One Health goals.

23. 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.

24. The PMP/AB consists of four stages (see Figure 1), namely:

- Stage 1 – biosecurity strategy developed using a risk-based approach;
- Stage 2 – biosecurity measures/systems implemented;
- Stage 3 – biosecurity and preparedness enhanced; and
- Stage 4 – sustainable biosecurity and health management systems established to support national aquaculture sector.

25. 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.

26. 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 adopted, and reporting of notifiable diseases to the Competent Authority and OIE); and revision and strengthening of the

[14] 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.
[15] In collaboration with MSU, Norwegian Agency for Development Cooperation (NORAD), Norwegian Veterinary Institute (NVI), the WB; hosted by the OIE.
[16] 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.

national strategy (e.g. strong port/border controls, rapid detection and response). This revised strategy (gateway pass) is required to move to Stage 3.

27. 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); and 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.

28. 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/compartment 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; and safe trade and transparency.

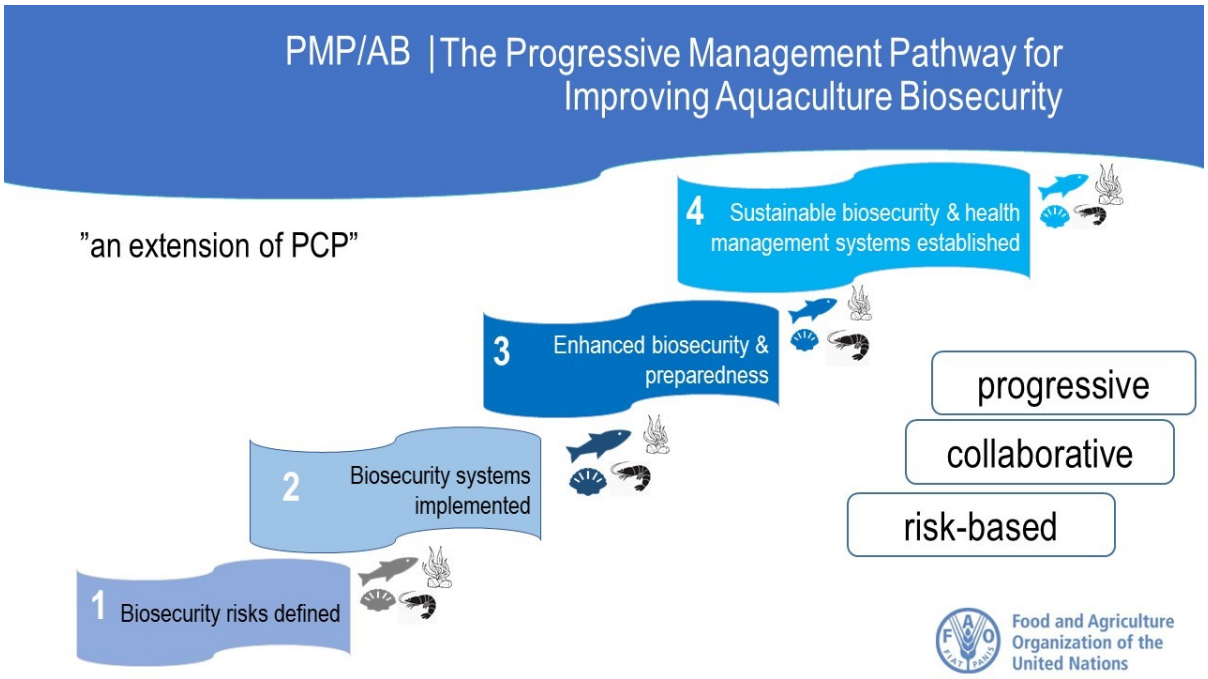

Figure 1. The PMP/AB consists of four stages and follows the principles of being risk-based, collaborative and progressive.

Entry Points for PMP/AB

29. 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

30. The PMP/AB addresses the lack of effective national plans by focusing 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.

31. 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.

32. 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.

33. The PMP/AB is applicable to improve biosecurity for all forms of aquaculture production scope and objectives – small to large; local to international traders.

34. 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.

35. The PMP/AB approach also looks at establishing risk ownership and promotes active engagement and long-term commitment to risk management. Risk ownership is an important principle as described in the ISO Standard 31000 on "risk management frameworks"[17]. The PMP/AB is broadly in line with ISO 31000 and has a set of principles to establish the Risk Management Framework at a national level. It promotes the "plan-do-check-act" cycle of quality management to emphasize the

[17] www.iso.org/ news/ref2263.html

central role for monitoring and evaluating that will enable problems or progress to be considered and actions taken.

36. 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.

CONCLUSIONS

37. 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.

38. 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.

39. 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.

40. Biosecurity measures are less expensive when put in place proactively and preventatively, and are more expensive as solution-based, reactionary responses to outbreaks. It is time to consider designing and applying a holistic global aquaculture biosecurity programme, taking into account the years of experience by both public and private actors, livestock sector achievements, and various bottlenecks observed and experienced, especially in developing countries. 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.

41. It is proposed to set up a multi-donor assisted, long-term global component on aquaculture biosecurity under a global aquaculture sustainability programme[18] which improves aquatic animal health governance and management at all levels. Creating healthy and resilient hosts through a combination of good biosecurity, genetics and nutrition is needed for a maturing aquaculture industry.

42. This global programme component on aquaculture biosecurity consists of five major pillars, namely:

- *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;

[18] On the basis of previous requests and endorsement by Members, efforts have been under way in FAO to frame a global aquaculture sustainability programme as part of the Blue Growth Initiative. See also: Working Document 2 (COFI:AQ/X/2019/2) and Session Background Document 2 (COFI:AQ/X/2019/SBD2).

- *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;

- *expanding understanding of aquaculture health economics* (burdens and investments, opportunity cost);

- *enhancing emergency preparedness* (e.g. early warning and forecasting tools, early detection, early response) at all levels; and

- *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).

43. The progress in the development of the aquaculture biosecurity programme component, including the progress in PMP/AB national application and toolkit development, shall be reported during the 11th session of the COFI/SCA.

GUIDANCE SOUGHT

44. The Sub-Committee is invited to:

- Review and discuss concrete mechanisms and provide guidance on the aquaculture biosecurity component including its five major pillars;

- Call upon Members, partners and donors to signify interest to collaborate and/or take a lead on the aquaculture biosecurity component of the global aquaculture sustainability programme;

- Call upon Members and funding institutions to support a multi-donor assisted, long-term global programme component towards improving aquaculture biosecurity at all levels.