NETWORK OF AQUACULTURE CENTRES IN ASIA-PACIFIC

Nineteenth Meeting of the Asia Regional Advisory Group on Aquatic Animal Health

REPORT OF THE MEETING

Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand

26-27 November 2020

Prepared by the NACA Secretariat

Preparation of this document:

This report was prepared by the 19th Asia Regional Advisory Group on Aquatic Animal Health (AG) who met virtually in Bangkok, Thailand on 26-27 November 2020.

The Advisory Group was established by the Governing Council of the Network of Aquaculture Centres in Asia-Pacific (NACA) in 2001 to provide advice to NACA members in the Asia-Pacific region on aquatic animal health management, through the following activities: (a) evaluate disease trends and emerging threats in the region; (b) identify developments with global aquatic animal disease issues and standards of importance to the region; (c) review and evaluate the Quarterly Aquatic Animal Disease reporting programme and assess the list of diseases of regional concern; (d) provide guidance and leadership on regional strategies to improving management of aquatic animal health including those under the framework of the Asia Regional Technical Guidelines; (e) monitor and evaluate progress on Technical Guidelines implementation; (f) facilitate coordination and communication of progress on regional aquatic animal health programmes; (g) advise in identification and designation of regional aquatic animal health resources, as Regional Resource Experts (RRE), Regional Resource Centres (RRC) and Regional Reference Laboratories (RRL); and (h) identify issues of relevance to the region that require depth review and propose appropriate actions needed. Members of the Advisory Group include invited aquatic animal disease experts in the region, representatives of the World Animal Health Organisation (OIE) and the Food and Agricultural Organization of the United Nations (FAO), collaborating regional organisations such as SEAFDEC Aquaculture Department (SEAFDEC AQD) and OIE-Regional Representation in Asia and the Pacific (OIE-RRAP), and the private sector.

Reference: NACA 2020. Nineteenth Meeting of the Asia Regional Advisory Group on Aquatic Animal Health: Report of the Meeting. Published by the Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand.

ABBREVIATIONS AND ACRONYMS

AAH	Aquatic Animal Health
AAHRDD	Aquatic Animal Health Research and Development Division, Department of Fisheries, Thailand
AAHSC	Aquatic Animal Health Standards Commission of the OIE
ACDP	Australian Center for Disease Preparedness
AG	Asia Regional Advisory Group on Aquatic Animal Health
AGM	Advisory Group Meeting
AHPND	Acute hepatopancreatic necrosis disease
AI	Artificial intelligence
AMR	Antimicrobial resistance
AMU	Antimicrobial use/usage
BVS	Bacterial vitrified syndrome
CEV	Carp edema virus
CHEV 1	Crustacea hepe-like virus 1
COFI/SCA	Committee on Fisheries, Sub-Committee on Aquaculture (FAO)
COVID-19	Corona virus disease 2019
CQIV	*Cherax quadricarinatus* iridescent virus
DIV1	Decapod iridescent virus 1
DPD	Digestive pathogenic dysbacteriosis
EHP	Hepatopancreatic microporidiosis caused by *Enterocytozoon hepatopenaei*
EUS	Epizootic ulcerative syndrome (Infection with *Aphanomyces invadans*)
FAO (HQ)	Food and Agricultural Organization of the United Nations (Headquarters)
GAV	Gill-associated virus
GPL	Glass post larvae syndrome
GS	General Session of the OIE Delegates
GSIV	Giant salamander iridovirus
IHHNV	Infectious hypodermal and haematopoietic necrosis virus
IHNV	Infectious haematopoietic necrosis virus
IMN	Infectious myonecrosis
IMNV	Infectious myonecrosis virus
ISAV	Infectious salmon anaemia virus
KHV	Koi herpesvirus
LMBV	Largemouth bass virus
MCP	Major capsid protein
MrNV	*Macrobrachium rosenbergii* nodavirus
MrTV	*Macrobrachium rosenbergii* taihu virus
NACA	Network of Aquaculture Centres in Asia-Pacific
NHP	Necrotising hepatopancreatitis
NSAAH	National strategy for aquatic animal health
OIE	World Organisation for Animal Health
OIE PVS	OIE Performance of Veterinary Services (tool)
OIE-RRAP	OIE Regional Representation in Asia and the Pacific, Tokyo, Japan
PCR	Polymerase chain reaction
PL	Post larvae
PMP/AB	Progressive management pathway for improving aquaculture biosecurity
PT	Proficiency testing
PRV	Piscine orthoreovirus
QAAD	Quarterly Aquatic Animal Disease
SAV	Salmonid alphavirus

SCRV	*Siniperca chuatsi* rhabdovirus
SDDV	Scale drop disease virus
SEAFDEC-AQD	Southeast Asian Fisheries Development Center Aquaculture Department
SHIV	Shrimp hemocyte iridescent virus
SHVV	Snakehead vesiculovirus
SMR	Six monthly report
TG	Technical Guidelines (Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals)
TiLV	Tilapia lake virus
TPD	Transluscent post-larva disease
VCMD	Viral covert mortality disease
VHS	Viral haemorrhagic septicaemia
VNN	Viral nervous necrosis
WAHIS	World Animal Health Information System
WFS	White faeces syndrome
WSD	White spot disease
YHV	Yellow head virus
YSFRI	Yellow Sea Fisheries Research Institute, P.R. China

The 19th Asia Regional Advisory Group on Aquatic Animal Health.

Participants of the virtual AGM 19 composed of AG members and co-opted members from FAO, OIE-RRAP, OIE-AAHSC, SEAFDEC AQD, AAHRDD, P.R. China, Australia, Singapore, Thailand, the private sectors (PHARMAQ, BMK-Asia), and NACA Secretariat. Observers from NACA members were also invited, and countries represented include: Bangladesh, Cambodia, P.R. China, Hong Kong SAR, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, and Sri Lanka. Additional observers from OIE-RRAP, FAO HQ, and R.O. Korea also participated.

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OPENING SESSION

The 19th Meeting of the Asia Regional Advisory Group on Aquatic Animal Health (AGM-19) was convened in Bangkok, Thailand on the 26-27 November 2020. Due to the current COVID-19 pandemic, AGM 19 was held virtually via Zoom platform. Originally attended by only AG members, co-opted members and few observers, this year's virtual AGM invited the participation of NACA member representatives, as well as additional observers from partner organisations and other countries in the region. Countries represented include Bangladesh, Cambodia, P.R. China, Hong Kong SAR, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, and Sri Lanka. Additional observers were from R.O. Korea (2), OIE-RRAP (2) and FAO HQ (3).

The meeting was opened by Dr. Eduardo Leaño, Aquatic Animal Health Senior Programme Officer of NACA and Technical Secretary of the AG. Welcome message was given by Dr. Jie Huang, Director General of NACA. Selection of Chairperson and Vice-chairperson proceeded, and Dr. Liu Hong (P.R. China) was appointed as Chairperson while Dr. Jing Wang (OIE-RRAP) as Vice-Chairperson. After brief self-introduction by all the participants, Dr. Liu Hong took over in facilitating the meeting. Due to the virtual nature of this year's meeting, the topics covered were also limited to few important updates and issues on aquatic animal health as shown in the meeting agenda (**Annex A**) which was adopted without amendment. The complete list of participants is attached as **Annex B**.

SESSION 1: PROGRESS REPORT FROM NACA'S ASIA REGIONAL AQUATIC ANIMAL HEALTH PROGRAMME

Dr. Eduardo Leaño presented the progress report of NACA's Asia Regional Aquatic Animal Health Programme since the previous AGM 18 which was held in Bangkok, Thailand on 18-19 November 2019 (back-to-back with the 1st Meeting of the *ad hoc* Steering Committee of the Regional Collaboration Framework on Aquatic Animal Health in Asia and the Pacific, held on 20-21 November). Report of the meeting (e-copy) was widely circulated among NACA member countries and partner organizations, and published at NACA website for free download. Five Quarterly Aquatic Animal Disease Reports (2nd to 4th quarters of 2019 and 1st to 2nd quarters of 2019) were also published which are available for free download at both NACA and OIE-RRAP websites. NACA continues to collaborate with partner organisations on some regional projects on antimicrobial use (AMU) and antimicrobial resistance (AMR) in aquaculture, and under the One Health platform. In December 2019, NACA (Dr. E. Leaño) was invited to the inception meeting of the Fleming Fund/CORDS AMR Project held in Bangkok, Thailand. NACA is one of the invited institutions to represent the aquatic sector, and Dr. E. Leaño became a member of the Steering Committee. The project focuses on the development and implementation of data collection tool/protocols for mapping and gap analysis of AMR surveillance in four regions (Southeast Asia, South Asia, East and West Africa). Another project on AMR is the development of Monitoring and Surveillance Guidelines for AMR in Aquaculture (for Southeast Asia) and the 2nd Consultation Meeting was held virtually in June 2020, organized by FAO-RAP. NACA also participated in the OIE Webinar on Responsible and Prudent Antimicrobial Use (AMU) in Aquatic Animals in Asia and the Pacific, held in November 2020. This webinar was undertaken to understand current governance, legislation system for regulation of AMU in aquatic animals in the region, to share experiences of prudent use

of antimicrobials in aquatic animals, to inform participants on the OIE International Standards for AMR/AMU in aquatic animals, and to explore approaches to support Members in implementing the concept of prudent use of antimicrobials in aquatic animals.

The COVID-19 pandemic halted some important regional activities on aquatic animal health, and limited activities were done virtually and electronically. In April 2020, the news that circulated on the emerging viral disease (Decapod iridescent virus 1; DIV1) causing significant mortalities among cultured crustaceans has prompted NACA to immediately release a Disease Advisory and Disease Card, which were properly endorsed by AG members. Both of these documents were published at NACA website in the same month, and widely circulated in the region and encouraged countries to undertake disease surveillance. Considering the importance of this new disease, NACA organized the "Regional Webinar on Infection with Decapod Iridescent Virus 1 (DIV1) and Preparedness for Emerging Shrimp Diseases (A Virtual Consultation)" in September. The consultation was attended by around 250 participants from around the world. Some of the key points that arose during the discussion were as follows:

- Previously identified as CQIV (originally isolated from red claw/freshwater crayfish *Cherax quadricarinatus*) and SHIV (from *P. vannamei*).
- Currently known species susceptible to DIV1 include *P. vannamei, P. monodon, M. rosenbergii, Exopalaemon carinicauda, M. nipponense, Procambarus clarkii*, and *C. quadricarinatus*;
- Reported in PR China and Chinese Taipei; detected in wild *P. monodon* samples from Andaman Sea;
- Virulence of DIV1 to penaeids is significantly lower than WSSV; however, it is highly virulent to freshwater prawn *M. rosenbergii*;
- Reporting (transparency) and information sharing among countries in the region should be encouraged, to allow assessment on how widespread the disease is in the region;
- Movement of live aquatic animals is the most likely means of transmission, therefore, it is necessary that those animals should be assured of their DIV1-free status from the point of origin, and should be properly quarantined (in case of broodstock) prior to use in any aquaculture facility;
- DIV1 remains viable in frozen condition (for about half year?), thus disease transmission is still likely through contamination from infected frozen products (can act as carriers).

NACA also actively participated in the virtual Regional Meeting on DIV1 organized by OIE-RRAP. Another disease card endorsed by AG members and published by NACA was on Viral covert mortality disease (VCMD), which was already listed in QAAD reporting since 2017.

The first online Training Course on Mariculture Technologies was co-organized by the Yellow Sea Fisheries Research Institute (YSFRI) and NACA in September 2020. The training course aims to help developing countries strengthen their capacity on human resources, to upgrade management and technology levels of marine aquaculture, and to train highly skilled professionals and management personnel, thereby contributing to healthy and sustainable development of aquaculture in the world. Important lectures on AAH management were given by Dr. J. Huang (Surveillance plan and

biosecurity system for shrimp farming) and Dr. E. Leaño (Health management in grouper aquaculture). YSFRI and NACA also co-organized the International Forum on Aquaculture for Silk Road Countries on the Impacts of COVID-19 pandemic in aquaculture in November 2020. The forum aims to further understand the changes and tendency of sustainable development of aquaculture during the pandemic, promote international cooperation in the aquaculture sector towards the post-pandemic of COVID-19, and promote sustainable development of aquaculture under the new global challenge of COVID-19 on aquaculture. Relevant presentations on the impact of COVID-19 on aquaculture were given by renowned experts in the world. On AAH, one presentation on emerging bacterial disease in shrimp named Bacterial vitrified syndrome, was presented by Dr. Yingeng Wang (YSFRI). This disease was similar to the Glass post-larvae (GPL) disease reported from P.R. China in May 2020. The disease occurred in the spring of 2020 and spread rapidly along the coastal area (from South to North) of P.R. China, resulting in shortage of PLs in 2020.

DISCUSSION

- On the news report of shrimp disease in China which was reported to have been caused by DIV1, after epidemiological investigation and pathogen testing in the laboratory, the observed shrimp mortalities were not actually caused by DIV1 alone but by multiple pathogens including WSSV.
- DIV1 was reported in P.R. China in 2017 and active surveillance is being undertaken since then. For 2020, the surveillance already collected 190 samples and no positive result was obtained for DIV1, while in 2018-2019 surveillance, prevalence rate is less than 10%. Thus, DIV1 is not as serious as previously reported;
- Based on experience on disease surveillance data on aquatic animal diseases of P.R. China, it has been observed that the prevalence of the diseases continuously decrease year by year, similar to WSD. After analysing the data for such trends on disease prevalence, it was found that the government, based on the surveillance results, has implemented more stringent measures including biosecurity and quarantine (e.g for shrimp PLs). Such strict regulations have resulted in more hatcheries undertaking testing of their PLs before distribution to grow-out farms. This indeed shows that disease surveillance in any country can significantly contribute to the overall prevention of disease occurrence and spread;
- On reporting for VCMD and DIV1 through the QAAD, no country (from those which are submitting the reports regularly) has reported the presence of VCMD since it was listed in 2017, while for DIV1, only Chinese Taipei officially reported the presence of the disease to both OIE and NACA;
- VCMD is not included in the national active surveillance programme of P.R. China in 2020 as this disease is not considered to be a major threat to the shrimp industry by risk analysis, and it's epidemiology is still under study. Experts from YSFRI have developed test kits to detect the presence of the virus. Data on mortality of VCMD is inconsistent, with some reporting significant number while others reporting no mortality;
- The virtual meeting and consultation on DIV1 hosted by OIE and NACA has provided valuable information to the participants regarding the disease and its status in the region. One of which is the sharing of positive control materials to enhance surveillance activities of the countries.

RECOMMENDATIONS

- AG recommended that the importance of continued surveillance for emerging diseases and biosecurity enhancements should be emphasised. There should also be sharing of information to create awareness so that the industry and regulators can actively take risk management measures. NACA has been and should continue to play a key role to coordinate in these situations.

SESSION 2: UPDATES FROM OIE AQUATIC ANIMAL HEALTH STANDARDS COMMISSION

Dr. Ingo Ernst gave a presentation on the progress of the Aquatic Animal Health Standards Commission's (AAHSC) work and the development of new and revised standards in the OIE Aquatic Animal Health Code and OIE Manual of Diagnostic Tests of Aquatic Animals. Dr. Ernst advised that since the 2019 NACA AG meeting, the AAHSC had met in February 2020 at the OIE headquarters in Paris; and had met virtually in September 2020.

Due to the COVID-19 pandemic, the 88th OIE General Session due to be held in May 2020 had been cancelled. No standards could therefore be adopted by the OIE General Assembly and no new or updated standards of the Aquatic Code and Aquatic Manual were published in 2020. Standards that were to be proposed for adoption at the OIE General Session were provided to members for an additional round of comments prior to the Commission's September 2020 meeting.

Dr. Ernst highlighted some of the key issues arising from the September 2020 meeting of the Aquatic Animals Commission meeting. They are summarized below:

Listed diseases. The commission considered listing/delisting of two diseases.

- Decapod iridescent virus 1 (DIV1) – the assessment against listing criteria for this emerging disease was updated based on new information. It is expected that listing of this disease will be proposed for adoption in May 2021.
- Infectious hypodermal and haematopoietic necrosis virus (IHHNV) – based on a request from some members this listed disease was reassessed against the listing criteria. The conclusion of the assessment is that IHHNV continues to meet the listing criteria although it is acknowledged that the nature of disease impacts have changed over time.

Safe commodities. Each disease-specific chapter of the Aquatic Code includes an article (article X.X.3) that lists commodities considered safe for trade without any disease specific measures. Some members have commented that the recommendations appear inconsistent, particularly with regard to thermal treatment. The Commission has proposed a revised structure to this article to improve clarity.

Approaches for self-declaration of freedom. The Commission has considered revised approaches to claiming and maintaining freedom from listed diseases. The suggested approaches have been developed through consultation with member countries on a discussion paper prepared by the

commission. The changes are intended to improve the practicality and flexibility of approaches to claiming freedom whilst also maintaining confidence in their rigour. Based on the approaches developed, the commission is in the process of revising the structure of articles on declaration of freedom in disease-specific chapters and to revise Chapter 1.4 on Surveillance. Progress to date includes:

- Revised articles for disease specific chapters have been developed and provided to members for comment.
- A revised Chapter 1.4 on surveillance has been drafted and following consultation with the two OIE collaborating centres on aquatic epidemiology it will be provided to member countries for comment (following the February 2021 Commission meeting).

Aquatic Manual. The Commission is continuing to progressively update the scientific information in all Aquatic Manual chapters and to reformat them into a new template. The revised chapters will have clear guidance on recommended tests for surveillance, clear information on their validation status, consistent case definitions, and updated scientific information.

Chapters carried over from 2020 and to be proposed for adoption in May 2021 include:

- Infection with *Batrachochytrium salamandrivorans*
- Infection with spring viraemia of carp virus
- Infection with infectious haematopoietic necrosis virus
- Infection with viral haemorrhagic septicaemia virus
- Infection with *Gyrodactylus salaris*
- Infection with salmonid alphavirus.

Additional chapters that have been thoroughly revised and provided for comment in the September 2020 commission report include:

- Infection with HPR-deleted or HPR0 infectious salmon anaemia virus
- Infection with koi herpesvirus
- The introductory chapter for fish diseases which includes information on standard diagnostic methods. This chapter was revised with all reference laboratory experts for fish diseases invited to participate. The chapter is cross referenced in disease-specific chapters where standard methods are referred to — thereby reducing repetition.

Susceptibility to listed diseases. The commission is continuing its progressive assessment of the susceptibility of host species to each listed disease. The latest disease to be considered against the criteria for host susceptibility is infection with *Bonamia ostreae.* The *ad hoc* group assessment found that of the 6 currently listed susceptible species, only 3 met the listing criteria.

OIE Strategy on Aquatic Animal Health. The OIE Director General committed to developing an OIE Strategy on Aquatic Animal Health at the OIE Global Conference on Aquatic Animal Health held in Chile in 2019. The strategy aims to provide coordinated and collaborative global actions to improve aquatic animal health.

The strategy was intended to be launched at the 2020 OIE General Session but due to its cancellation the strategy launch has been delayed. The strategy is now expected to be launched at the 2021 OIE General Session. The strategy was developed with extensive consultation with member countries, experts and partners to ensure the strategy best meets the common needs of the OIE community. The NACA AG provided input through its 2019 meeting and piloted a questionnaire that was later used to survey the views of all member countries.

DISCUSSION

- For CEV, the disease has been reported in several countries in Asia, Europe and North America especially in the last two years. CEV was quite active in Europe from 2015-2020 that a group was organized by the EU fish disease reference laboratories to work together on this disease.
- In Asia-Pacific, CEV is also prevalent as the region is the top cyprinid producer in the world, including ornamental koi and common carp. In P.R. China, outbreaks of CEV have been a problem since around 2013/2014 and it is currently included in the national active disease surveillance programme.
- For NACA/OIE/FAO QAAD reporting, CEV has been included in the list of reportable diseases since 2017, and has been reported from India and Japan;
- Two different opinions on CEV exist, first is on the pathogenicity of the virus and there are reports that the virus cannot cause acute mortality in carps. If carp are already infected by the virus when an outbreak occurs, they can survive longer than those which are not previously infected by the virus. The second is on the diagnostic test wherein only one genome is available from genbank and the primer is designed based only on one fragment, which is not enough to develop a good test for this virus;
- Dr. Ernst took the opportunity to thank some of the AG members and meeting participants who have contributed to the work of the Commission: fellow commission member Prof. Hong Liu, Dr. Siow-Foong Chang for Section 4 of the Code specifically on the chapter on Emergency Disease Preparedness and Disease Outbreak Management; and, Dr. Hyoung Jun Kim (OIE Resource Expert) for his work on the Introductory chapter of Fish Diseases;
- On the provision of positive control samples (e.g. for DIV1), the laboratory of Dr. Kim has provided samples for free to some countries who have made requests. However, there costs are incurred in sending the samples and these may be prohibitive. It was suggested that the OIE consider whether financial support could be provided to Reference Laboratories to facilitate this important activity, especially for emerging diseases like DIV1;
- On DIV1 wherein the existing PCR method only targets the ATPase gene, there is an issue on the mutation of the virus which has been found in some affected areas wherein the MCP gene is qPCR-negative (with ATPase gene positive). In such kind of DIV1 infection with negative MCP, no mortality and no histopathological changes in the affected tissues are observed;
- For confirmatory diagnosis of DIV1, two qPCR methods that target both the ATPase and MCP genes should be performed. Positive results should be obtained for both;

- A research team in P.R. China has finished the study on susceptibility of *P. monodon* to DIV1 and confirmed that it is one of the susceptible species. The team also found natural infection of DIV1 in *P. monodon*.

RECOMMENDATIONS

- As the Asia Pacific region is a major aquaculture centre, the AG recommended that NACA member countries should continue to be actively engaged in the development of OIE standards.
- The AG recommended that member countries contribute to the control of transboundary diseases of aquatic animals by complying with the obligations of the OIE Aquatic Code to notify the occurrence of listed diseases and emerging diseases.

SESSION 3: UPDATES ON THE PROGRESSIVE MANAGEMENT PATHWAY FOR IMPROVING AQUACULTURE BIOSECURITY (PMP/AB)

Dr. Melba Reantaso, Team Leader (Food Safety, Nutrition and Health, Fisheries Division, FAO) delivered a presentation on a new initiative that FAO and partners have been developing since 2017. This initiative is called the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB). In the development of the PMP/AB it is important to understand the disease situation in the aquaculture setting, the pathways to disease emergence and economic impacts.

She presented a chronology of disease/pathogen emergence in aquaculture where in the 1970s, there were a few diseases of parasitic, fungal and viral origin affecting salmon, shrimp, tilapia and many finfish species in the case of EUS. Going into the 1980s the number of shrimp pathogens (mostly viral) increased with a bacterial pathogen (NHP). We have seen the emergence of ISA and sea lice. In the 1990s few more viral diseases of shrimp and the sector suffered from Vibriosis and the emergence of KHV. In the decade 2000, more shrimp viral diseases appeared and previously unknown diseases such as AHPND of shrimp of bacterial aetiology, TiLV of tilapia, VNN of marine fish and tilapia and EHP a shrimp parasite.

She then discussed the drivers, factors and pathways to aquatic disease emergence categorized into four major areas, namely:

- *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; 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 changes in geographic ranges of wild stocks, microbes and parasites as environmental factors change near the tolerance levels for hosts and disease agents.

The four major categories of pathways, factors and/or drivers are presented in **Figure 1** as a causal web[1] that organizes them into upstream and downstream effects of disease emergence. Because the factors leading to exotic and endemic diseases emergencies are quite different, this figure organizes emerging diseases into "exotic" and "endemic" to provide a better understanding. For exotic diseases, the exposure pathways include trade, newly emerging pathogens (perhaps through mutation), husbandry practices (e.g. use of live feed), and pathogens from wild populations. The stress-related factors that increase the impact of endemic diseases may include changes in management practices (intensification, diversification), soil and water chemistry, species farmed outside the native/optimal range, species selected for growth rather than disease resistance, climate change and other sources of stress that increase pathogen virulence.

Emphasis is also 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.

Disease emergence (exotic and endemic) is affected by aspects related to detection and effective response. These aspects include surveillance capacity, availability of diagnostics, institutional coordination, research infrastructure, level of biosecurity and available options for control. All of these, combined, will determine the consequence of disease emergence.

[1] FAO. 2020. Progress Towards Development of the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB): Highlights of 2019 Activities. FAO Fisheries and Aquaculture Circular No 1211, Rome. https://doi.org/10.4060/cb0560en

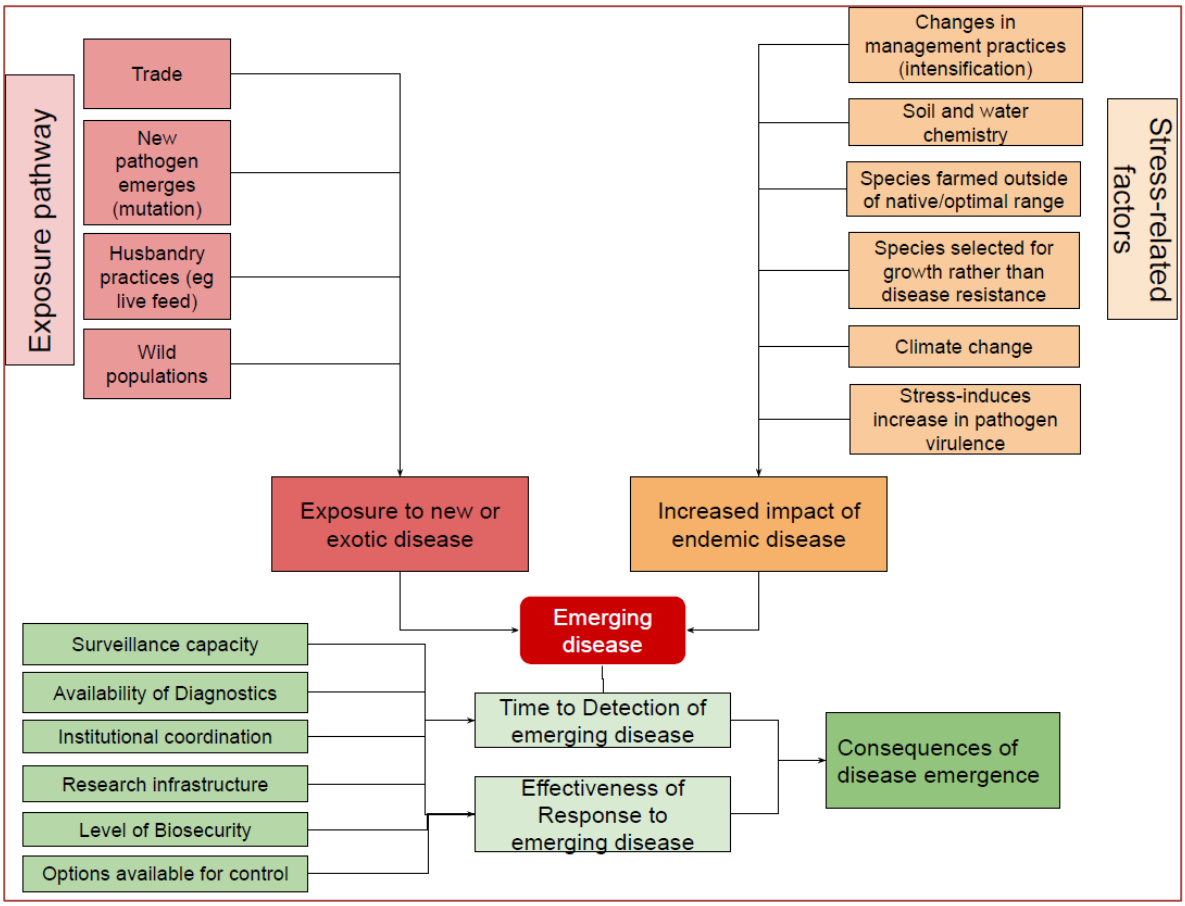

Figure 1. Pathways, factors and/or drivers for disease emergence in aquaculture.

The PMP/AB was introduced and its concept, principles, and benefits described (**Figure 2**). The PMP/AB was developed after a consensus was reached during two multi-stakeholder meetings held at the World Bank headquarters in Washington D.C. (April 2018)[2] and at OIE headquarters in Paris (January 2019)[3] and a Technical Working Group meeting held at FAO headquarters (March 2019)[4].

The PMP/AB is a pathway that builds on existing frameworks, supported by appropriate tools (via the "PMP/AB toolkit"). The PMP/AB focuses on aquaculture biosecurity, which includes health management and reduction of AMR. The PMP/AB will not directly focus on food safety; however, it will promote sustainable aquaculture production with good husbandry practices, environmental practices, and prudent treatment or antimicrobial use.

The PMP/AB follows the principles of being risk-based, progressive and collaborative. The PMP/AB is expected to result in (1): sustainable reduction of burden of disease; (2) improvement of health at farm and national levels; (3) minimization of global spread of diseases; (4) optimization of socio-economic benefits from aquaculture; (5) attraction of investment opportunities into aquaculture; and (6) achievement of One Health goals. The definition of biosecurity in the context of the PMP/AB was proposed as "the cost-effective management of risks posed by infectious agents to aquaculture

[2] http://www.fao.org/3/ca4891en/ca4891en.pdf
[3] http://www.fao.org/3/cb0745en/CB0745EN.pdf
[4] http://www.fao.org/3/cb0582en/CB0582EN.pdf

through a strategic approach at enterprise, national and international levels with shared public-private responsibilities".

The PMP/AB has four stages; each stage has a set of indicators, outcomes and activities. The four stages are:

- PMP/AB Stage 1: Biosecurity risks defined
- PMP/AB Stage 2: Biosecurity systems implemented
- PMP/AB Stage 3: Enhanced biosecurity and preparedness
- PMP/AB Stage 4: Sustainable biosecurity & health management systems established

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.

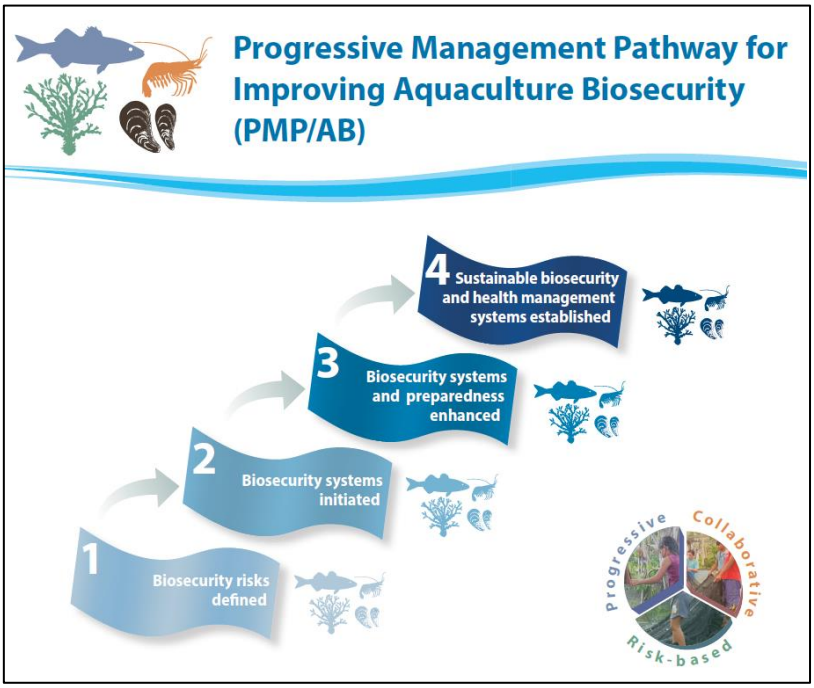

Figure 2. The Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB) is a four stage pathway that follows the principle of being risk-based, collaborative and progressive.

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; and
- 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.

Figure 3 shows all the essential elements of any aquatic animal health protection programme that was developed by FAO and NACA in 2000 as part of a regional project for 21 countries in Asia. The development of a National Strategy on Aquatic Animal Health (NSAAH) is a first step in the process that can be used in PMP/AB development.

The PMP/AB was presented during the 10th session of the FAO Committee on Fisheries Sub-Committee on Aquaculture (COFI/SCA10) and generated outstanding outcomes[5]. The COFI/SCA 10,

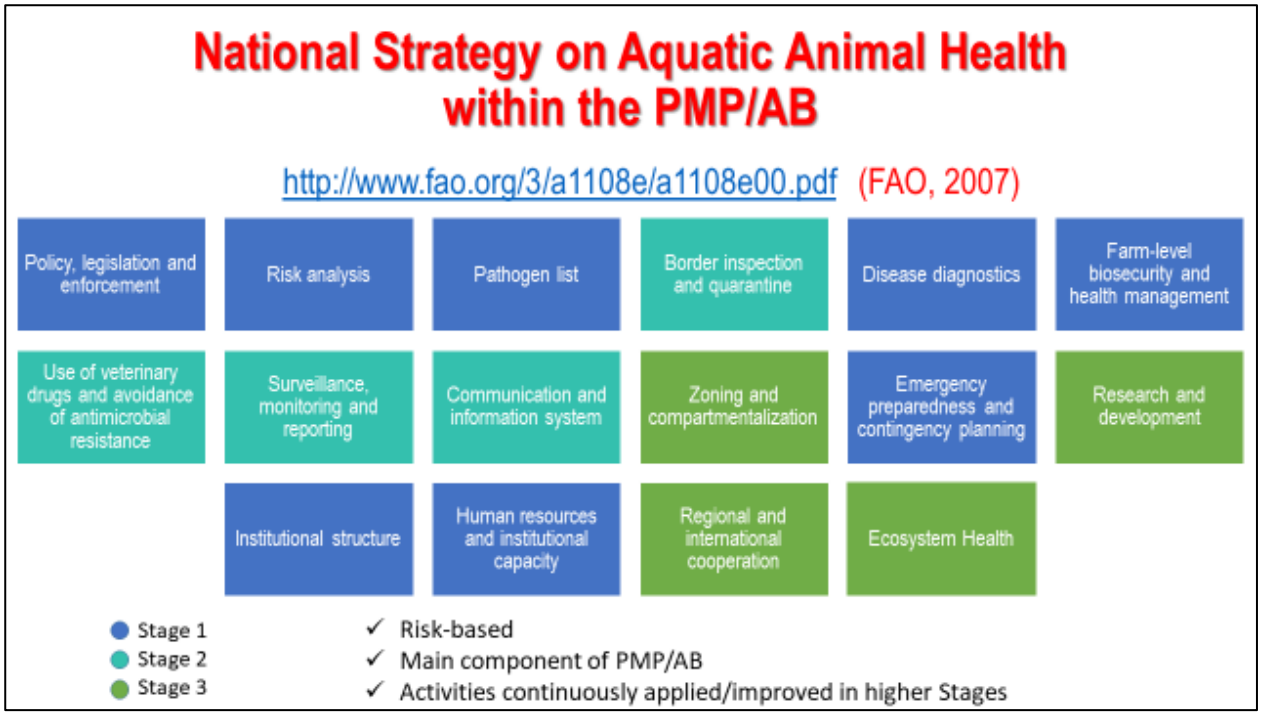

Figure 3. Essential elements of any aquatic animal health protection programme and how they related to the PMP/AB.

attended by 59 Members of FAO, by one associate Member and by observers from four intergovernmental and seven international nongovernmental organizations:

1) welcomed the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB) and further highlighted the importance of improved aquaculture biosecurity in reducing disease burden, improving health at farm and national levels, minimizing global

[5] http://www.fao.org/3/ca7417t/CA7417T.pdf

spread of diseases, optimizing socio-economic benefits from aquaculture, attracting investment opportunities, and achieving One Health goals.

2) agreed to the development, as part of FAO's global aquaculture sustainability programme, of a multi-donor assisted long-term component on aquaculture biosecurity including the 5 pillars.;
3) requested the formation of an FAO Technical Working Group to develop the PMP/AB and associated tools and mechanism;
4) encouraged commitment on resource mobilization; and,
5) urged the pilot testing of PMP/AB;

The five pillars include:

- 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;
- 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).

Dr. Reantaso then described ongoing relevant activities such as: PMP/AB Technical Working Group; PMP/AB communication stream: guidance document, policy brief; PMP/AB toolkits; pilot testing: China, Ghana, Indonesia, Philippines, Namibia, Zambia; advocacy: finfish/shrimp/seaweed sectors, molluscan sector (in progress); and, Fish/Vet Dialogue.

The PMP/AB has a range of toolkits that can be developed that may include the following:

- Technical: e.g. Contingency plan – Disease strategy; Diagnostics; Disease burden; Emergency preparedness; Farm-level biosecurity; Health management; Information (digital technology, AI); Prudent use of Antimicrobials; Risk analysis; Surveillance; Value chain analysis;
- Governance: Technical Working Group; Health Strategy and Pathogen List; OIE collaboration (PVS, WAHIS)

It is expected that various mechanisms will be explored to support the PMP/AB, e.g. gap analysis/self assessment; stakeholder mapping and consultations; e-learning, webinars; Farmer Field school; PPP; Training of trainers; Field and laboratory-based capacity building activites.

A number of PMP/AB toolkits under development include the following: (1) an update of the Asia Diagnostic Guide to Aquatic Animal Diseases (FAO/NACA) which is now called Guide to Diseases of Aquatic Organisms (Finfish, Crustaceans, Molluscs, Seaweed) with additional chapters on Fish-born zoonotic parasites, Fish-born zoonotic bacteria and important Fish parasites; (2) Disease strategy manual[6] – part of contingency plan – component of emergency preparedness. Two have been completed (IMNV, AHPND); two are in final stages (TiLV, EUS); two are being planned (EHP, KHV); (3) 12-point surveillance checklist for multidisciplinary team in developing countries.

Dr. Reantaso concluded her presentation with a note that PMP/AB can offer, including:

- co-management approach, greater use of planning processes that brings stakeholders together = a solid platform for public-private sector partnership
- risk ownership, active engagement and long-term commitment to risk management
- governance mechanism and a range of toolkits
- specific entry points for any country
- opportunity for longevity, sufficiently responsive to environmental and anthropological challenges, enabling policy environments, adoption of sound aquaculture production practices

DISCUSSION

- Farmers in many countries are now getting more and more interested in aquaculture biosecurity, and this will help in the prevention and management of important aquatic animal diseases;
- The 12-point checklist will also be of great help when countries undertake active disease surveillance, and should be highly considered before any surveillance activities are implemented;
- PMP/AB is a very good concept for the implementation of any biosecurity plan/system, however, different sectors (industry, academe, government) have quite different interests. Thus it is better to have a different sections of the platform that will be appropriate for the sectors involved whether at the farm or national level of biosecurity implementation;
- The TWG of PMP/AB will try to brainstorm on this aspect and while the concept is already clear, the actual implementation is indeed different depending on the sectors involved. The common issue that is always raised by any sector that will be involved is the buy-in (what benefit can they get when they implement any biosecurity plans/measures). The sectors, especially the industry people, can get involved actively through dialogues in order to promote and even get consensus on the concept of PMP/AB;
- FAO is planning to organise a Fish Vet Dialogue, and this can be a venue to raise and discuss this issue of how can all these governance authorities share the responsibilities in dealing with aquatic animal diseases and aquaculture biosecurity;
- Aquaculture biosecurity can be easily promoted to the private sector especially at the farm level. However, national implementation of any biosecurity plans/measures always needs

[6] http://www.fao.org/documents/card/en/c/ca6052en/; http://www.fao.org/documents/card/en/c/cb2119en/

the support and interest of the government, without which, it will be very difficult to implement;

- It is indeed important to consult the private sector or the industry people in order to get their perspectives on any issues relating to the implementation of aquatic animal health strategies including aquaculture biosecurity;
- On the emergency response of the region for emerging threats and diseases, it was observed that there has been a significant improvement especially for countries with the capacity to deal with such emergencies, considering the availability of more advanced diagnostic techniques, highly trained personnel, and implementation of some biosecurity measures especially for movements of live aquatic animals;
- It is apparent that the health services cannot cope up with the rapid development of the aquaculture sector, and it is hoped that the sector (both governance and industry) can act not on an *ad hoc* basis but in a more systematic way and on a long term basis, that biosecurity should be in place in parallel to any aquaculture development. A present, it is still quite difficult to achieve this despite all the disease emergencies and outbreaks that the aquaculture sector has experienced and has been experiencing at present;
- Systematic assessment of disease burden is very important, as this might inform the policy/decision makers how much the industry is losing. Currently, such information (on some figures on the amount of losses due to diseases) is not available for most governance authorities;
- In India, there has been much significant improvement on disease reporting and surveillance especially for new diseases once they are validated. After the first phase of the National Surveillance Programme wherein NACA played an important role in the realization and implementation of the programme, the government of India was highly enthusiastic and continued to support the second phase. This resulted in further improvement in disease monitoring and reporting and implementation of some biosecurity measures for disease prevention;
- Aquaculture biosecurity is a highly complicated process (compared to terrestrial biosecurity) considering the complexity of the culture environment and culture systems, and the diversity of cultured species. Thus, the little steps that the industry takes and implement towards achieving biosecurity in aquaculture, either at the farm or national level, should be highlighted and should not be compared to the progress made by the livestock sector. Aquaculture will still be on its own because of its uniqueness;
- In P.R. China, the PMP/AB project really provides guidelines and helps in improving biosecurity management level in the aquaculture industry. This indeed is a very huge project that needs multi-sectoral cooperation. For the national aquatic animal health sector, some works are now being done step-by-step including establishment of standard documents on disease surveillance, and revision of the national disease list as a start;
- On emerging diseases, some of the initial things that can be done in reducing the emergence of diseases include enhancing detection, reporting and emergency response.

RECOMMENDATIONS

- AG recommended that the national aquatic animal health strategies of the member countries should be further strengthened. Many countries have existing national AAH strategies but need be updated. Those that still do not have an AAH strategy should try to formulate one for better management of the aquaculture industry.
- AG recommended that success stories of countries in the region in dealing with disease emergencies and disease prevention should be highlighted. This would help other countries to avoid the pitfall of disease burden.

SESSION 4: UPDATES ON OIE REGIONAL COLLABORATION FRAMEWORK ON AQUATIC ANIMAL HEALTH

Dr. Jing Wang gave a presentation on the activities of the Regional Collaboration Framework on Aquatic Animal Health and its background and key objectives. In the OIE Expert Consultation Meeting on Aquatic Animal Disease Diagnosis and Control held in November 2018 in Bangkok (Thailand), it was proposed to establish the Regional Collaboration Framework on Aquatic Animal Health in Asia and the Pacific (hereinafter referred to as "the Framework"), which would initially focus on building a framework of actors to strengthen laboratory capacity for aquatic animal disease activities in Asia and the Pacific such as emergency responses to disease outbreaks. It also intended to contribute to improved information sharing among OIE Reference Centres and OIE Member Countries regarding aquatic animal health issues. This proposal was further discussed and endorsed by the Regional Commission for Asia, the Far East and Oceania in its 31st Conference held in Sendai, Japan, in September 2019.

The 1st meeting of the *ad hoc* Steering Committee was organised in November 2019 to share information regarding planned activities and capacities of OIE RLs, to identify interests amongst OIE RLs and Members, and to discuss the activities and objectives of the Framework. During the 1st meeting the following three projects were identified as priority activities for 2021.

1) Collection and Evaluation of Existing Guidelines and Awareness Materials on Aquaculture Biosecurity for Small-scale Farms in the Asia-Pacific Region; the project aims:
   - To collect and collate available information, existing regulations and awareness materials on aquaculture biosecurity from selected countries in the Asia-Pacific region (hereinafter "the Region");
   - To identify gaps and challenges in the implementation of such documents, especially at the farm level; and,
   - To develop a report to support OIE Members in the Region in understanding how to utilise available resources or further improve their regulation, awareness materials and technical guidelines.
2) Collection and Evaluation of Existing Test Methods for Acute hepatopancreatic necrosis disease (AHPND) ; the project aims:

- To collect material causing AHPND and APHND-like disease from the region and evaluate existing test method for AHPND detection;
- To understand the mechanism on how the pathogenic agent *Vibrio parahaemolyticus* takes up the 70-kbp plasmid with genes that encode homologues of the Pir toxins protein A and B, Pir-A and Pir-B, by collecting available AHPND control material from the region;
- To collect samples or information to support the Aquatic Animal Health Standards Commission's work on re-evaluating the definition of AHPND;
- To develop and publish a laboratory diagnostic algorithm to address the need in the Asia-Pacific region for AHPND detection and a report to be considered by the Aquatic Animal Health Standards Commission for further improvement of existing OIE standards.

3) The method of utilize the OIE scientific network is currently a concept note of a project under review by the *ad hoc* steering committee of the Framework.

Besides the three priority projects, the OIE regional representation for Asia and the Pacific also conducted a mapping excise to investigate the current expertise and recourses of OIE Reference Centres in the region. A survey summary is available at the regional website at: https://rr-asia.oie.int/en/projects/regional-reference-centres-platform/.

Dr. Jing Wang also shared the date and main objectives of the upcoming 2nd virtual meeting of the *ad hoc* Steering Committee of the Framework and welcomed the NACA AGM to participate in the discussion.

DISCUSSION

- OIE-RRAP in Tokyo is the main connection of NACA to OIE especially in the area of aquatic animal health. Through the concerted effort of NACA and OIE-Tokyo, it has become successful in bringing the aquatic animal health sector into the frontline, at least for some important issues being tackled in OIE. OIE-RRAP has been giving priority to aquatic animal health in the implementation of regional projects in close coordination with the national Focal Points for Aquatic Animals;
- The current programme on the Regional Collaboration Framework is a very good initiative wherein the aquatic animal health sector will be given full attention in terms of the important issues that the aquaculture industry is facing, including biosecurity, AHPND, emergency preparedness and response, and maybe emerging diseases (including DIV1) and other related issues (food safety, AMU, AMR) in the future.
- The Australian Government continues to fund the regional proficiency testing (PT) program for aquatic animal disease diagnosis. The program is implemented by the ACDP (Australian Center for Disease Preparedness) which is an accredited PT provider. The OIE will organize PT provider training in 2021 for countries that are interested in having their own national PT programme. This training will involve both livestock and aquatic sectors.
- OIE is also encouraging more countries to apply for twinning project. This is a program that can help national reference laboratories build a collaborative relationship with OIE Reference Laboratories, and become a potential reference laboratory in the future. A

questionnaire is currently being prepared that will help OIE to identify both parent and child laboratories that can be involved in future twinning programmes;

- Encouraging countries in the region to undertake PVS Aquatic can be considered as one of the future activities of the Framework. Currently, OIE is preparing the second version of the PVS tool, and once the new version is finalized by OIE HQ, some training can be organized which can be used to promote the adoption of PVS Aquatic assessment by member countries;
- There is an activity within the soon to be released OIE Strategy for Aquatic Animal Health that is looking at ways to support increased uptake of the PVS pathway by member countries. This includes ideas on what are some of the barriers might be to countries participating in the PVS and to find ways to address them;
- Based on the experience from Indonesia in the preparation of documents for the PVS assessment, the most difficult to collect has been data from the provinces and local districts. At present, relevant data from 6 or 7 provinces is still needed for the assessment;
- On the new Aquatic Code chapter on Biosecurity for aquaculture establishments, it will be proposed for adoption by OIE members at the next GS (2021).

RECOMMENDATIONS

- AG recommended that member countries and collaborating organisations in the region should fully support this new initiative of OIE-RRAP (Regional Collaboration Framework on AAH) to further strengthen aquatic animal health management in the region through implementation of important projects that have been proposed through the Framework;
- AG recommended that national AAH laboratories be invited to future meetings of the Framework, as important information can be shared to such laboratories like the provision of positive samples for emerging diseases, and the possibility of exchange of materials not only from the OIE Reference Laboratories to the member countries but also between and among the other laboratories in the region.

SESSION 5: EMERGING AQUATIC ANIMAL DISEASES AND PATHOGENS IN THE RECENT DECADE IN ASIA-PACIFIC

Dr. Jie Huang gave a presentation on the emerging aquatic animal diseases and pathogens in the Asia-Pacific over the past decade. The presentation illustrated the causative agents, affected species, presence in the region, and relevant references for 27 emerging diseases and pathogens, and another 399 new viruses reported in finfish, crustaceans, molluscs, and amphibians. Viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis virus (IHNV), and carp edema virus (CEV) re-emerged in fish in some countries in the region. Newly found fish viruses include *Siniperca chuatsi* rhabdovirus (SCRV), snakehead vesiculovirus (SHVV), scale drop disease virus (SDDV), largemouth bass virus (LMBV), tilapia lake virus (TiLV), and piscine orthoreovirus (PRV). Infectious salmon anaemia virus (ISAV) and Salmonid alphavirus (SAV) are not found in the region.

Epitheliocystis, a skin and gill disease caused by pathogenic intracellular bacteria, including a range of Proteobacteria was also reported.

For crustaceans, decapod iridescent virus 1 (DIV1), covert mortality nodavirus (CMNV), Okavirus 1 (original YHV-8), *Macrobrachium rosenbergii* Taihu virus (MrTV), crustacea hepe-like virus 1 (CHEV1), and other 399 RNA viruses were reported in the Asia-Pacific during the recent decade. Acute hepatopancreatic necrosis disease (AHPND) and infection with *Spiroplasma* sp. in *M. rosenbergii* were reported as the major emerging bacterial diseases in cultured shrimps and prawns. Dr. Huang grouped the following shrimp diseases into digestive pathogenic dysbacteriosis (DPD) of hepatopancreatic and intestinal microbiota dominated with pathogenic *Vibrio* spp.

- white faeces syndrome (WFS), hepatopancreatic necrosis syndrome (HPNS), septic hepatopancreatic necrosis (SHPN), and running mortality syndrome (RMS) for grow-out culture;
- glass postlarva (GPL), translucent post-larva disease (TPD), bacterial vitrified syndrome (BVS), and early mortality syndrome (EMS, excluding AHPND) during the postlarval/juvenile period of penaeid shrimps.

He also summarized parasitic diseases, including infection with *Enterocytozoon hepatopenaei* (EHP), milky blood disease caused by *Hematodinium* sp., toothpaste crab disease caused by *Ameson portunus* n. sp., and whitened musculature of spiny lobster caused by *Ameson iseebi* sp. nov.. Mass mortality of *Crassostrea gigas* was reported in Oceania in 2016. Giant salamander iridovirus (GSIV) was reported in China in 2014.

Dr. Huang concluded strategies to facilitate potential solutions for emerging diseases. For finding emerging diseases, governments shall encourage reporting from the private sector, establish a communication platform for remote diagnosis, encourage active media for aquaculture stakeholders, and develop an aquaculture insurance policy based on reporting of aquaculture diseases. For identifying emerging diseases, governance-research-services-industry cooperation is necessary, aquatic animal health research must be supported, passive surveillance and rapid response to emerging diseases need to be implemented, and broad application of metatranscriptomic and metagenomic based technologies should be encouraged. For notification of emerging diseases, publications on case studies need to be encouraged, international mechanisms for trading trust based on transparency need to be established, transparency from all source countries be accounted, and contribution of finding emerging diseases shall be encouraged. For a better response to emerging diseases, relevant authorities and enterprises should establish and implement contingency plans at different levels. Governments should implement domestic, on-site quarantine inspection policies, establish a national zoning system, and support the development and application of innovative treatment measures. Finally, more international, regional, national, and local training courses for emerging disease responses need to be organized.

DISCUSSION

- The list of emerging diseases over the past 10 years has been sourced mostly from published papers, and does not generally reflect the economic impacts/losses. Some diseases reported

through publication might have limited impacts or only affect a limited area or species, and unless they are reported to cause significant production/economic losses, some of these diseases might not become significant to the aquaculture industry;

- Information on these potential pathogens (e.g. for shrimps) is highly important, as they can be a cause of new emerging disease(s) in the future. These pathogens might not cause problems at the present time, but the more aquaculture environment and culture system are mismanaged, the more that these potential pathogens can cause significant disease problems;
- Exposing these potential pathogens to stressful environment in aquaculture can possibly cause some of them to mutate and become more pathogenic and cause disease in the future. Thus, emerging diseases will persist as we continue to modify our culture system or intensify culture production;
- Much strong and good management in aquaculture, including biosecurity, is needed to prevent the occurrence of these emerging diseases. Cultured animals should be exposed to these pathogens as little as possible, even if vaccines (for some of the emerging diseases) become available;
- It is important to acknowledge that these emerging diseases are omnipresent. We may not see disease but we can definitely detect, isolate and identify the pathogens, and when production is intensified, that is the time when most disease outbreaks will occur;
- Regardless of what is being done so far, it is quite difficult to apply specific control measures against things that we do not know, or against every disease (of which there are many). It is, therefore, relevant to increase capability and awareness on aquaculture biosecurity in the region, as it is a really crucial concept. At present, people don't realize the importance or fully understand the concept of biosecurity;
- In terms of proper biosecurity, it is also important to think about breeding programs and to consider the tolerance or resistance of the cultured aquatic animals to different diseases;
- Keeping the pathogenic agent out of the system (through biosecurity) will not result in a sterile culture environment, as beneficial and non-pathogenic microorganisms will still be present in the system;
- On YHV genotype 8 which is now classified under a new name, it was initially identified and classified as a new variety of a previously known species. However, classification based on the identity of conserved genes has resulted in the classification of genotype 8 as a new species. For the other genotypes of YHV (e.g. 4, 5, 6), no genome sequence has been reported. Thus, they cannot be further classified.
- It is a fact that there are a lot of pathogens present in the aquatic environment, some of them with uncertain significance. What it really implies is that aquatic animals are grown in a "pathogen soup", and that management of their health is really important to prevent those pathogens from causing disease(s). The disease response is indeed important, and presently with some of the sectors of the industry (e.g. multinational companies investing in aquaculture) it has become professionally mature. It is hoped that prevention practices will come into play.

- The type of actions and biosecurity measures that prevent diseases from emerging in the first place is also important. Currently, there are still a lot of poor practices (e.g. feeding raw fish, frozen uncooked fish, or untreated whole foods to broodstock). These are really dangerous and highly risky practices for spreading diseases (especially those unknown) to healthy animals;
- These fundamental actions are needed, and though resistance from the industry often somehow occurs, they need to be pushed (one step at a time) especially on the implementation of important aquaculture regulations at the farm level;
- Just like in the salmon industry, if the shrimp farmers are guaranteed clean seeds and use the right biosecurity strategy for whatever culture system that they are practicing, and even if they don't have the capacity to run a highly intensive system, they can still succeed with clean seeds and low density rearing. However, there is a need for some level of regulation and high cooperation among the players in the industry (e.g hatchery operators, farmers).

RECOMMENDATIONS

- With the vast information available on the potential pathogens of aquatic animals, AG recommended that it is better to culture aquatic animals in a more environmentally-friendly or more sustainable systems in order to prevent pathogens from creating future disease problems;
- AG recommended that capacity and awareness on aquaculture biosecurity should be pushed forward and its implementation promoted, especially at the farm level.
- AG recommended that NACA create an information system for these emerging pathogens that might be distributed widely through some modern technologies like "WeChat" or other online platforms.

SESSION 6: UPDATES ON QAAD REPORTING

6.1. QAAD REPORT IN THE FUTURE: UPDATES ON THE NEW FUNCTION OF THE NEW WAHIS SYSTEM

Dr. Jing Wang presented the progress and the functions of the new World Animal Health Information System (WAHIS) together with preliminary ways of accommodating QAAD specific information in the future electronic system.

The new OIE WAHIS project was launched in 2016, aiming to develop a modern and dynamic platform to report on the global animal health situation. OIE-WAHIS has been developed to evolve and grow as new needs arise, and it will be released in several stages. In release one, it will include OIE WAHIS main core modules (immediate notifications, six-monthly reports, public interface), E-learning, standard Interconnection, Smartphone application and integration of historical data from 2005. In release 2, it will introduce more functions, such as additional core modules (annual report, wild annual report, public wildlife interface), local report modules and completion and optimization of the release one modules. An analytics and dashboard public interface will be a specific section

for analytics, allowing consulting users to instantly monitor the national or regional animal health situation. Jing Wang mentioned that integration of the QAAD report into new OIE-WAHIS will start in release two in 2022.

With respect to possible ways of accommodating QAAD specific information in WAHIS, and in order to create a more user-friendly reporting system (before WAHIS release two), OIE and NACA will develop a QAAD secured delegate/Focal Point site where Members can submit aquatic animal disease data to NACA and OIE at the OIE regional website (https://rr-asia.oie.int/en/). Only the OIE Delegate and Focal Point for aquatic animals will have the password. This will enable them to access the Delegate-secured site, which means that the Focal Points can submit their disease information in excel through the delegate-secure site. OIE and NACA developed a new annual reporting template for the Delegate-secured site based on the old QAAD form. The annual reporting template includes information on the monthly disease status of each QAAD disease and epidemiological information. OIE and NACA will encourage Members to provide their aquatic animal health information monthly or bi-monthly. However, each Member will decide the best frequency for submitting data to the OIE and NACA. By clicking the name of a Member, everyone can see the aquatic health situation of each Member of each year through the public interface.

Currently the Focal Points for Aquatic Animals have to report their aquatic animal health information (particularly the OIE listed disease situation) both OIE WAHIS and QAAD. Thus, in the long term, OIE and NACA would like to remove this duplication between WAHIS and QAAD through the establishment of a Regional Core of disease online reporting system for non-OIE listed aquatic animal diseases of regional importance in Asia and the Pacific under the new OIE-WAHIS Six-Monthly Report (SMR) module. Under this system, disease status and epidemiological information will be reported following the format of WAHIS SMR, which will be compiled and stored at the Regional Core. The OIE Members in the region will be able to report their non-OIE listed disease information six-monthly in OIE WAHIS release two, 2022. Meanwhile, OIE RRAP and NACA will be able to access the system and extract relevant information through the back office or Regional Dashboard in a fixed excel format. Aquatic animal diseases including OIE listed diseases, emerging diseases and non-OIE listed disease information will be visible only for MCs in our region via a specific Regional Dashboard or the report prepared by RRAP and NACA.

6.2. UPDATES ON QAAD REPORTING AND DISEASE LIST

Dr. Eduardo Leaño presented the status of QAAD Reporting in the Asia-Pacific region. There are now a total of 88 QAAD reports published since its inception way back in 1998. At present, only e-copies of the report are published at both NACA and OIE-RRAP websites. Website downloads (NACA) during 2019 to 2020 ranged from around 300 to 1,200, while the 2nd quarter report for 2020 (2 weeks after upload) has a total of around 100 downloads.

Percentage of member countries submitting the report is still a concern. Only 36-45% of the countries (out of 33) are submitting at least one report for the period covered, with 13 countries

(Australia, Chinese Taipei, Hong Kong SAR, India, Iran, Malaysia, Myanmar, New Caledonia, New Zealand, Philippines, Singapore, Thailand and Vietnam) submitting the reports quarterly.

Reported diseases for finfish include Infection with infectious haematopietic necrosis and Infection with viral haemorrhagic septicaemia (reported by Iran), Infection with *Aphanomyces invadans* (India), Infection with red seabream iridovirus (Chinese Taipei, Hong Kong SAR and Singapore), Infection with Koi herpesvirus (Chinese Taipei), Viral encephalopathy and retinopathy (Australia, Brunei Darussalam, Chinese Taipei, India, New Caledonia and Singapore), Enteric septicaemia of catfish (Vietnam), Carp edema virus disease (India), and Tilapia lake virus (India, Philippines and Thailand). For crustaceans, reported diseases were Infections with viruses including White spot syndrome virus (Australia, Chinese Taipei, India, Iran, Philippines, Thailand and Vietnam), Infectious hypodermal and haematopoietic necrosis virus (Australia, India, Philippines and Thailand), *Macrobrachium rosenbergii* nodavirus (Thailand), Yellow head virus genotype 1 (Thailand), and Decapod iridescent virus 1 (Chinese Taipei). Also reported were bacterial disease Acute hepatopancreatic necrosis disease (Philippines, Thailand and Vietnam), and parasitic disease Hepatopancreatic microsporidiosis caused by *Enterocytozoon hepatopenaei* (Chinese Taipei, India, Malaysia, Philippines and Thailand).

For molluscs, New Zealand reported Infection with *Bonamia ostreae*, while Australia and New Zealand reported Infection with *Bonamia exitiosa*. Australia, India and New Zealand also reported the presence of Infection with *Perkinsus olseni*. Lastly for amphibians, Thailand reported the presence of Infection with *Ranavirus* species, while Australia, New Caledonia and Singapore reported Infection with *Batrachochytrium dendrobatidis*.

Other reported diseases are:

Bangladesh:

- *Streptococcus* sp.(Climbing perch; Tilapia)
- *Aeromonas* sp. (Climbing perch; Shing; Asian catfish; Pabda catfish)
- *Staphylococcus* sp. (Tilapia)

Myanmar

- Parasitic infestation in freshwater fish

Singapore:

- *Lates calcarifer* Herpesvirus
- *Lates calcarifer* Birnavirus
- *Streptococcus agalactiae* (Jade perch)
- *Streptococcus iniae* (Asian seabass, red snapper)
- *Megalocytivirus* (ornamental guppy)
- Big belly bacteria
- Scale drop disease virus

NACA also received queries and requests for amendments from few countries in the region including:

- Vietnam in December 2019. Amendment on Infection with YHV1 from "-" (not reported, but disease is known to occur) to "0000" (never reported) starting from 3rd quarter of 2019. This was after recent verification of the YHV genotype detected since 2015, and found that the YHV genotype was actually GAV and not YHV1.
- Australia in July 2020. Requested to correct the name of "Infection with *Ranavirus*" to "Infection with *Ranavirus* species" (Note: name was corrected in the 2020 QAAD Form prior to circulation to all member countries). They also inquired to change the name of "Decapod iridescent virus 1" to "Infection with Decapod iridescent virus 1" (Note: DIV1 was the name endorsed by AG during the AGM 18; and names of non-OIE listed diseases do not usually follow the OIE naming nomenclature of "Infection with [pathogen]").
- Singapore in November 2020. Amendment for their report on the Infection with *Batrachochytrium dendrobatidis* for 2020 ("+" report during the 1st quarter of 2020). These amendments will be published in the next QAD Report (3Q 2020) in January 2021.

DISCUSSION

- The establishment of Regional Core of disease online reporting system for non-OIE listed aquatic animal diseases of regional importance in Asia and the Pacific under the new OIE-WAHIS Six-Monthly Report (SMR) module will make the job of both FPs and NACA/OIE RRAP easier in reporting and producing the QAAD report respectively;
- On improving the percentage of countries submitting the QAAD reports, although it is the obligation of the OIE member countries to submit disease reports, it is not compulsory at all and both NACA and OIE cannot push member countries to do so. However, transparency on disease reporting has more advantages than disadvantages, not only for the country itself but for other countries as well if everyone is willing to share their information on disease outbreaks or disease presence.
- Countries which are regularly submitting the quarterly reports are duly acknowledged by the group, as these reports are valuable especially to understand those non-OIE listed diseases for consideration by the OIE AAHSC;
- Another importance of QAAD reporting is usefulness when countries are having negotiations with their trading partners/countries (e.g. export of shrimp products), since importing countries usually check their disease reporting history with reference to OIE six-monthly report and/or QAAD Reports. This transparency for disease information is very important for the country to build trust with their trading partners for export of their aquaculture products;
- Since disease report submission is the responsibility of the OIE Delegate, what OIE has been doing for a very long time is supporting the FP Aquatics in terms of their capacity for disease diagnosis which is important for disease surveillance and reporting.
- Once the QAAD is fully integrated with the new WAHIS system, it will be easier for the FP to lobby with their respective OIE Delegate to report diseases, especially non-OIE listed diseases because of their importance to the region;

- Reporting of the disease doesn't usually mean that there is a disease outbreak in the country that reported it. If a pathogen is reported to be present, it means that it was detected but may not necessarily indicate that an outbreak occurred. Such information should always be included in the epidemiological comments for clarification on pathogen detection and/or disease outbreak, and should become a part of the transparency that the country can show to establish trust with trading partners;
- In doing import risk assessment, it is easier to assess counties that are regularly submitting disease reports because by just looking at the history of reporting, one can follow their biosecurity measures very clearly, especially towards the declaration of disease-free status;
- P.R. China fully supports disease information transparency, and an annual report on aquatic animal diseases has been published each year which includes surveillance report data of major aquaculture diseases (both active and passive). An English version of the report was published last year.
- For the QAAD Report, P.R. China is not submitting any report due to some internal issues on the reporting process, while for WAHIS, its yearly report is regularly submitted to OIE. Once the new OIE WAHIS is fully implemented with both QAAD and WAHIS reporting to be merged into one, aquatic animal disease information from P.R. China will then appear in the QAAD reports;
- On the usefulness of QAAD reports, it was re-emphasized that FAO will continue to have closer cooperation with NACA and OIE in the utilization of such reports and similar technical tools. This is especially important because the reports (both QAAD and WAHIS) have been used by several countries in the region and incorporated in their national aquatic animal health strategies. The disease lists are used in updating their list of diseases that will be included in their national aquatic animal disease surveillance and in mainstreaming of aquatic animal health management (including disease prevention) at the national level;
- On the delay in submitting the disease report, one of the reasons (in the case of Malaysia) is the need to validate and/or confirm positive cases, especially if the result is coming from non-accredited laboratories. Validation is needed to avoid submission of wrong data for positive cases;
- For Indonesia, delay in the submission of the report was mainly due to the delayed approval and endorsement from the permanent OIE Delegate after the FP filled-up the necessary disease information in the QAAD form. They also lack positive reference materials for some important and emerging diseases. It is good to know that this activity is included in the planned activities of the OIE Framework;
- In Pakistan, there has been a problem in coordination with international organizations with the recent re-organization and transfer of responsibilities. In recent years, coordination with NACA was transferred to the Ministry of Maritime Affairs, and this year, it was transferred back to the Ministry of Food Security and Research. Collection of disease information has resumed and it is hoped that QAAD reporting from the country will resume very soon;
- OIE expressed its willingness to extend assistance and support to newly appointed OIE FP for Aquatic Animals (Indonesia and Pakistan), not only on disease reporting but for other aquatic animal health issues and other OIE activities as well;

- In Malaysia, the national list of reportable pathogens includes the OIE-listed diseases which are automatically included in the active or passive surveillance programme. Thus, the disease reporting clearly reflects the country's management of fish health issues;
- One of the things that might improve reporting (if countries are afraid that when they report, there might be some restrictions on the products such as shrimps that they export from their countries), is to clearly state in the OIE Aquatic Code Section 5.4.2 (which covers products for human consumption) that shrimp products with shell-off-heads-off are considered safe commodity for any listed shrimp pathogens. As such, countries should not be afraid of reporting the presence of any shrimp pathogens as most processed shrimp products that are being exported are considered safe. However, there is a need for the countries of destination to respect such designations set by OIE.

RECOMMENDATIONS

- AG recommended that OIE-RRAP and NACA make use of future meetings to be organized for OIE FP for Aquatic Animals (or with the OIE Delegates) to efficiently relay the current status of QAAD reporting and other relevant information on aquatic animal diseases;

SESSION 7. OTHER MATTERS AND CLOSING

- The 11th Symposium on Diseases in Asian Aquaculture (DAA 11) supposed to be held in Kuching, Sarawak, Malaysia on 29 September to 2 October 2020 is now postponed to 23-26 August 2021 in the same venue. Postponement has already been announced on the website (www.daa11.org) and registration and abstract submission are still open. With the continuous uncertainties brought by the current pandemic (COVID-19), the national organizing committee and Fish Health Section Executive Committee will immediately announce on the website if there will be any changes or further updates. If the current situation will not change (resurging of COVID-19 cases and travel restrictions), one option is to have a virtual meeting, but this will require a different planning and set-up in order to accommodate submitted paper presentations;
- On organisation of virtual meetings and training, NACA has been organizing important meetings on aquaculture (e.g. DIV1) and some in collaboration with partner institutes (e.g. Training on Mariculture Technologies, Aquaculture Fora), and it will organize more international virtual meetings/trainings in the future. Countries interested to collaborate with NACA on such activities are more than welcome. These international virtual meetings/trainings are great opportunities for large numbers of the general public to have a chance to interact and discuss with known experts in aquaculture and aquatic animal health. This might not be possible during face-to-face events;
- The report of the AGM 19 (Discussions and Recommendations) was circulated by e-mail to all AG members and co-opted members for comments, endorsement and adoption.

- The next AGM (AGM 20) will be held back-to-back with DAA 11 in August 2021 if the face-to-face symposium will push through as planned. Otherwise, it will be held virtually in Bangkok in November 2021;
- The AGM 19 officially closed at 16:30 PM (BKK time), 27 November 2020.

ANNEX A

19TH MEETING OF ASIA REGIONAL ADVISORY GROUP ON AQUATIC ANIMAL HEALTH (AGM19) (VIRTUAL MEETING) 26-27 NOVEMBER 2020 13:00-15:00/16:00 (BKK TIME; GMT+7)

AGENDA:

Day 1 (26 November)

Welcome and Introduction (15 mins)

- Introduction (Dr. Eduardo Leaño)
- Welcome Remarks (Dr. Jie Huang, DG NACA)
- Self-introduction (all participants)
- Selection of Chair and Vice-chair (Chair will take over in moderating the meeting)

Progress since AGM 18 (15 mins; Dr. Eduardo Leaño, NACA)

Updates from OIE Aquatic Animal Health Standards Commission (15 mins; Dr. Ingo Ernst, AAHSC, OIE)

Updates on Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB) (15 mins; Dr. Melba Reantaso, FAO)

Note: 15-20 minutes discussion and recommendations after each presentation

Day 2 (27 November)

Welcome and recap of day 1 (5 mins; Dr. Eduardo Leaño, NACA)

Updates on OIE Regional Collaboration Framework on AAH (15 mins; Dr. Jing Wang, OIE-RRAP)

Emerging aquatic animal diseases and pathogens in the recent decade in Asia-Pacific (15 mins; Dr. Jie Huang, NACA)

Updates on QAAD Reporting:

- QAAD Report in the Future: Updates on the new function of the new WAHIS system (10 mis; Dr. Jing Wang;OIE-RRAP)
- Updates on reporting and disease list (5 mins; Dr. Eduardo Leaño, NACA)

Other issues (10 mins)

Note: 15-20 minutes discussion and recommendations after each presentation

ANNEX B

List of Participants (AGM 19)

I. Advisory Group Members
World Organisation for Animal Health (OIE) / Australia
Dr. Ingo Ernst (AAHSC; DAWE-Australia) Director, Aquatic Pest and Health Policy Animal Division, Australian Government Department of Agriculture, Water and the Environment GPO Box 858, Canberra ACT 2601, Australia Ingo.Ernst@awe.gov.au
Food and Agriculture Organization of the United Nations (FAO)
Dr. Melba Reantaso Aquaculture Officer, Fisheries Division Food and Agriculture Organization of the United Nations Rome, Italy Melba.Reantaso@fao.org
OIE Regional Representation for Asia and the Pacific, Tokyo, Japan
Dr. Jing Wang OIE Regional Representation for Asia and the Pacific Food Science Building 5F The University of Tokyo 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan j.wang@oie.int; rr.asiapacific@oie.int
Aquatic Animal Health Research and Development Division, Department of Fisheries, Thailand
Dr. Janejit Kongkumnerd Director Aquatic Animal Health Research and Development Division Department of Fisheries, Kasetsart University Campus Ladyao, Jatujak, Bangkok 10900, Thailand kjanejit@yahoo.com
SEAFDEC AQD, Philippines
Dr. Eleonor Tendencia Head, Fish Health Section SEAFDEC Aquaculture Department Tigbauan, Iloilo, Philippines gigi@seafdec.org.ph
Private Sector
Dr. Kjetil Fyrand Director, R&D Aqua-China PHARMAQ AS Harbitzaléen 2A, N-0213 Oslo, Norway kjetil.fyrand@zoetis.com
Thailand
Dr. Supranee Chinabut Bangkok, Thailand supraneecb@yahoo.com
Prof. Timothy Flegel Centex Shrimp, 4th Floor Chalermprakiat Building Faculty of Science, Mahidol University Rama 6 Road, Bangkok 10400, Thailand tim.flegel@gmail.com

P.R. China
Dr. Chenxu Cai and Dr. Liang Yan National Fisheries Technology Extension Center Ministry of Agriculture, Beijing P.R. China 1185478291@qq.com, liang-ly@foxmail.com **Dr. Hong Liu** The Laboratory of Aquatic Animal Diseases, Shenzhen Exit & Entry Inspection and Quarantine Bureau, AQSIQ Room 908, 1011 Fuqiang Road Futuan, Shenzhen The People's Republic of China 709274714@qq.com
II. Co-opted members
Dr. Siow-Foong Chang National Parks Board Animal and Veterinary Services JEM Office Tower, 52 Jurong Gateway Road, #09-01, Singapore siowfoongchang@yahoo.com; chang_siow_foong@nparks,gov.sg
Dr. Andy Shinn Director Benchmark R&D (Thailand) Ltd. 57 / 1 Moo 6, Tambon Samed Amphur Muang Chonburi, Thailand andy.shinn@bmk.asia
Dr. Saraya Tavornpanich Norwegian Veterinary Institute Oslo, Norway saraya.tavornpanich@vetinst.no
III. Observers/Country representatives
Dr. Md. Nowsher Ali Assistant Director Department of Fisheries Matshabhaban, Ramna, Dhaka, Bangladesh mnali28bcs@yahoo.com
Mr. Khan Chan Dara Chief Office of Aquatic Animal Health & Disease Management Department of Aquaculture Development, Fisheries Administration, Ministry of Agriculture Forestry and Fisheries, Phnom Penh, Cambodia chandara_khan@yahoo.com
Dr. Li Pak Yi (Veron) Fisheries Management Officer Agriculture, Fisheries and Conservation Department 5/F, Cheung Sha Wan Government Offices, 303 Cheung Sha Wan Road Kowloon, Hong Kong SAR pak_yi_lee@afcd.gov.hk
Dr. Neeraj Sood and **Dr. Pravata Pradhan** ICAR-National Bureau of Fish Genetic Resources Canal Ring Road, P.O. Dilkusha, Lucknow, India sood_neeraj@rediffmail.com; pradhanpk1@gmail.com
Dr. Christina Retna Handayani and **Ms. Erna Yuniarsih** Directorate General for Aquaculture Ministry of Marine Affairs and Fisheries Jakarta, Indonesia Handayani.retna@yahoo.com; erna.aziez@gmail.com

Dr. Hyoung Jun Kim and **Mr. Young Chui Kim** Aquatic Animal Quarantine (AAQ) Laboratory National Fishery Products Quality Management Service 337, Haeyang-ro, Yeongdo-gu, Busan Republic of Korea hjkim1882@korea.kr
Dr. Kua Beng Chu Director Fish Health Research Division, Fisheries Research Institute Department of Fisheries Penang, Malaysia kbengchu@yahoo.com
Dr. Aung Naing Oo Director Aquaculture Division, Department of Fisheries Ministry of Agriculture, Livestock and Irrigation Republic of the Union of Myanmar ano93dofmm@gmail.com
Mr. Subhash Kumar Jha Fisheries Development Officer Central Fisheries Promotion and Conservation Center Balaju, Nepal jhasuvas2012@gmail.com
Mr. Muhammad Junaid Watto Chief Technical Officer Fisheries Development Board Islamabad, Pakistan junaid.fdb@gmail.com
Mr. WPR Chandrarathna Fish Pathologist National Aquaculture Development Authority No.41/1, New Parliament Road, Pelawatta Battaramulla, Sri Lanka palitha.chandrarathna@gmail.com; fp@naqda.gov.lk
Dr. Bin Hao, Mr. Andrea Dall'Occo and **Mr. Brett MacKinnon** Fisheries Division Food and Agriculture Organization of the United Nations Rome, Italy Bin.Hao@fao.org; andreadeallocco@gmail.com; mackinnonbrett@gmail.com
Ms. Asako Endo and **Ms. Karakawa Nanae** OIE Regional Representation for Asia and the Pacific Food Science Building 5F The University of Tokyo 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan a.endo@oie.int; nanaekarakawa@g.ecc.u-tokyo.ac.jp
IV. NACA Secretariat
Suraswadi Building, Department of Fisheries Compound Kasetsart University Campus, Ladyao, Jatujak Bangkok 10900, Thailand **Dr. Eduardo Leaño**, Senior Progamme Officer, Aquatic Animal Health, eduardo@enaca.org **Dr. Jie Huang**, Director General, Jie.Huang@enaca.org **Dr. Derun Yuan**, Senior Programme Officer, Training and Education, yuan@enaca.org **Mr. Simon Wilkinson**, Senior Programme Officer, Information and Communication, simon@enaca.org

Annex C:
List of Diseases in the Asia-Pacific

Quarterly Aquatic Animal Disease Report
(Beginning January 2021)

1. DISEASES PREVALENT IN THE REGION	
1.1 FINFISH DISEASES	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with epizootic haematopoietic necrosis virus	1.Grouper iridoviral disease
2. Infection with infectious haematopoietic necrosis virus	2.Viral encephalopathy and retinopathy
3. Infection with spring viraemia of carp virus	3.Enteric septicaemia of catfish
4. Infection with viral haemorrhagic septicaemia virus	4.Carp edema virus disease (CEVD)
5. Infection with *Aphanomyces invadans* (EUS))	5. Tilapia lake virus (TiLV) disease
6. Infection with red seabream iridovirus	
7. Infection with koi herpesvirus	
1.2 MOLLUSC DISEASES	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with *Bonamia exitiosa*	1. Infection with *Marteilioides chungmuensis*
2. Infection with *Perkinsus olseni*	2. Acute viral necrosis (in scallops)
3. Infection with abalone herpes-like virus	
4. Infection with *Xenohaliotis californiensis*	
5. Infection with *Bonamia ostreae*	
1.3 CRUSTACEAN DISEASES	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with Taura syndrome virus (TSV)	1. Hepatopancreatic microsporidiosis (HPM) caused by *Enterocytozoon hepatopenaei* (EHP)
2. Infection with White spot syndrome virus (WSSV)	
3. Infection with yellow head virus genotype 1	2. Viral covert mortality diseases (VCMD)
4. Infection with Infectious hypodermal and haematopoietic necrosis virus (IHHNV)	3. *Spiroplasma eriocheiris* infection
5. Infection with Infectious myonecrosis virus (IMNV)	4. Decapod iridescent virus 1 (DIV1)
6. Infection with *Macrobrachium rosenbergii* nodavirus (MrNV; White tail disease)	
7. Infection with *Hepatobacter penaei* (Necrotising hepatopancreatitis)	
8. Acute hepatopancreatic necrosis disease (AHPND)	
9. Infection with *Aphanomyces astaci* (Crayfsh plague)	
1.4 AMPHIBIAN DISEASES	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with *Ranavirus* species	
2. Infection with *Bachtracochytrium dendrobatidis*	
3. Infection with *Batrachochytrium salamandrivorans*	
2. DISEASES PRESUMED EXOTIC TO THE REGION	
2.1 Finfish	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with HPR-deleted or HPR0 salmon anaemia virus	1. Channel catfish virus disease
2. Infection with salmon pancreas disease virus	
2. Infection with *Gyrodactylus salaris*	
2.2 Molluscs	
OIE-listed diseases	**Non OIE-listed diseases**
1. Infection with *Marteilia refringens*	
2. Infection with *Perkinsus marinus*	

Annex D:

ASIA REGIONAL TECHNICAL GUIDELINES – STATUS OVERVIEW (ADOPTED FROM AGM 9 REPORT)

Element of technical guidelines	Progress / status	Gaps / opportunities
1. Disease reporting *An understanding of the basic aquatic animal health situation is a pre-requisite for prioritising activities, developing national policy and identifying pathogens of national importance.*	• Regional QAAD reporting system established – participation has increased • The QAAD list has incorporated emerging diseases that were later listed by the OIE • Many countries have established national lists for reporting purposes with appropriate supporting legislation	• Participation could improve further – some countries report irregularly • The proposed regional core utilising the OIE's WAHID will streamline reporting and may improve participation • The exact status of individual countries with regard to adoption of national lists and supporting legislation is not know
2. Disease diagnosis *Diagnosis requires various levels of data, starting with farm- or site-level observations and progressing in technical complexity to electron microscopy, immunological and nucleic acid assays and other biomolecular methods. This means all levels of expertise, including that of the farmer and extension officer working at the pond side, make essential contributions to rapid and accurate disease diagnosis.* *Effective diagnostic capability underpins a range of programs including early detection for emergency response and substantiating disease status through surveillance and reporting.*	• Diagnostic capabilities have improved in many countries • NACA disease cards have been developed and maintained for emerging diseases • The Asia regional diagnostic manual has been developed • An Asia regional diagnostic field guide has been developed • OIE reference laboratories • Regional reference laboratories – where no OIE reference laboratory exists • Regional Resource Experts are available to provide specialist advice • Ad hoc laboratory proficiency testing programs have been run	• OIE twinning programs are a means to assist laboratories to develop capabilities • The exact status of diagnostic capability in individual countries is not certain • There is limited or no access to ongoing laboratory proficiency testing programs • Some areas of specialist diagnostic expertise are lacking • Network approaches are a means draw on available diagnostic expertise
3. Health certification and Quarantine measures *The purpose of applying quarantine measures and health certification is to facilitate transboundary trade in aquatic*	• Strong progress has been made, particularly for high risk importations (e.g. importation of broodstock and seed stock) • Training has been provided through regional initiatives (e.g. AADCP project)	• The importance of supporting aquatic animal health attestations through sound aquatic animal health programs continues to be underestimated, with possible ramifications for trade

animals and their products, while minimising the risk of spreading infectious diseases	• Commercial implications for trade have driven improved certification practices • Harmonisation with OIE model certificates has occurred	• Some inappropriate or illegal activities continue and threaten to spread trans-boundary diseases
4. Disease zoning and compartmentalisation *Zoning (and compartmentalization) allows for part of a nation's territory to be identified as free of a particular disease, rather than having to demonstrate that the entire country is free. This is particularly helpful to facilitate trade in circumstances where eradication of a disease is not feasible.Zoning is also an effective tool to restrict the spread of important pathogens and aid in their eradication.*	• Is an emerging need to meet requirements of importing countries • To facilitate trade, some countries are working toward having compartments and zones recognised	• Where common health status can be identified restrictions on trade can be reduced • Training opportunities would be beneficial • Learn from the experience of terrestrial animal industries (e.g. poultry)
5. Disease surveillance and reporting *Necessary to produce meaningful reports on a country's disease status by providing evidence to substantiate claims of absence of a particular disease and thereby support import risk analysis, justify import health certification requirements, and enable export health certification*	• Regional Resource Experts are available to provide specialist advice • Training has been provided through a number of initiatives (e.g. AADCP project) • Many published resources are available, including those of the OIE (publications and the OIE centre for aquatic animal epidemiology) • Collation of surveillance information has improved through participation in international reporting	• Remains a reliance on passive surveillance. Active surveillance may be beneficial but cost is often a barrier. • Methodologies to undertake effective but low-cost active surveillance would be of assistance • Epidemiological expertise is often limited • There is a need to increase surveillance of wildlife to support health status
6. Contingency planning *Important to provide a rapid and planned response for containment of a disease outbreak—thereby limiting the impact, scale and costs of the outbreak*	• Important provides a rapid and planned response for containment of a disease outbreak Some countries have advanced contingency planning with appropriate supporting legislation • Some countries have tested contingency plans through simulation exercises • Resources are available (e.g. Australia's AQUAVETPLAN, FAO guidelines, OIE links to resources)	• The exact status of contingency planning in individual countries is not certain • Training in emergency management frameworks may be useful • Support for developing contingency plans might usefully be directed at particular disease threats e.g. IMN

7. Import risk analysis *The movement of live aquatic animals involves a degree of disease risk to the importing country. Import risk analysis (IRA) is the process by which hazards associated with the movement of a particular commodity are identified and mitigative options are assessed. The results of these analyses are communicated to the authorities responsible for approving or rejecting the import.*	• Numerous resources and case studies published • The approach has been applied, particularly for some circumstances e.g. import of live *P. vannamei* • However risk analysis is not always applied, or is not applied appropriately • Regional training has been provided (e.g. AADCP project)	• There is a need to build awareness of the concepts • Training can be abstract and disengaging - should aim at trainees learning on scenarios relevant to their circumstances • This is a high priority generic need that is suited to development of a central training program
8. National strategies *The implementation of these Technical Guidelines in an effective manner requires an appropriate national administrative and legal framework, as well as sufficient expertise, manpower and infrastructure.*	• Many countries have developed national strategies • Detailed assistance has been provided to some countries (e.g. AADCP project)	• The exact status of national strategies in individual countries is not certain • The OIE's PVS tool provides a means of assessing the progress of individual countries