NETWORK OF AQUACULTURE CENTRES IN ASIA-PACIFIC

Twenty Second Meeting of the Asia Regional Advisory Group on Aquatic Animal Health

REPORT OF THE MEETING

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

6-7 November 2023

Prepared by the NACA Secretariat

Preparation of this document:

This report was prepared by the 22nd Asia Regional Advisory Group on Aquatic Animal Health (AG) who met virtually in Bangkok, Thailand on 6-7 November 2023.

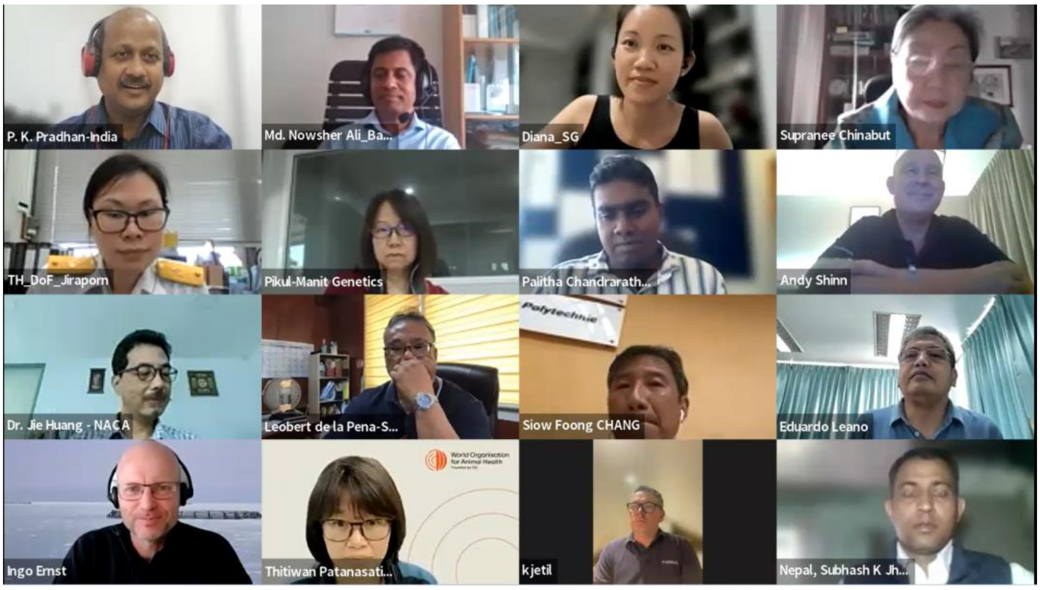
The AG was established by the Governing Council of the Network of Aquaculture Centres in Asia-Pacific (NACA) in 2001 to provide advice to NACA members in the Asia-Pacific region on aquatic animal health management, through the following activities: (a) evaluate disease trends and emerging threats in 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 Organisation for Animal Health (WOAH) and the Food and Agricultural Organization of the United Nations (FAO), collaborating regional organisations such as SEAFDEC Aquaculture Department (SEAFDEC AQD) and WOAH-Regional Representation in Asia and the Pacific (WOAH-RRAP), and the private sector.

Reference: NACA 2023. Twenty Second 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

AAD	Aquatic animal disease
AAH	Aquatic animal health
AAHSC	Aquatic Animal Health Standards Commission of the WOAH
AG	Asia Regional Advisory Group on Aquatic Animal Health (NACA)
AGM	Advisory Group Meeting
AMR	Antimicrobial resistance
AMU	Antimicrobial use/usage
ANAAHC	ASEAN Network of Aquatic Animal Health Centres
AP-AquaNet	Asia Pacific Network for Aquatic Animal Health
DA-BFAR	Department of Agriculture – Bureau of Fisheries and Aquatic Resources (Philippines)
DOF	Department of Fisheries-Thailland
EHP	Hepatopancreatic microporidiosis caused by *Enterocytozoon hepatopenaei*
EKE	Expert Knowledge Elicitation
EUS	Epizootic ulcerative syndrome (Infection with *Aphanomyces invadans*)
FAO (HQ)	Food and Agricultural Organization of the United Nations (Headquarters)
FHS-AFS	Fish Health Section of the Asian Fisheries Society
GC	NACA Governing Council
GS	General Session of the OIE Delegates
ICTV	International Committee on Taxonomy of Viruses
IHHNV	Infectious hypodermal and haematopoietic necrosis virus
iIPV	Infection with Infectious precocity virus
ISKNV	Infectious spleen and kidney necrosis virus
NAOHS	National Aquatic Organism Health Strategy
NACA	Network of Aquaculture Centres in Asia-Pacific
NFRDI	National Fisheries Research and Devekoment Institute (Philippines)
NVI	Norwegian Veterinary Institute
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
PMP/AB	Progressive management pathway for improving aquaculture biosecurity
RAOHS	NACA Regional Aquatic Organism Health Strategy
RSIV	Red seabream iridovirus
SEAFDEC-AQD	Southeast Asian Fisheries Development Center, Aquaculture Department
TG	Technical Guidelines (Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals)
TRBIV	Turbot red body iridovirus
TWG	Technical Working Group
WOAH	World Organisation for Animal Health (Founded as OIE)
WOAH PVS	WOAH Performance of Veterinary Services
WOAH RRAP	WOAH Regional Representation for Asia and the Pacific

The 22nd Asia Regional Advisory Group on Aquatic Animal Health.



Participants of the virtual AGM 22 composed of AG members and co-opted members from FAO (Rome, Italy), WOAH-RRAP (Tokyo, Japan), WOAH-AAHSC (Paris, France), SEAFDEC AQD (Iloilo, Philippines), AAHRDD (Bangkok, Thailand), Australia, Singapore, Thailand, the private sectors (PHARMAQ, Inve), NVI (Ås, Norway), and NACA Secretariat. Observers from NACA member countries and territories were also invited, and governments represented include: Australia, Bangladesh, Cambodia, Hong Kong SAR, India, Indonesia, Lao PDR, Malaysia, Maldives, Nepal, Philippines, Sri Lanka, Thailand and Vietnam.

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OPENING SESSION

The 22nd Meeting of the Asia Regional Advisory Group on Aquatic Animal Health (AGM 22) was convened virtually in Bangkok, Thailand on 6-7 November 2023. Originally attended by only AG members, co-opted members and few observers, the meeting was again participated by NACA member country representatives. NACA member countries and territories represented include Australia, Bangladesh, Cambodia, Hong Kong SAR, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines and Sri Lanka.

The meeting was opened by **Dr. Eduardo Leaño**, Senior Programme Officer of NACA and Technical Secretary of the AG. Welcome message was given by **Dr. Jie Huang**, Director General of NACA. Dr. Huang emphasized the aquaculture production of the AP region through sustainable development, which is a critical requirement for food security and livelihood. The collaboration among NACA, FAO, WOAH and other relevant organizations in the region has set-up successful mechanisms to face challenges brought about by aquatic animal diseases and biosecurity risks in the past decade. Previous and current members of the AG were thanked for their contribution to this mechanism since its establishment in 2002.

After brief self-introduction by all the participants, Chairperson **Dr. Andy Shinn** and Vice-Chairperson **Dr. Leobert dela Peña** took over in the facilitation of the AGM 22 and moved for the adoption of the Provisional Agenda (**Annex A**). 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 21 which was held virtually on 17-18 November 2022. Key points discussed during the AGM 21 include:

- AMU in Aquaculture. WOAH requires countries to report country level AMU for both terrestrial and aquatic animals which can be a starting point in looking at the data that WOAH has collected. However, AMU in aquatic animals only mention the types of antimicrobials used and no information is available on the volume of actual usage at the farm level..
- WOAH Disease List. Member countries should nominate diseases that they think no longer meet the WOAH listing criteria together with evidences (e.g. for IHHNV). Upon submission, WOAH will look at it thoroughly and properly assess whether the disease can be delisted or not.
- Aquaculture Biosecurity. Disease surveillance (both passive and active) should be continued by every member country especially for important aquatic animal diseases. Surveillance is one of the key components/elements of a National Aquatic Organism Health Strategy that has long been promoted by FAO and NACA since early 2000. Basic farm-level biosecurity

measures should be continuously promoted for adoption of farmers, depending on their facilities and capacity.

Biosecurity should not become another burden, especially for small-scale farmers which lack the capacity, but rather a motivation for the farmers to improve the overall farm management in order to prevent occurrence of any disease and to sustain production.WOAH AAH Strategy. The Strategy is important and should be promoted by countries in the region, in line with their respective NAAHS for better aquatic animal health management and consequently prevention of disease outbreaks. It is crucial to receive feedbacks from member countries so that WOAH can identify what will not work, and would know the needs of the country especially in terms of support from WOAH.

The biosecurity assessment tool, once finalized, should be pilot tested in selected countries in the region, involving different aquaculture species and culture systems. This is to assess its applicability into the more complex structure of the aquaculture industry in the AP. Explore the usability of the assessment tool for other purposes including IRA, risk management, internal audits of compartment and zones, and trading and export.

- WOAH Aquatic Animal Health Strategy. Continue to encourage countries in the region to undertake PVS aquatic. Member countries should continue to support the implementation of WOAH Aquatic Strategy either through national initiative or through collaborative projects that are being implemented in the region (e.g. on emergency preparedness and response). Different strategies on aquatic animal health management should be coordinated efficiently especially projects implemented by international and regional organizations like FAO, WOAH, SEAFDEC and NACA.

  The global community should continue to provide resources and training in order to strengthen and further promote the importance of aquatic animal health among the current and future activities of WOAH. Continue to emphasize the benefits of disease reporting and transparency, especially in the prevention of spread of many transboundary aquatic animal diseases.
- WOAH Regional Collaboration Framework. The collaboration framework should be continued and supported to improve the aquatic animal health networking in the region, and to make sure that all the activities are aligned and coordinated with the activities of WOAH Headquarters, especially the Aquatic Animal Health Strategy.

Report of the meeting (e-copy) was widely circulated among NACA member countries and partner organizations, and published at NACA website for free download.

The regional aquatic animal disease reporting requires all Members to submit monthly data as soon as available to WOAH-RRAP and NACA to ensure the timeliness of the disease information. Updated reports are regularly published in dedicated pages at NACA and WOAH-RRAP websites. A technical workshop was organized by WOAH to discuss the development of the regional interface for efficient online disease reporting. Issues raised for consideration include: frequency of disease report submission, emerging diseases, non-WOAH listed diseases, NACA access to WAHIS, and data/information that can be extracted for preparation of disease reports.

NACA, in collaboration with FAO and selected member countries, has developed its Regional Aquatic Organism Health Strategy (RAOHS). The RAOHS was presented during the 32nd NACA Governing Council (GC) Meeting held on 7-9 August in Chiangmai, Thailand, and it was consensually endorsed by the NACA GC on 8 August. A Regional Technical Working Group (RTWG) was formed to facilitate implementation of the RAOHS in selected countries in the region. Currently, the RTWG is looking to build a regional working group of risk analysis experts, which is one of the priority areas identified from the list of RAOHS activities that can be implemented.

NACA is collaborating with fai on fish welfare and in 2023, it con-organized two webinars: 1) Fish Welfare: What we need to know?; and, 2) How to measure Tilapia welfare?. Both of these are free webinars and attended by participants from around the world.

NACA continues to closely collaborate with WOAH on several aquatic animal health programmes in the region and beyond. The Regional Collaboration Framework, now renamed as Asia-Pacific Aquatic Animal Health Network (AP-AquaNet) organized it 4th Steering Committee Meeting in Busan, South Korea on 29 June 2023. Updates on the different projects being implemented in the region were presented, including farm-level aquaculture biosecurity which was undertaken by NACA. Two WOAH expert groups were joined by NACA: 1) Observatory Consultation Group which monitors the implementation of WOAH Standards; and 2) Electronic Expert Group on AMU in Aquaculture at Field Level. NACA also extended support to the launch of Regional Aquatic Animal Health Networks in the African region (Northern and Southern Africa). Dr. Leano shared successful experiences of NACA on networking in the AP region, specifically the regional Health and Biosecurity Programme, and assisted in giving guidance to the network on their short- and medium-term plan of activities on aquatic animal health management. NACA also supported and attended important WOAH activities including the 90th GS and the Regional Workshop for WOAH Focal Points for Aquatic Animals.

For other activities, a Regional Training on Mitigation of Antimicrobial Resistance Risks in Aquaculture was organized by ASEAN Network for Aquatic Animal Health Centres (ANAAHC), and NACA (E. Leaño) was invited as a lecturer on “Good aquaculture practices to minimize AMR risk in aquaculture”. NACA has co-organized, together with the Fish Health Section of the Asian Fisheries Society (FHS-AFS) and the Department of Fisheries – Thailand (DOF), the Fish Health Section Conference: From the Pillars to the Next. The conference was held in Swissotel Bangkok Ratchada, Bangkok, Thailand on 6-8 September 2023. Lastly, Dr. Leaño was invited as a plenary speaker (Aquatic Animal Disease Reporting in the Asia-Pacific Region) during the 10th Fisheries Scientific Conference organized by the National Fisheries Research and Development Institute (NFRDI) of the Philippines.

DISCUSSION

- One of the real benefits of NACA and the works that it does on aquatic animal health is bringing different groups together and create a link between different organization which is really valuable;

- The African region is now very active in the establishment of their aquatic animal health networks, and in December 2004, the region will be launching the Regional Aquatic Animal Health Laboratory Network which NACA is also supporting. This is in addition to the already established Regional Aquatic Animal Health Network which was launched in both the Northern and Southern Africa this year (2023).
- The WOAH Electronic Expert Group on AMU in Aquaculture at Farm/Field Level, there has already been a lot of discussion during the last 2 meetings of the Group on how to proceed with the formulation of the Guidelines. The quantification of AMU at farm level in the aquaculture sector has a lot of challenges and difficulties in collecting the actual amount of antimicrobials that are being used by the farmers. The group is really finding it hard on how to develop the guidelines at this time. Some of the challenges include the absence of prescription for AMU in aquaculture, the accessibility to different antimicrobials by the farmers, and the lack of proper monitoring protocols on the actual usage.
- The guidelines is making use of all available references including the Guidelines on AMU at Farm Level being developed by both FAO and WOAH which mainly focus on terrestrial animals (but also include aquatics).
- On RAOHS, most of the countries represented in this AG are familiar with the Regional Strategy and some of them has been a part in its formulation during the expert consultation held in Phuket in March 2023. The RAOHS is a sort of a guidelines which can be used by countries in the region in developing their respective national strategies depending on their capacity and available resources to implement the different activities that were identified in the Strategy.
- The RAOHS has listed 40 activities under 17 programmes which can be implemented by both NACA members and the Secretariat. NACA will also try to mobilize resources to assist some of the member countries in the implementation of the different activities.

SESSION 2: UPDATES FROM WOAH AQUATIC ANIMAL HEALTH STANDARDS COMMISSION

Dr. Ingo Ernst gave a presentation on the progress of the Aquatic Animal Health Standards Commission's (AAHSC) work to develop new and revised standards for the WOAH Aquatic Animal Health Code and WOAH Manual of Diagnostic Tests of Aquatic Animals.

Dr. Ernst highlighted some of the ongoing work discussed at the Commission's September 2023 meeting and the draft standards included in the meeting report for members comments.

Dr Ernst highlighted some of the key activities that may be of most interest to AG members.

Listed diseases. The commission considered member country comments on the proposal to list the species ISKNV (including its three genogroups RSIV, TRBIV and ISKNV). The majority of members supported the proposal to list ISKNV. Some minor revisions were made to the assessment which was provided again to support members consideration of the proposal to support listing of ISKNV. The commission is aware of a proposal before the ICTV to rename the species ISKNV.

Compartmentalisation. The commission developed a discussion paper on compartmentalisation and provided it to members for their response to some key issues. The discussion paper aims to find consensus on key issues relevant to compartmentalisation prior to revision of the existing Chapter 4.3. The discussion paper presents the concept of two major types of compartments: dependent compartments (status requires disease freedom in a surrounding zone) and independent compartments (status is independent of disease status external to the compartment).

Trade in milt and fertilised eggs of fish. The commission provided a new draft chapter on measures to reduce the risk of pathogen transfer via eggs and milt. The chapter was developed with the assistance of an industry working group. The new chapter provides improved assurance for trade in eggs and milt from countries, zones or compartments not declared free by including measures for establishing the health status at place of origin of the broodstock, conditions for collection and incubations centres, and health certification for milt and fertilized eggs of fish.

Movement of ornamental aquatic animals. This draft new chapter addresses risks of disease transmission via the movement of ornamental aquatic animals. The chapter includes guidance on eligibility of species; application of risk analysis; options for risk mitigation pre-border, border, and post border; and welfare.

Preparedness and outbreak response. The commission provided two draft new chapters for comment. Chapter 4.X. describes essential elements of an emergency disease preparedness framework. Chapter 4.Y. describes actions to activate an emergency response to suspicion or confirmation of an important disease.

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 have clear guidance on recommended tests for surveillance, information on their validation status, consistent case definitions, and updated scientific information. Dr Ernst provided an update on the progress to update all manual chapters as described below.

Crustacean disease chapters - 6 of the 10 chapters in the crustacean section have been revised and adopted. Thoroughly revised versions of the four remaining chapters were provided for member comment in the Sep 2023 meeting report including:

- Chapter 2.2.0. General information;
- Chapter 2.2.2. Infection with *Aphanomyces astasci* (crayfish plague);
- Chapter 2.2.6. Infection with *Macrobrachium rosenbergii* nodavirus (white tail disease);
- Chapter 2.2.9. Infection with yellow head virus genotype 1

Fish disease chapters - 10 of the 11 chapters in the fish section have been revised and adopted. The remaining chapter is Infection with RSIV and is on hold pending a decision on listing of the species ISKNV.

Mollusc chapters – none of the 8 chapters have been revised and adopted. Thoroughly revised versions of three chapters were provided for member comment in the Sep 2023 meeting report including:

- Chapter 2.4.0. General information;
- Chapter 2.4.1. Infection with abalone herpesvirus;
- Chapter 2.4.4. Infection with *Marteilia refringens*

Amphibian chapters – revision of the four chapters in the amphibian section has not commenced.

DISCUSSION

- On the proposal to list ISKNV which also includes both RSIV and TRBIV, it will definitely resolve some of the issues involved in reporting of these diseases under the current Aquatic Animal Disease Reporting System for Asia-Pacific. At present, two countries are reporting the presence of ISKNV: India which report it under "Infection with RSIV", and Hong Kong under "Other Diseases".
- On the new chapter for ornamental aquatic animals that is being developed, it is something that has been requested from several member countries for a long period of time and also discussed during the Global Conference on Aquatic Animal Health in 2019. Then it was included in the WOAH Aquatic Animal Health Strategy which was launched in 2021.
- It has been know for a long time that aside from food fish, ornamental fish is also one of carriers/sources of infectious pathogens. Including them now under WOAH standards might affect the ornamental fish industry (e.g. trade barrier) especially for the small scale businesses in many countries.
- The Chapter that is being developed might be a surprise to some as it should have been an issue that should have been addressed directly a long time ago. As we all know, movement of live aquatic animals is an issue for ornamentals, and we are somehow lucky as most of them don't get released from fish tanks in people's home. They often don't have a pathway to aquaculture or wild animals, but there are still some reported escapees/release where it will pose risk for disease/pathogen spread.
- There's always been measures in the Code for listed diseases which are applied for trade of live aquatic animals. The problem is, they are not suited for ornamentals as those measures are really focused on country free zones or compartments, and there's not really a mechanism to guide the type of trade that we have for ornamentals.
- What the Chapter is trying to do is to provide a broader framework for application of disease specific chapters, specifically if there is a hazard that are identified through risk analysis. The chapter also carefully emphasized the obligation of importing countries to implement standards appropriately. For example, if a country is applying measures for a disease that is not listed, they need to undertake risk analysis. If applying measures for listed diseases, they need to follow the recommended measures in the code, otherwise, do something that exceeds those measures (e.g. risk analysis).
- Ornamentals were also raised as an issue on several programmes on AMU and AMR, whether they can be included in the development of guidelines. Considering the different trade path of ornamentals compared to food fish, however, it is often difficult to control or

monitor AMU as they are not currently covered under any regulations for cultured food fish. In the African region, the culture of ornamentals is directly under aquaculture, thus they are covered by their existing national regulations including AMU.

- Further on AMU (on ornamentals), a decision should be based on what we are trying to achieve in terms of producing AMR. The risks need to be considered, and how our actions can mitigate those risks in most sensible and achievable ways.
- It is important to highlight that the current WOAH standards are already applied to ornamental fish, especially to kois and goldfish specifically on the spread of koi herpesviruses which is not a new thing. However, as ornamental fish only focuses on kois and carps, ISKNV will become a significant issue as it can infect a wide host range (from marine to brackishwater) and covers a wider geographical range.
- On EHP, considering the huge economic losses it has caused, it is really overlooked in the shadow of AHPND. Despite its massive impact on the industry, the Commission was slow to recognize that and members also did not raise it to WOAH to seek any standards for managing it. But in the past couple of years, EHP was already recognized as emerging disease and WOAH has already developed a disease card. Members were also invited to comment on what direction it should go, whether it should be listed or not. But so far, no comments are received from member countries. Maybe because the disease is quite widespread by now and has impacted shrimp farms around the world, although some countries are still free from it, e.g. Australia which has detected similar parasite but not EHP, and maybe some of the Pacific Islands.

SESSION 3: AQUACULTURE BIOSECURITY

3.1 THE PROGRESSIVE MANAGEMENT PATHWAY FOR IMPROVING AQUACULTURE BIOSECURITY (PMP/AB): UPDATE FROM NOVEMBER 2021 PRESENTATION; ACTIVITIES OF RELEVANCE TO ASIA

Dr. Melba Reantaso, Team Leader of Food Safety, Nutrition and Health, Fisheries and Aquaculture Division of FAO, presented a pre-recording on “Aquaculture Biosecurity (PMP/AB) and FAO Aquatic Animal Health Initiatives in the Asia-Pacific Region”

Progress in the Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB)

- The genesis and processes taken in the development of the PMP/AB since 2018 was briefly described including convening of multistakeholder meetings, establishment of a Technical Working Group (TWG) and relevant meetings, presentation and progress reporting during the 10th, 11th and 12th sessions of the FAO Committee on Fisheries Sub-Committee on Aquaculture. The PMP/AB Guidance for application document (https://www.fao.org/documents/card/en/c/cc6858en) contains information on the PMP/AB vision, mission, scope, terminology, benefits, advancement along the pathway and stage descriptions, objectives and key outcomes. The document also mentioned several

PMP/AB toolkits and at which PMP/AB stage they may be used, such as guidance in (i) conducting SWOT and gap analysis, (ii) developing a national or regional aquatic organism health strategy (NAOHS or RAOHS), (iii) developing a National Aquatic Pathogen List, (iv) risk analysis (e.g. import risk analysis and risk analysis along the value chain), (v) design of an active surveillance , and (vi) emergency preparedness and response. Another toolkit under development is 'Cost-benefit analysis (CBA) framework for biosecurity systems' where a conceptual framework is being finalized to be applied using four country case studies dealing with SPF/SPT in shrimp, Saproleginosis in finfish and emergency response to WSSV and TiLV.

- The PMP/AB TWG continues to finalise and further develop additional toolkits including: (1) Step-wise guidance for pilot testing; (2) PMP/AB governance mechanisms; (3) Biosecurity Action Plans; (4) Risk analysis in the aquaculture value chain; (5) Emergency preparedness; (6) Training Modules/E-learning; (7) Public-private sector partnership (PPP); (8) Aquaculture health economics/cost-benefit analysis/disease burden; and (9) Communication strategy.

- A layman's article on PMP/AB was published in institutional newsletters (FAO, Infofish, NACA) and industry magazines in several languages such as Arabic, Brazilian, Chinese, English, Spanish in order to reach wider stakeholders.

- As part of the regional rollout of the PMP/AB, FAO supported the development of the NACA RAOHS containing 17 Programmes and 38-related activities. The systematic development process involved nomination of focal points by each NACA Member countries, that conducted the FAO self-assessment survey, attended virtual meetings and in-person regional workshop in Phuket (February 2023). The RAOHS was presented at the 32nd NACA Governing Council Meeting (August 2023), and the RAOHS was endorsed. A Regional PMP/AB Technical Working Group was subsequently established through a Call for Expression of Interest.

FAO initiatives and activities of relevance to the Asia-Pacific region

RECOFI Workshop on Enhancing Knowledge on Aquatic Health Management and Biosecurity and Understanding of Antimicrobial Resistance in Aquaculture: regional workshop under the auspices of FAO's Regional Commission on Fisheries (RECOFI), hosted by the Kingdom of Saudi Arabia, July 0223.

"Pathway to Aquaculture Biosecurity, Managing Disease Risks in the Aquaculture Value Chain": an Elearning Course (https://elearning.fao.org/course/view.php?id=979) in collaboration with the FAO Elearning Academy was launched in August 2023 composed of five lessons: (i) introduction to PMPAB; (ii) introduction to risk analysis, (iii) import risk analysis, (iv) risk analysis in the aquaculture value chain (AVC) , and (v) the application of risk analysis in the AVC.

Training Course on Risk Analysis in the Aquaculture Value Chain (Sept 2023) in collaboration with the ASEAN Network of Aquatic Animal Health Centers (ANAAHC) and hosted by the Thai Department of Fisheries (DoF)

Intensive training course on design of active disease surveillance he FAO 12-point active surveillance checklist for aquatic organism diseases (https://doi.org/10.1111/raq.12530): Philippines, September 2023 (https://www.fao.org/philippines/news/detail/ru/c/1650601/)

Antimicrobial Resistance (AMR) in Aquaculture

- ASEAN regional webinar on AMR (Regional Training on Mitigation of Antimicrobial Resistance (AMR) Risks in Aquaculture – March 5, 2023); FAO delivered a pre-recorded presentation titled "Understanding Biosecurity Using Risk Analysis Principles".
- Launch of four new 'FAO Reference Centers for Antimicrobial Resistance (AMR) and Aquaculture Biosecurity (AB)'. The RCs include: Pearl River Fisheries Research Institute and the Yellow Sea Fisheries Research Institute of the Chinese Academy of Fishery Science (CAFS), Nitte University in India, the Mississippi State University in the USA) in addition to the Centre for Environment, Fisheries and Aquaculture Science from the UK. This partnership underscores FAO's commitment to address AMR through the One Health and the Quadripartite initiative, to implement FAO AMR Action Plan 2021-2025 and promote responsible antimicrobial use in aquaculture.
- During the celebration of the 2023 World Antimicrobial Awareness Week (WAAW 23), FAO organized a webinar titled " Preventing Antimicrobial Resistance Together" (27 November).

PMP/AB and AMR related publications in 2023

- FAO Aquaculture Newsletter, p.14-17 (https://www.fao.org/3/cc6639en/cc6639en.pdf#page=14)
- Network of Aquaculture Centres in Asia Pacific (NACA) https://enaca.org/?id=1281
- Camino hacia la bioseguridad en la acuicultura: Mitigación de riesgos, gestión progresiva e involucramiento de la cadena de valor, pp. 81-84 (https://issuu.com/revista-cna/docs/edicion_155)
- FAO E -Learning Academy, a training course called "Pathway to Aquaculture Biosecurity, Managing Disease Risks in the Aquaculture Value Chain" https://elearning.fao.org/course/view.php?id=979,
- Special Issue in Reviews in Aquaculture (https://www.fao.org/documents/card/fr/c/cc4958en; https://doi.org/10.1111/raq.12789): presentations delivered during the virtual technical seminar on Tilapia Health, *Quo vadis* (https://infofish.org/tilapia/) ()
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Moving forward: planned events in 2024

During the first half of 2024, the following activities/events are being planned:

- Data Analysis Workshop related to PMP/AB Toolkit8 (CBA): March 2024, FAO HQ, Rome, Italy
- Physical launch of NACA RAOHS, Regional and Global PMP/AB Meeting, FAO Reference Centres for AMR and AB Meeting: April 2024, Qingdao, China to be hosted by the Chinese Academy of Fishery Sciences
- Fish-Vet Dialogue II: June 2024, FAO HQ, Rome, Italy; a follow-up of Fish-Vet Dialogue I (https://infofish.org/Fish-VetDialogue/)
- "To vaccinate or not to vaccinate": international conference: June 2024, FAO HQ, Rome, Italy
- Launch of the E-learning Module on "Emergency Preparedness and Contingency Planning"; June 2024
- Ongoing support will continue to be provided to Indonesia and Sri Lanka (through ongoing projects), and other interested new Asian countries.

Discussion

- On the physical launch of NACA RAOHS, it is planned to have it as a back-to-back event with the NACA Governing Council Meeting (GCM) in India, or a 1-hour session within the GCM. Usually, during launch event of instruments like the RAOHS, the presence of country-based donors are encouraged, in order to disseminate information and maybe stimulate interest to fund some of the activities in RAOHS. Launching of RAOHS during the GCM will also provide a good chance for NACA to continue working and supporting the Strategy.

- During the RAOHS development workshop in Phuket, some of the countries informed the group that they were already implementing some of the activities under RAOHS. Countries were then asked to use RAOHS as a guidelines in improving their national aquatic organism health strategies based on their capacity and on what they can do, and to give an update on such activities especially to the Regional Technical Working Group (RTWG).
- The Fish Vet Dialogue 2 is planned for next year as a hybrid event, which will be held in Rome, Italy. It is hoped that countries in Asia will participate in this important event.
- Emergency preparedness and contingency planning is one of the two important elements of the PMP/AB (the other is risk analysis). Currently, a document is being finalized on this for mass mortality events in aquatic population following the same mechanism used for the risk analysis. This will include development of e-learning course which will cover an introduction to emergency preparedness, disease investigation, surveillance and diagnostics, plus two other topics. Once the e-learning course has been completed and launched, an in-person event will be organized next year which will focus more on simulation exercises, desktop activities and other aspects of emergency preparedness and response.

3.2 Farm-level aquaculture biosecurity: From a tilapia parasites perspective

Dr. Andy Shinn gave a presentation on the "Translocation of tilapia’s tiny terrors: Nile tilapia and its parasites".

Over the last 80 years, tilapias have undergone extensive translocation for aquaculture, and today active production is documented in 124 countries. The most widely cultivated species, *Oreochromis niloticus* (Nile tilapia), is raised in at least 75 countries. Collectively, the tilapias, comprising 13 species, constitute one of the largest aquaculture groups, contributing to approximately 6.5 million tonnes of production. This indicates that roughly 1 in 10 farmed fish globally is a tilapia. Notably, around 79% of the total production comes from 79 countries beyond the natural range of tilapia.

Nile tilapia, on its own, holds the third position in terms of annual aquaculture production with 4.13 million tonnes and ranks fifth in value among fish species (out of 273 categories listed by FAO FishStatJ). Capture fisheries contribute an additional 723,627 tonnes of tilapias, with over 47% of this sourced from established invasive populations outside Africa. The initial translocation of tilapia is traced back to a shipment of *O. mossambicus* (Mozambique tilapia) to Kali Serang, Java, in 1939. Subsequently, records indicate the translocation of O. niloticus to Argentina (1940), *O. mossambicus* to Hong Kong, Indonesia, Malaysia, and Singapore in the early 1940s, and the introduction of redbelly tilapia (*Coptodon zillii*) to Mexico and Antigua in 1943-1945.

Beyond the tonnages derived from capture fisheries, the adaptability of tilapias to colonize new environments is highlighted by media reports, such as the mass mortality of 15-25 tonnes of wild tilapia in 2016 at Kedungombo Reservoir in Sumberlawang, Sragen, Central Java.

A pertinent inquiry arising from the extensive translocation of species is the extent to which their native (African) parasites have been relocated with them and the identification of any new species acquired. Until a recent publication by Shinn et al. (2023), a preliminary examination of metazoan parasites documented in *O. niloticus* suggested that they hosted a minimum of 30 different species. A subsequent, more thorough investigation confirmed that tilapias indeed harbour a diverse array of parasites, many of which have been transferred alongside their hosts.

A comprehensive review by Shinn et al. (2023) delved into more than 820 fish translocations, scrutinizing over 2500 host-parasite records from 73+ countries. While the complete review offers insights into various major parasite taxonomic groups, their constituent species, and provides commentary on management and control strategies, particular emphasis was placed on hook-bearing species of "monogenean," belonging to the class Monopisthocotylea (formerly a subclass within Monogenea, recently elevated to class status based on new molecular evidence).

New data from the review suggests that "monogeneans" infecting tilapia may become some of the most widespread tropical freshwater fish parasites, given the ubiquity of tilapias and the prevalence of their monogeneans. Supporting this notion, forty helminth species have been reported to be translocated into Mexico with introduced fish, with 33 of these being monogeneans, including 14 introduced alongside tilapias. Commonly translocated species of monopisthocotyleans include those of *Cichlidogyrus* (e.g., *C. halli* reported in 7 countries outside of Africa; *C. thurstonae* (8); *C. sclerosus* (11); and *C. tilapiae* (12)), *Gyrodactylus* (e.g., *G. cichlidarum* (13)), and *Scutogyrus* (e.g., *S. longicornis* (8)). The feeding and attachment activities of these monopisthocotyleans can create entry points for secondary pathogens, heightening susceptibility to bacterial infections such as *Streptococcus iniae* (see Xu et al., 2007) and *Aeromonas hydrophila* (see Abdel-Latif & Khafaga, 2020).

The review, encompassing over 2,500 parasite records, has expanded our understanding of the parasite fauna associated with tilapias, now comprising over 153 protistan and over 284 metazoan species. However, it underscores substantial knowledge gaps, particularly in regions where much remains to be determined. Records include instances from 8 countries where only protistans are known, 32 countries with only metazoan records, 35 countries with records for both protistans and metazoans, and over 80 countries where no records are available. Notably, this latter group encompasses at least 19 African countries and over 10 countries in Southeast Asia.

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DISCUSSION

- It is hoped that this kind of information on parasites (especially the lovely and clear photos shared by Dr. Shinn) will reach the young generation to make sure that they can see the important view and importance of fish parasites. The problem remains, however, on how to attract funding for parasite research, and one way to address this is to modify research studies on fish health to include parasites especially on the view of biosecurity as mentioned during the presentation.
- There are loads of these parasites which were misidentified due to the limited information available during the identification process. It is, therefore, necessary to go back and probably re-examine some of these records to properly identify the parasites concerned.
- For countries where parasites are not present/reported, it might be a result of the lack of capacity to look for them. This is true, as in many cases, protozoan are not checked for or just dismissed, and in some cases the parasites found are not speciated.
- Fish parasitology is an important discipline but at present, we are losing the discipline. It is hoped that this kind of presentation will encourage some researchers to become a parasitologist.
- On tilapia biosecurity at present, including vulnerability in terms of disease spread, some parasitic infestations are still overlooked (e.g. endoparasites). Parasites might be present at very low levels but numbers will definitely increase when the host fish is subjected to transport stress.
- In terms of hatchery production of selected genetic lines for tilapia, there are two strategies that are usually applied: one is to collect the eggs from the broodstock and transfer them to hatchery; second is eggs are allowed to hatch naturally in the broodstock ponds and fry are then collected for rearing. In both of these methods, biosecurity is definitely low.
- Transcontinental transfer of pathogens in tilapia is common, especially during the growth of industry from Asia to Africa to Latin America. For *Streptococcus* as example, it is quite distinct how the different serotypes spread from one location to another which might be due to movements of live tilapia including fry, fingerlings and broodstock. This scenario is definitely happening to parasites as well.
- On disease diagnostics, there has been a lot of shift to modern molecular techniques including sequencing and e-DNA which usually generate huge data, thus there is a need to set-up a separate server just to house the data. Application of these modern diagnostic techniques for parasites, e.g. e-DNA for transport water to detect parasites, might be considered in the future.
- Despite the importance of parasitic diseases in cultured animals, the problem persists on the low uptake on research and activities on parasitic diseases. First, few parasitic diseases are included in the reportable diseases, one of the reasons why many parasites are often overlooked. Second, except from research funding, the aquaculture sector is also in shortage of experts on parasitic diseases (most experts in the region are already retired), thus it is important to encourage the younger generation of researchers and students to get more involved on parasitology not only for fish but also from crustaceans and shellfishes.

3.3 Farm-level aquaculture biosecurity: Updates on "Oplan Balik Sugpo" (Operation Black Tiger Shrimp Revival)

Dr. Leobert dela Peña presented an update on the 'Oplan Balik Sugpo", a project being implemented by SEAFDEC AQD on the revival of the *P. monodon* culture in the Philippines.

The global aquaculture in recent years has witnessed a significant surge in shrimp production, with Asia as a pivotal contributor to this dynamic industry. Recently, a survey and forecast report from FAO and Rabobank (2023) on global aquaculture production reported that shrimp production is driven by Latin America, with Ecuador being the major contributor. Meanwhile, in Asia, shrimp supply recently declined in 2022, which is projected to return to an increasing growth curve. Among the various shrimp species cultivated, the black tiger shrimp (*Penaeus monodon*) stands out as a prominent player in the aquaculture landscape as it recently made a comeback mainly due to production from China and India. Recognized for its large body size, high value, and having been successfully bred in captivity, the black tiger shrimp has become a preferred Penaeid species of research and development within the aquaculture sector. The black tiger shrimp was also once regarded as an economic jewel of the Philippines and other countries in Asia that garnered millions of dollars' worth of earnings from production and export. However, due to several factors such as no guidelines for expansion and regard for sustainability, rampant use of unapproved chemicals, the unabated release of untreated effluents, no disease screening, and no biosecurity measures have resulted in catastrophic disease outbreaks, the industry encountered a boom-and-bust cycle in production.

As the black tiger shrimp's market demand continues to increase, the industry grapples not only with meeting these demands but also with the imperative need for proactive and robust biosecurity measures, especially at the farm level. To augment the need for increasing demand and to revive the shrimp industry, particularly *P. monodon*, SEAFDEC/AQD prioritized "Oplan Balik Sugpo" as one of its five thrust programs. A joint undertaking by SEAFDEC/AQD and DA-BFAR, the program generally intends to bring back the *P. monodon* industry of the Philippines and help farmers revive their hopes and venture again into shrimp culture. Also, this program helps the industry by producing high-quality post-larvae (PL) from the hatchery and implementing environment-friendly strategies in the grow-out phase.

As global aquaculture witnessed a surge in the movement of live shrimp and other products across borders, the vulnerability of the shrimp industry to various pathogens dictated a paradigm shift towards proactive biosecurity measures from the hatchery up to the grow-out phases. In the hatchery phase, some implemented interventions or innovations include PCR screening of spent spawners and different post-larval stages, egg washing, disinfection and rinsing. There are two vital facilities in the shrimp hatchery phase. First is the Spawner/Broodstock Facility, where the spawners were quarantined, acclimatized, disinfected, spawned, and sampled for PCR tests. The second is the main shrimp hatchery, where the nauplii are stocked, reared, and sampled until PL. The key biosecurity features of the facilities are enclosed modules, the use of shower rooms, a UV-sterilized seawater system, and filtered air supply. In the hatchery phase, proactive monitoring of water and

PL was done through bacterial analysis conducted twice a week. PCR tests and PL quality monitoring were performed at PL 5, PL 10, and PL 15.

Understanding and prioritizing the need for farm-level biosecurity emerges as an indispensable strategy for ensuring the health, sustainability, and productivity of shrimp culture in order to sustain the revival of the *P. monodon* industry in the country. For the grow-out culture, the technology demonstration has been carried out at the Dumangas Brackishwater Station (DBS) and started with the low or partial discharge and closed-recirculating systems of shrimp farming, employing environment-friendly schemes at the intensive level (Baliao, 2000; Baliao & Tookwinas, 2002). In this phase, there were several interventions and schemes that SEAFDEC/AQD conducted to ensure an environment-friendly and a biosecure shrimp farming. The basic components include proper pond preparation (GAqPs), crop rotation, use of pond reservoir, biomanipulators, salinity reduction, application of probiotics, and high-quality PL and feeds. Biosecurity measures in grow-out phase include the weekly sampling of *P. monodon* for bacteriological and PCR analyses. Meanwhile, twice a week sampling was conducted for bacteriological analysis of the pond water. In order to monitor the clinical signs of diseases, daily monitoring of shrimp in the pond and those swimming along the dikes was conducted.

With these interventions, the "Oplan Balik Sugpo" has conducted several successful production runs from 2019 to 2023. In 2019, biomass harvested was 5.6 metric tons/ha with a survival rate of 93% and an Average Body Weight (ABW) of 30 g. In 2020, it was 4.8 metric tons/ha, 91% survival rate and ABW of 28 g. In 2021 and 2022, respectively, they were 4.5 and 7.3 metric tons/ha, 85% and 95% survival, and 30 g and 35 g ABW. The first phase of "Oplan Balik Sugpo's" grow-out technology demonstration is almost complete. For the second phase, the technology will be adopted by DA-BFAR and NFRDI, demonstrated in their technology outreach stations, packaged, and transferred to shrimp farmers. The project could also be implemented via requests from shrimp farmers through DA-BFAR, and SEAFDEC/AQD will conduct a site visit and assessment, provide training, or send personnel for technical assistance.

In conclusion, the important role of farm-level biosecurity in the shrimp industry cannot be overstated. This farm-level biosecurity is an integral component in the pursuit of sustainable aquaculture, and these measures shield shrimp farms from the pervasive threats of diseases. Furthermore, as we tackle the dynamics of shrimp production, it is necessary to view biosecurity not merely as a protective barrier but also as a proactive investment in ensuring the sustainability of both our aquaculture enterprises and the delicate balance of our aquatic environments.

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Discussion

- The effort made by SEAFDEC AQD to revive the *P. monodon* industry and the progress that they have made is well acknowledged. What is important to highlight here is the implementation of farm-level biosecurity measures especially at grow-out culture operations. Enhanced farm-level biosecurity measures is not that expensive to implement, modification in ponds which can be done by farmers themselves.
- Presently, verification studies for grow-out culture is still within SEAFDEC AQD, but starting next year, this will be expanded to some government agencies (e.g. National Fisheries Research and Development Institute) and some private farmers who already expressed interest to pilot test the technology.
- Costing of farm-level biosecurity measures for grow-out operation was also done, and results showed that enhanced biosecurity measures comprise only PHP10-15 per kilogram of shrimp produced. This is a good thing, as we don't want farmers to look at biosecurity as another production burden in producing shrimps or fish. Thus, in promoting the technology, one of the important things that should be highlighted is the benefits that the farmers can get from applying enhanced farm-level biosecurity measures, which is affordable but effective in improving culture operations and increasing production.
- The project is under the Southeast Asia Development Program, thus, any ASEAN member country can request for assistance on this technology from SEAFDEC AQD. For countries other than ASEAN, request for assistance can be made through the SEAFDEC Secretariat in Bangkok, Thailand.
- Bangladesh is a big producer of organic *P. monodon* which is an important export product. main problem is most of farms are small-scale thus biosecurity measures are not implemented properly. Currently, on-going World Bank projects are making several interventions on *P. monodon* culture including water supply canals, clustering of several small farms to manage sourcing of healthy seeds, feeds and other farm supplies as well as overall pond management.
- Small-scale farmers are always considered as the "weak link" for the implementation any farm-level biosecurity measures, thus it is very important to let the farmers become aware that not all biosecurity measures are expensive or difficult to implement. We have to let them know that through proper pond management, good feeding, maintaining good water quality and preventing their stocks to get infected with any disease are already biosecurity measures that any farmer can easily implement especially for grow-out culture.
- Effluent management is usually a problem in shrimp culture (e.g. in Bangladesh). Wastewater treatment is one of the most difficult aspect in the shrimp culture operation especially grow-out. Although some big farms have waste-water treatment ponds, it is still hart to monitor if the wastewater are treated properly prior to disposal.
- Under the program, fry production is under strict biosecurity control and monitored for the presence of important shrimp pathogens under the Philippine setting, to make sure that the PL's supplied for grow-out operation are healthy and free from major pathogens.
- Spawners collected from the wild which tested positive to some important pathogens are not discarded, but proper egg washing and disinfection are done to prevent infection of the

fry and PLs produced. Several runs for this egg washing and disinfection (even if they came from infected broodstock) has proven that it is possible to produce disease free PLs for grow-out culture operation.

SESSION 4: UPDATES ON WOAH ASIA-PACIFIC NETWORK ON AQUATIC ANIMAL HEALTH (AP-AQUANET)

Dr. Thitiwan Patanasatienkul gave a presentation on the updates on activities of the Asia-Pacific Network on Aquatic Animal Health (AP-AquaNet). Aquaculture production is a significant food production sector in the Asia-Pacific region, accounting for approximately 88% of global aquaculture production. With a wide range of species farmed in various production systems, including shrimp, fish, molluscs, and seaweed, the sector has not only contributed significantly to regional food security but has also played a pivotal role in driving economic development and employment opportunities. China, India, Indonesia, Vietnam, Bangladesh, Thailand, and Myanmar are major aquaculture producers ranking among the top ten producers worldwide.

The emergence of diseases in aquatic animals in the Asia-Pacific region presents a significant challenge to the sustainability of aquaculture and the health of aquatic ecosystems. One pressing issue is the lack of a cohesive collaboration mechanism among international organizations operating in the region. Without effective coordination, it becomes challenging to pool resources, share information, and implement standardized disease management strategies. As a result, emerging diseases may spread more rapidly and unpredictably, threatening both the aquaculture industry and wild aquatic populations. To tackle this issue successfully, a regional collaboration framework was established, which brings together key stakeholders and international organisations, fostering unified responses to the growing threats posed by aquatic animal diseases in the Asia-Pacific region.

The Regional Collaboration Framework serves as an effective mechanism for implementing the Aquatic Animal Health Strategy, addressing regional requirements, and enhancing collaboration. Numerous stakeholders participate in the *Framework*, including the World Organisation for Animal Health (WOAH) Reference Centres in the region, the Aquatic Animal Health Standard Commission, Focal Points of WOAH Members, WOAH Regional Representation for Asia and the Pacific (RRAP), and international partners such as the Network of Aquaculture Centres in Asia-Pacific (NACA), Southeast Asian Fisheries Development Center (SEAFDEC), Food and Agriculture Organization of the United Nations (FAO), and others to be engaged for collaboration. Additionally, outreach efforts will target various partners and institutions, including university research institutions, the private sector, and other donors with a focus on aquatic animal health and objectives aligned with those of this *Framework*.

Four meetings of the *ad hoc* Steering Committee of the *Framework* have been organized so far with the most recent meeting held in Busan, Republic of Korea on 29 June 2023. Progress and output of the Flagship activities (2020 – 2023) were presented, including projects on (1) aquaculture biosecurity in small-scale farms, (2) evaluation of the existing AHPND diagnostic methods, and (3) regional collaboration to respond to emerging diseases of aquatic animals. Three new Flagship activities were identified at the 4th *ad hoc* Steering Committee meeting: (1) a response exercise to examine regional coordination and response to emerging diseases, (2) assessment of on-farm biosecurity in aquaculture, and (3) improving Aquatic Animal Diseases Reporting in Asia and the Pacific. The activities will be led by Experts from different WOAH Reference laboratories, regional partners, WOAH Headquarter, and RRAP. In addition, awareness programme on AMU/AMR in aquaculture will also be conducted to support the implementation of Aquatic Animal Health Strategy. Concept Notes are being developed with the plan of the project implementation in 2024. In addition, the *ad hoc* Steering Committee adopted the name change from the *Regional Collaboration Framework for Aquatic Animal Health for Asia and the Pacific* to *Asia Pacific Aquatic Animal Health Network (AP AquaNet)*.

Discussion

- The Aquatic Focal Point workshop and the Steering Committee meeting in Busan were excellent. For the Steering Committee in particular, they focused on achievable activities that can be implemented over the coming years which are really meaningful for the region.
- One of the three priority projects mentioned is on improving disease reporting in the AP region, and a Concept Note was already submitted to the WOAH-RRAP for consideration. For the Aquaculture Biosecurity, project proposal will still be formulated and submitted to WOAH-RRAP for consideration.

Session 5: Updates on Regional Disease Reporting and Disease List

Dr. Eduardo Leaño presented the status of aquatic animal disease reporting in the Asia-Pacific region. From January 2021, a new AAD reporting was implemented wherein all Members are requested to submit the monthly data as soon as available to WOAH-RRAP and to NACA to ensure the timeliness of the disease information. The new AAD monthly reporting is a "rolling report" containing all the disease information from January of each year (in every report that is submitted). Updated reports are published in dedicated pages at both NACA (https://enaca.org/?id=8) and WOAH-RRAP (https://rr-asia.woah.org/en/projects/regional-aquatic-animal-disease-report-from-2021/). Considering the continuously decreasing number of countries submitting disease report, member country performance for the last 10+ years was assessed as shown in Table 1.

Table 1. AAD Report submission from 2013 to 2023 2Q (10+ years).

Country	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Australia	1234	1234	1234	1234	1234	1234	1234	1234	4	4	2
Chinese Taipei				1234	1234	1234	1234	1234	4	4	3
Hong Kong SAR	1234	1234	1234	1234	1234	1234	1234	1234	4	4	2
Philippines	1234	1234	1234	1234	1234	1234	1234	1234	4	4	2

Singapore	**1234**	**1234**	**1234**	**1234**	**1234**	**1234**	**1234**	**1234**	**4**	**4**	**2**
India	**1234**	**12**	**23**	**4**	**1234**	**1234**	**1234**	**1234**	**4**	**4**	**2**
Malaysia	**12 4**		**12**	**12 4**	**1234**	**123**	**34**	**123**	**4**	**4**	
Myanmar	**1234**	**1 34**	**1234**	**1234**	**234**	**1234**	**1234**	**1234**	**4**	**4**	**2**
Thailand	**234**	**1234**	**1**	**12 4**	**1234**	**1**	**234**	**123**	**1+**	**4**	**2**
Vietnam	**34**	**123**	**1234**	**1234**	**1234**	**123**	**1234**	**1234**	**4**	**4**	
New Caledonia				**1234**	**1234**	**123**	**234**	**1234**	**4**		
New Zealand				**1234**	**1234**	**1 3**	**1234**	**1234**			
Iran	**1234**	**1234**	**12**	**234**	**1234**	**34**	**1234**	**123**			
Japan	**1234**	**1234**	**1234**	**1234**	**1234**	**1234**	**1**				
Bangladesh		**34**	**1**				**12 4**	1234	4	4	2
Sri Lanka	**1 34**	**12 4**						34	4		
Brunei Darussalam				**1**				2 4	1		
Maldives		**34**	**2**	**1**	**1**						
French Polynesia*				**1234**	**123**						
Indonesia	**1 34**	**123**	**1**	**1234**	**123**						
Mongolia				**12**	**1**						
PR China	**12**	**12**	**123**								
R.O. Korea	**1234**	**1234**	**1234**								
Nepal	**1234**	**123**									
Lao PDR	**234**	**1 4**									
Percent (N=22)	**77.2**	**81.8**	**72.7**								
Percent (N=33)				**57.6**	**54.5**	**42.4**	**45.4**	**48.5**	**39.4**	**30.3**	**24.2**

Year: **White (2013-2015):** NACA QAAD Reporting (22 participating governments); **Yellow (2016-2020):** QAAD reporting merged with WOAH-RRAP (33 participating governments); **Blue (2021-2023):** New/current aquatic animal disease reporting.

Color codes for country report submission: **Dark green** – countries which regularly submit reports on quarterly basis; **Light green** – countries which regularly submit reports but missed few quarters in some years; **Pink** – countries which used to regularly submit reports but stopped submitting reports in recent years; **Light purple** – countries which used to submit reports, stopped, then resumed submitting reports in recent years; **White** – countries which used to submit reports but totally stopped several years ago and never resumed.

In lieu of the QAAD Reports, NACA has published quarterly news article on AAD reporting since October 2021. From July 2022 to June 2023, reported diseases for finfish include Infection with epizootic haematopoietic necrosis virus (Australia), Infection with *Aphanomyces invadans* (EUS; Australia; Bangladesh, Chinese Taipei and India), Infection with red seabream iridovirus (Chinese Taipei and India), Infection with tilapia lake virus (Chinese Taipei, India and the Philippines), Viral encephalopathy and retinopathy (Australia and Chinese Taipei), Grouper iridoviral disease (Chinese Taipei), Infection with carp edema virus (India), and Enteric septiceamia of catfish (Vietnam). For molluscs, India reported Infection with *Perkinsus olseni*.

For crustaceans, reported diseases were Infection with white spot syndrome virus (Australia, Bangladesh, Chinese Taipei, India, the Philippines, Thailand and Vietnam), Infection with infectious hypodermal and haematopoietic necrosis virus (the Philippines and Thailand), Acute hepatopancreatic necrosis disease (Bangladesh, Chinese Taipei, the Philippines, Thailand and Vietnam), Infection with Infectious myonecrosis virus (India), Infection with decapod iridescent virus 1 (Chinese Taipei), and Hepatopancreatic microsporidiosis caused by *Enterocytozoon hepatopenaei* (Chinese Taipei, India, the Philippines and Thailand). Lastly for amphibians, Chinese Taipei reported Infection with *Ranavirus* species, while Australia reported Infection with *Batrachochytrium dendrobatidis* in several species of wild frogs.

Other reported diseases are:

Bangladesh:

- Infection with *Streptococcus agalactiae*
- Infection with *Aeromonas* sp.

Hong Kong

- Infection with Infectious spleen and kidney necrosis virus

The low number of countries submitting the monthly/quarterly reports (<40%) remains a concern, especially reports from major aquaculture producing countries in the region. National Focal Points for Aquatic Animals should take full responsibility in preparing the reports, and in proper coordination with their respective WOAH Delegate who will officially submit the report to WOAH. Member countries contribute to the control of transboundary diseases of aquatic animals by complying with their obligations to the OIE to notify the occurrence of listed diseases and emerging diseases. Sharing of information (including disease occurrences) create awareness so that the industry and regulators can actively take the needed risk management measures including emergency preparedness and response. One importance of disease reporting is its usefulness when countries are having negotiations with their trading partners/countries (e.g. export of shrimp products): importing countries usually check their disease reporting history with reference to WOAH six-monthly report and/or NACA-WOAH-FAO AAD 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.

DISCUSSION

- Disease reporting is one of the priorities identified during the Steering Committee meeting of the AP-AquaNet. A concept note was already prepared which include ways on how to improve disease reporting in the region. Some countries were identified as "champions" for disease reporting, which can help to encourage other countries to resume disease reporting, e.g. Indonesia (which has problem on transition of responsibilities for disease reporting), PR China and other major aquaculture producing countries.
- It is a concerning issue on the low number of countries submitting reports (e.g. only 11 out of 33 countries submitted reports for 2022). It is indeed a sad story, reporting in terms of the Code and obligations as a member of WOAH, it is the most fundamental one. If the country is not transparent or communicating to trading partners on their disease status, it will also reflect on their capabilities for disease diagnosis which is important for trade. All countries that have an aquaculture industry has capabilities on disease diagnosis, thus it is important to do disease reporting.
- The data presented on the number of countries submitting reports only shows that many countries are apparently dismissive with their obligations to their trading partners, which is actually damaging their own reputation and harming their opportunities for trade. When a country considers importing from a particular country, it will look at the reporting history and will see if a country is not sharing information. And if no information is shared, how can the importing country be assured of the quality of the product. Especially if there are changes in disease status, how it can be communicated if routine disease submission is not met.
- The data presented is almost the same as the reports being received by the WOAH WAHIS. Disease reporting for aquatic animals is really low. It is important to note that disease reporting is not "mandatory" (thus, we cannot tell the countries that they have to submit disease report) but it is "obligatory" (it is county's obligation as member of WOAH to submit disease reports).
- India is still actively implementing its national surveillance programme and very transparent on their aquatic animal disease status (e.g. IMNV, RSIVD). Once the report is approved and endorsed by the Competent Authority, this is then submitted to both WOAH and NACA for reporting. India also faced a lot resistance from the industry as it is affecting trading of their produce. The industry have been raising this issue many times in different forums, including comparing India with other countries which are not submitting disease reports (a problem that the CA and experts don't know how to solve).
- The national surveillance programme of India is a good example on how it greatly improved their disease reporting, in terms of coverage and number of diseases that are being reported. This programme which is funded by the government is really an admirable action, especially in support to the aquatic animal health management of the country.
- It has been 25 years since the inception of the reporting system which involves both passive and active surveillance and using the three levels of diagnostics, and maybe some countries still have not recognized the benefits of reporting. Reporting

- In Malaysia, endorsement from the top management usually take some time, thus disease submission is usually delayed. Disease reporting is really important as it was through this that the country managed to secure some funding for national active surveillance programme.
- In Bangladesh, the disease reporting prior to 2019 was under a different agency (Department of Livestock) thus there was a gap on submission from 2014 to 2018. Since 2019, the responsibility was transferred to the Department of Fisheries with Dr. Ali as the responsible focal point, thus the resumption of regular disease reporting for the country. Bangladesh also comply with the obligatory provisions of the Aquatic Code. Currently, a national aquatic animal health strategy has already been drafted, thus Bangladesh is on the way in establishing active and passive disease surveillance. The current World Bank project has also taken initiative in establishing some quarantine facilities and disease diagnostic laboratories which will support disease reporting from the country.
- It was noticed that the drop in the number of countries submitting disease report was somehow related to the recent pandemic event, that such can be attributed to the lack of funding for some programmes or funding was re-directed to other aspects, or due to the change in the structure of report submission from quarterly to the current frequency of submission required from the members.
- One of the changes that happened recently is the implementation of the new WAHIS which somehow affected the submission of reports to the WOAH HQ for some time. This can be another valid reason for the decrease in report submission.
- For the new reporting system since 2021, there was not much changes except from requesting countries to submit the report once the data are collected (monthly if possible). However, most countries still submit the report quarterly (some annually) except for Chinese Taipei which submit the report monthly.
- To sum it up, disease reporting is a fundamental issue that was addressed during the foundation of WOAH, and to the understanding the global disease situation thus it deserves a special attention. Few points that can be extracted from the report and the discussion:
    - Reporting performance regionally is not acceptable and individual countries need to take responsibility for that
    - There are some benefits from reporting including reputational benefits and relationships to trading partners.
    - To recognize the AP-AquaNet project on reporting which will be exploring these issues and look for positive and constructive ways to improve reporting in the region in a way that benefit members
    - Look at case studies and demonstrating the benefits of reporting.
- It is also an obligation of trading partners, when a country does report, that they to respond reasonably and appropriately and within the guidance of the standards. There are many cases that this doesn't happen and sometimes can punish countries which are reporting conscientiously.
- On the issue of disease reporting being obligatory and not mandatory, it is good to separate two things: the regional reporting is not included in the Standard as it include diseases which

are not listed in WOAH as well as emerging diseases, and such is not obligatory; reporting to WOAH headquarter through WAHIS is an obligation as it is included under the Standards under Article 113 that states "The CA **shall**, under the responsibility of the delegate, send to the HQ disease reports….". In case country do not submit report, there is no precautionary measures that can be applied through the organisation.

SESSION 7. OTHER MATTERS AND CLOSING

- **Disease card for Infection with Infectious Precocity Virus (iIPV). Dr. Jie Huang** informed the group that there is no revision made on the original draft of the disease card, and he summarized again the important points included in the disease card. One comment was to provide a more explicit mention of the impact of the disease, e.g. actual impact on production. Usually, the disease can cause at least 30% decrease in production due to stunted growth. It might also be important to mention the presence of similar clinical signs observed in other countries or alternatively it can be mentioned that there is little surveillance conducted and encourage countries to test for the virus in case they observe similar disease signs among cultured prawns. Positive control for virus detection can be requested from the concerned experts indicated in the disease card. Although the virus was detected in *P. vannamei*, it has not been tested whether it is actually susceptible to the virus. It was recommended that the disease card be revised to include the suggested information mentioned above. Moreover, if there is interest to conduct a rapid risk assessment for this disease, FAO can assist to organize it. FAO has an existing methodology for risk assessment called Expert Knowledge Elicitation (EKE) risk assessment which takes convening experts on risk analysis and on the disease. This has been done for TiLV and maybe worthwhile for this new disease.
- **Fish Health Section Conference: From the Pillars to the Next. Dr. Leaño** presented the summary of the recently held FHS Conference. The Fish Health Section Conference: From the Pillars to the Next was successfully held on 6-8 September 2023 at Swissotel Bangkok Ratchada, Bangkok, Thailand. Initially coined as "handover conference" and with the theme "Learning from the past to inform the future", the event gathered 17 FHS pillars which include founding members and past officers/members of Executive Committee (ExeCom). Headed by Dr. Richard Arthur (Canada) who founded the Asian Fish Health Network (under IDRC project) which eventually gave birth to the FHS, the pillars had a great reunion and catching-up, gave advises, and shared their experiences with the younger generation of fish health enthusiasts. The Conference was attended by 158 participants/students from 16 countries and territories around the world including Australia, Bangladesh, Canada, P.R. China, Chinese Taipei, Ethiopia, Indonesia, Italy, Japan, Malaysia, Norway, Philippines, Saudi Arabia, Thailand, United Kingdom and Vietnam. A total of 35 abstracts were received, and these were delegated to 20 oral presentations and 15 poster presentations.

After the opening session, the pillars were introduced to the participants before the informal meet and greet, so as to name faces especially for the younger generation. Everyone were then invited to engage in discussions with the pillars and the rest of the participants. Poster viewing (with presenting authors) was also done during the informal session. The FHS Showcase featured the history and journey of the Section based on the experiences of the pillars. A video presentation was prepared by Drs. Melba Reantaso and Dr. Richard Arthur, while a more personal sharing was delivered by Dr. Celia Lavilla-Pitogo. Drs. Rohana Subasinghe, Leong Tak Seng, Supranee Chinabut and Erlinda Lacierda also shared their journey with the FHS. Representing the younger generation were Joseph Carlo Vergel (Philippines), Cong-Yan Chen (Chinese Taipei), Xiaomeng Guo (China), Dr. Sandra Catherine Zainathan (Malaysia) and Dr. Jiraporn Jarungsriapisit (Thailand). Here, they shared their current activities on fish health and what they thought of the Section in general. Pillars who were not able to attend in-person shared their messages through written (Drs. Gilda Lio-Po, Kiyokuni Muroga and Ian Anderson) and video (Drs. Hambali Supriyadi, C.V. Mohan and Faizah Shaharom) messages. Dear departed pillars were also honored: Dr. Takahisa Kimura (Japan); Dr. Darnas Dana (Indonesia); Dr. Lee-Hong Susan Lim (Malaysia); Prof. Donald V. Lightner (USA); Prof. Kishio Hatai (Japan); Dr. Pan Jin Pei (China); Dr. Akhmad Rukyani (Indonesia); and, Dr. Hariyadi Mangunwirya (Indonesia).

Plenary sessions (plenary presentations and panel discussion) were held on day 2 of the Conference, featuring experts on finfish and shrimp health as listed below:

Finfish Health:

- Prof. Ikuo Hirono: Fish Immunology Research for Fish Vaccine Development
- Dr. Andy Shinn: Translocation of tilapia's tiny terrors: Nile tilapia and its parasites
- Assoc. Prof. Win Surachetpong: New Challenges, New Solutions: Mitigating Emerging Diseases in Aquatic Animal Health
- Mr. Amorn Luengnaruemitchai: Practical Biosecurity Measures in Tilapia Hatchery

Shrimp Health:

- Prof. Chalor Limsuwan: Challenges and Diseases Management in Shrimp Aquaculture
- Prof. Grace Chu-Fang Lo: Passing on the Torch of Wisdom in Shrimp Aquaculture Research
- Prof. Han-Ching Wang: Taking up the Torch of Wisdom: An Interdisciplinary Cooperation of Science, Implementation and Vision for Shrimp Aquaculture
- Dr. Kallaya Sritunyalucksana: Scientific, Technological and Social Solutions for Sustainable Aquaculture

Day 3 of the Conference featured oral presentations from the younger generation of researchers and students. Out of the 20 presentations, seven (7) were from students who were judged based on the overall content and clarity of presentations as well as the question and answer session. The panel of judges is composed of Dr. James L. Torres (Philippines), Dr. Janejit Kongkumnerd (Thailand), and Dr. Stephen Pyecroft (Australia). The winners are:

- Hiraoki Saito (Tokyo University of Marine Science and Technology, Japan): Cell-mediated and Humoral Immune Responses of Goldfish after Live-attenuated virus Vaccination and High-Water Temperature Treatment against Herpesviral Hematopoietic Necrosis (HVHN)
- Cong-Yan Chen (National Cheng Kung University, Chinese Taipei): White Spot Syndrome Virus Facilitates and Relies on host de novo Nucleotide Synthesis to Support Viral Pathogenesis
- Suwimon Paimeeka (Kasetsart University, Thailand): Novel Multiplex PCR Assay for the Detection of Three Major Viruses Affecting Global Tilapia Aquaculture

- **Other Matters:** The training on Risk Analysis along the Aquaculture Value Chain was really effective and participants really learned a lot on how risk assessment is done on specific aquaculture commodity and disease of concern. Risk analysis is something to be learned by "doing", and the general plan during the training was to stimulate the thinking of the ASEAN and NACA to form a core group to further their knowledge by applying risk analysis through some country case studies. If there will be interest from any country to undertake risk analysis, FAO can surely assist. It is very important that a country should establish risk profile of important commodities, and then select specific pathogen(s) that they want to focus on. It was recommended that NACA prepare a concept note on the follow-up activity for the training and FAO will look at the possibility of sourcing some funds to facilitate the activity.

  NACA is also collaborating with fai on fish welfare, and upon discussion with the team with regard to the risk assessment training, they are interested if a fish welfare training can be patterned to what was undertaken for the risk assessment. The team is willing to collaborate with FAO in this regard.

- The AGM 22 officially closed at 16:30 PM (BKK time), 7 November 2023.

GENERAL RECOMMENDATIONS

From the extensive discussions made throughout the meeting, the following recommendations were formulated by the group:

- Member Countries should take up the NACA RAOHS for implementation and alignment of their national strategies for improved aquatic organism health management.
- NACA should continue to stimulate member countries to look at the details of RAOHS and to implement them, even if the country already has their national aquatic animal health strategy. It is important to put ROAHS as one of the activities of the member countries.
- NACA to continue to support aquatic animal health initiatives in other regions, just like the Regional AAH Networks in the African region.
- Member Countries should support the new Chapter that is being developed by WOAH on ornamental fish, as this group of aquatic animals are also potential source of pathogen

spread through live movement and trading. They also play important roles on the overall AMU and AMR in the aquaculture sector.

- Member Countries should participate actively on important aquatic animal health activities in the region and in the world, including the forthcoming FishVet Dialogue 2, and some training activities (e.g. risk assessment and emergency preparedness and response).
- Parasitology should be given importance in terms of research, diagnostic tools (application of modern diagnostics) and human resource/experts, as many parasitic diseases of aquatic animals are also important and can cause problems if left uncontrolled or overlooked.
- Enhanced farm-level biosecurity should be properly implemented based on the capacity of the farms themselves. Farm-level biosecurity should not be seen as another burden for the farmers to implement, but rather a measure in improving their pond management strategies. It is also important to focus more on the benefits that the farmers can get from applying enhanced farm-level biosecurity measures, which is affordable but effective in improving culture operations and increasing production.
- The collaborative framework (now known as AP AquaNet) should be continued and supported to improve the aquatic animal health networking in the region, and to make sure that all the activities are aligned and coordinated with the activities of the WOAH Headquarters, especially the Aquatic Animal Health Strategy.
- It is high time to do a retrospective analysis of all the disease reports taking advantage of the AI technologies, and be able to see the past trends and how it has affected the past scenarios and maybe on how it will affect the future scenarios.
- Member Countries should highly support national disease surveillance programme (e.g. India) as this will facilitate improvement on disease reporting as well as promote transparency which is important for trading of aquatic animal produce.
- The disease card on Infection with infectious precocity virus (iIPV) should be revised to provide more information on the overall economic and production impacts of the disease. It might also be important to mention the presence of similar clinical signs observed in other countries, or alternatively, it can be mentioned that there is little surveillance conducted and encourage countries to test for the virus in case they observe similar disease signs among cultured prawns.
- NACA to prepare a concept note on the follow-up activity for the risk assessment training (actual scenarios), and FAO will look at the possibility of sourcing some funds to facilitate the activity.

ANNEX A

22ND MEETING OF ASIA REGIONAL ADVISORY GROUP ON AQUATIC ANIMAL HEALTH (AGM22) (VIRTUAL MEETING) 6-7 NOVEMBER 2023 13:00-16:00 (BKK TIME; GMT+7)

PROVISIONAL AGENDA:

Day 1 (06 November; Monday)

Welcome and Introduction (15 mins)

- Introduction (**Dr. Eduardo Leaño, NACA**)
- Welcome Remarks (**Dr. Jie Huang, DG NACA**)
- Self-introduction (**all participants**)

Chairperson (Dr. Andy Shinn) or Vice Chairperson (Dr. Leobert dela Peña) will take over in moderating the meeting

- Progress since AGM 21 (15 mins; **Dr. Eduardo Leaño, NACA**)
- Updates from WOAH Aquatic Animal Health Standards Commission (15 mins; **Dr. Ingo Ernst, AAHSC, WOAH**)
- Updates on WOAH Asia-Pacific Network on Aquatic Animal Health (AP-AquaNet) (15 mins; **Dr. Thitiwan Patanasatienkul, WOAH-RRAP**)
- Farm level biosecurity: updates on SEAFDEC AQD's Oplan Balik Sugpo (15 mins; **Dr. Leobert dela Peña**)

Note: 15-20 minutes discussion and recommendations after each presentation (Country representatives are encouraged to participate actively in the discussion)

Day 2 (07 November; Tuesday)

- Welcome and recap of day 1 (5 mins; **NACA Secretariat**)
- Farm level biosecurity: from a tilapia parasites perspective (15 mins; **Dr. Andy Shinn)**
- Aquaculture Biosecurity (PMP/AB) and FAO's AAH Initiatives in the AP region (15 mins; **Dr. Melba Reantaso, FAO**)
- Updates on Aquatic Animal Disease Reporting and disease list (10 mins; **Dr. Eduardo Leaño, NACA**)
- Other matters including emerging diseases in the region (if any) (20 mins)
    - FHS-AFS Conference: From the pillars to the next; highlights of the conference (10 mins; **Dr. Eduardo Leaño, NACA**)

Note: 15-20 minutes discussion and recommendations after each presentation (Country representatives are encouraged to participate actively in the discussion)

Annex B

List of Participants (AGM 21)

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Annex C:
List of Diseases in the Asia-Pacific

Reportable Aquatic Animal Diseases
(Beginning January 2024)

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))	
6. Infection with red seabream iridovirus	
7. Infection with koi herpesvirus	
8. Infection with tilapia lake virus	
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)	
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)	
10. Infection with Decapod iridescent virus 1 (DIV1)	
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

Annex E: Proposed Disease Card

Diseases of Crustaceans – **Infection with Infectious Precocity Virus (iIPV)**

Infection with infectious precocity virus (iIPV) is an emerging disease in farmed giant freshwater prawn *Macrobrachium rosenbergii*, causing stunted growth due to precocity. The disease is also called iron prawn syndrome (IPS) due to the stunted prawns having hard shells (Dong et al., 2021). This disease card provides the disease information, diagnosis methods, listed experts, and reference.

Disease Agent

Infectious precocity virus (IPV) has a single-stranded positive-stranded RNA genome of about 12, 630 nt, including a poly(A) tail at the 3' end. Phylogenetic analysis of the conserved RNA-dependent RNA polymerase (RdRp) and NS3 domains showed that IPV belongs to a new genus between Jingmenvirus and *Flavivirus* in *Flaviviridae* (Dong et al., 2021).

Target Tissues

Histopathology and *in situ* hybridization showed that iIPV has significant nerve tropism (Dong et al., 2021; Wang et al., in review). The average relative abundance in the nerve relative tissues of prawns infected with IPV, including eyestalks, the brain, and the thoracic ganglion can reach about 70%. The hepatopancreas is an unsusceptible tissue of IPV with a relative abundance less than 0.01%. The average relative abundances of IPV in the muscle, stomach, and gonad are no more than 1%, respectively (Wang et al., in review). Most symptomatic prawns with typical IPS clinical signs had a high load of IPV above 3×10^5 copies/μg-RNA in eyestalk. Therefore, the test of IPV with molecular detection should use tissues containing eyestalks, brain, gills, thoracic ganglion, or pereiopods. The hepatopancreas, gonad, stomach, muscle, and compound eyes (due to pigment inhibiting amplification) are not suitable for sensitive diagnosis of iIPV. Moreover, the distal end of a pereiopod may be used as a live sampling method for IPV detection (Wang et al., in review).

Host Range

Currently known susceptible species of IPV include *M. rosenbergii* (Dong et al., 2021). IPV can be detected in *M. nipponense*, *Procambarus clarkii*, *Penaeus vannamei*, *P. monodon*, *Oratosquilla oratoria*, and *Anisops kuroiwae* (Zhao et al., 2023).

Presence in Asia-Pacific

iIPV was first reported in farmed *M. rosenbergii* in China (Dong et al., 2021). However, stunted pond-cultured *M. rosenbergii* with similar signs has been reported in other Asia-Pacific countries since 2007 (Paulraj et al., 2007).

Signs of Disease

Disease signs (Level I diagnosis) (Dong et al., 2021; Wang et al., in review)

The following disease signs can be used for presumptive diagnosis of the disease.

- Diseased *M. rosenbergii* is characterized by sexual precocity and precocity-associated growth retardation (Figure 1).
- Delayed moulting and hard shells.
- In the early stage of aquaculture, *M. rosenbergii* infected with IPV exhibit reduced feeding or no eating when the water temperature drops by a large range (such as a drop of 5 ℃).
- The affected female prawns show growth retardation and sexual precocity, i.e., carrying eggs on the abdomen or showing developed ovaries with a smaller body size.
- The affected male prawns show growth retardation and sexual precocity, i.e., having blue second pereiopods and dark body colour with a smaller body size.

- Contagious features show in the healthy population restocked to a pond with the diseased population.

Histo- and Cytopathological signs (Level II diagnoses) (Dong et al., 2021)

The following can be observed in infected prawns:

- Putative eosinophilic inclusions were observed in the perinuclear cytoplasm of some neurosecretory cells of the organ of Bellonci and the globular cells of the semi-ellipsoid in histopathological sections stained by H&E (Figure 2).
- Typical *Flavivirus*-like virions occur in cytoplasmic inclusions of infected shrimp eyestalk tissues under a transmission electron microscope. Virions of IPV exhibit as spherical with a diameter of 40 to 60 nm, with a higher electron-dense envelop (Figure 3).

Molecular Diagnostic Methods (Level III diagnoses)

Nested RT-PCR (Dong et al., 2021)

In the first step, the RT-PCR amplifies a 1038 bp amplicon. In the second step, a 395 bp amplicon is amplified. To visualize the amplicons, the RT-PCR products were analyzed in a 2% agarose gel containing GeneFinder. The extracted RNA was reverse-transcribed at 42°C for 45 min and 90°C for 5 min using a PrimeScript II first-strand cDNA synthesis kit (TaKaRa).

The first-step of the nested RT-PCR:

i) The cDNA obtained in the above steps is used as the template. The reaction system of the first-step of the nested RT-PCR is 20 µL, including: one microliter (1 µL) aliquot of cDNA template solution, 10 µL Premix *Taq* (with 0.5 U *Ex Taq*, 4 nmol dNTP, and 40 nmol $MgCl_2$) (TaKaRa), 2.5 pmol IPV-F1 (5'-GCA-CAC-TCC-CAA-CAC-GTT-TC-3'), 2.5 pmol IPV-R1 (5'-CGC-GCG-TAA-TCT-CTA-CAC-CT-3'), and nuclease-free water were added to 20 µL.

ii) The first step of the nested RT-PCR was performed at 94°C for 2 min, followed by 30 cycles of 94°C for 30 s, 59°C for 30 s, and 72°C for 65 s, finally ending at 72°C for 10 min.

The second step of the nested RT-PCR:

iii) The reaction system of the second of the nested RT-PCR is 20 µL, including: one microliter (1 µL) aliquot of the 1st-step product for the template, 10 µL Premix *Taq* (with 0.5 U *Ex Taq*, 4 nmol dNTP, and 40 nmol $MgCl_2$) (TaKaRa), 2.5 pmol IPV-F1 (5'-TCC-CTA-GGC-AGG-GGA-TAC-TG-3'), 2.5 pmol IPV-R1 (5'-AGC-TAT-CCG-TGG-TGT-GGA-AC-3'), and nuclease-free water were added to 20 µL.

iv) The second step of the nested RT-PCR was performed at 94°C for 2 min, followed by 30 cycles of 94°C for 30 s, 59°C for 30 s, and 72°C for 30 s, finally ending at 72°C for 10 min.

This diagnostic method did not cross-react to *Macrobrachium rosenbergii* nodavirus (MrNV), Tembusu virus (TMUV), yellow head virus genotype 8 (YHV-8), covert mortality nodavirus (CMNV), and the prawn RNA.

Nested RT-PCR (Zhao *et al.*, 2023)

In the first step, the RT-PCR amplifies a 754 bp amplicon. In the second step, a 395 bp amplicon is amplified. To visualize the amplicons, The PCR products were analyzed in 1 % agarose gel containing ethidium bromide. cDNA Synthesis SuperMix (AccurateBiology, China) was used to synthesize first-strand cDNA following the manufacturer's instructions.

The first-step of the nested RT-PCR:

i) The reaction system of the first step of the nested RT-PCR is 20 µL, including: 1 µL aliquot of cDNA template solution, 10 µL Premix *Taq* (with 0.5 U *Ex Taq*, 4 nmol dNTP, 40 nmol $MgCl_2$) (TaKaRa), 2.5 pmol IPV-F1 (5′- GCC-TCC-ACA-TCA-TTG-GCT-TCG-3′), 2.5 pmol IPV-R1 (5′-TCG-GGT-GTC-ATC-AAC-AAA-CTC-ATA-3′) and nuclease-free water were added to 20 µL.

ii) The first step of the nested RT-PCR was performed at 94 ℃ for 5 min, followed by 30 cycles of 94 ℃ for 30 s, 56 ℃ for 60 s, and 72 ℃ for 60 s, finally ending at 72 ℃ for 10 min.

The second step of the nested RT-PCR:

i) The reaction system of the second of the nested RT-PCR is 20 µL, including: one microliter (1 µL) aliquot of the 1st-step product for the template, 10 μL Premix *Taq* (with 0.5 U *Ex Taq*, 4 nmol dNTP, 40 nmol $MgCl_2$) (TaKaRa), 2.5 pmol IPV-F2 (5′-ACA-TCA-TTG-GCT-TCG-TAT-3′), 2.5 pmol IPV-R2 (5′-ACA-GAG-CAG-GAG-ATT-GGA-3) and nuclease-free water were added to 20 μL.

ii) The second step of the nested RT-PCR was performed with the following cycling parameters: initial denaturation at 94 ℃ for 5 min, followed by 30 cycles of 94 ℃ for 30 s, 56 ℃ for 60 s and 72 ℃ for 30 s, with a final extension at 72 ℃ for 10 min.

This diagnostic method did not cross-react to positive recombinant plasmid of infectious hypodermal and hematopoietic necrosis virus (IHHNV), white spot syndrome virus (WSSV), *Enterocytozoon hepatopenaei* (EHP).

Real-time quantitative RT-PCR (Wang et al., in review)

A TaqMan probe RT-qPCR detection technology for IPV was established using a pair of primers (IPV-F/IPV-R) targeting an amplicon of 139 bp in the IPV ORF1 gene.
The amplification can be carried out following the protocol:

i) The total volume of the one step TaqMan-RT-qPCR reaction system is 20 µL, including: 10 µL 2 × Luna Universal One-Step Reaction Mix (NEW ENGLAND BioLabs, USA), 1 µL 20 × Luna WarmStart® RT Enzyme Mix (NEW ENGLAND BioLabs, USA), 0.4 µM of IPV-F (5'-AGG-AGA-GGG-TTT-TGG-CTT-G-3'), 0.4 µM of IPV-R (5'-CTG-GAT-TGG-AAG-GGA-ACT-CTG-3'), 0.2 µM IPV-P (FAM-5'-CCG-CGA-CAC-TTA-CAA-CTG-CCC-TT-3'-TAMRA), 1 µL template RNA and 7 µL nuclease-free water.

ii) The amplification was performed at 55 ℃ for 10 min, 95°C for 1 min for initial denaturation, followed by 40 cycles of 95°C for 10 s and 60°C for 30 s.

The detection limit of this method was as low as 1.0×10^0 copy/reaction. The TaqMan-RT-qPCR was about 13 and 1300 times more sensitive than Dong et al.'s (2021) nested RT-PCR and first-step RT-PCR. Compared with Dong et al.'s (2021) nested RT-PCR, diagnostic sensitivity (DSe) and diagnostic specificity (DSp) of TaqMan-RT-qPCR were 97.0 % and 86.1 %, respectively. In contrast, DSe and DSp of nested RT-PCR were 85.2 % and 97.2 %, respectively, compared with TaqMan-RT-qPCR. A majority of symptomatic prawns showing clinical signs of IPS had the IPV copy number of eyestalks higher than 3×10^5 copies/µg-RNA or Ct value lower than 20 (Wang et al., in review).

Real-time quantitative PCR (Zhao *et al.*, 2023)

A TaqMan probe RT-qPCR detection technology for IPV was established using a pair of primers (IPVq-F/IPVq-R). The sequences of primers are IPVq-F: 5′-GAA-GAT-GTC-ATC-GTC-CCA-GAG-TT-3′ and IPVq-R: 5′- GGA-ATG-CCC-CCT-CCG-TAT-3′. The sequence of the TaqMan probe is FAM-5'-CCC-CAA-GGT-TTT-ATT-G-3'-TAMRA.
The amplification can be carried out following the protocol:

i) Real-time PCR amplification was performed in a 16.5 μL reaction system consisting of 1.5 μL of cDNA sample and 15 μL reaction mixture containing 1 μL of each primer.

ii) The PCR profile was held at 95 ℃ for 1 min for initial denaturation, followed by 40 cycles of 95 ℃ for 15 s and 60 ℃ for 30 s. Fluorescence was collected at 60 ℃.

The limit of this method was as low as 10^1 copies. No validation information for DSe and DSp was available (Zhao *et al.*, 2023).

In situ hybridization (Dong et al., 2021)

Synthesis of RNA probe:

i) The 395 bp amplification product amplified by RT-PCR in the 2nd step was extracted and connected with PMD18-T vector (TaKaRa). The recombinant reaction was carried in a 10 μL mixture containing 5 μL Solution I, 4 μL PCR procedures and 1 μL PMD18-T vector. The recombinant plasmid was transformed into TOP10 competent *Escherichia coli* (TIANGEN). Select one clone from Luria Bertani (LB) agar supplemented with ampicillin (Amp) (Solarbio) for sequencing. Positive clone was selected to extract plasmid DNA.

ii) Using a set of primers F (5'-GTA-CCC-GGG-GAT-CCT-CTA-GAG-AT-3') and R (5'-TAA-TAC-GAC-TCA-CTA-TAG-GGT-TGC-ATG-CCT-GCA-GGT-CGA-CGA-T-3') possessed T7 transposon sequence (underlined) to amplify the template of the RNA probe and tail it. The reaction was synthesized with 10 μL Premix *Taq* (with 4 nmol deoxynucleoside triphosphate, 0.5 U *Ex Taq*, and 40 nmol Mg^{2+}) (TaKaRa), 1 μL DNA template and 10 pmol of each primer. The amplification procedure was performed with the following parameters: an initial denaturation at 95°C for 4 min, followed by 30 cycles of 95°C for 30 s, 58°C for 30 s, and 72°C for 30 s, with a final extension at 72°C for 10 min.

iii) The digoxigenin-labelled antisense RNA probe performed in a 20 μL mixture containing 1 μg template, 2 μL dithiothreitol (100 mmol/L) (Promega), 4 μL transcription optimized 5 × buffer (200 mmol/L Tris-HCl, 30 mmol/L $MgCl_2$, 10 mmol/L spermidine, 50 mmol/L NaCl, pH 7.9) (Promega), 1 μL T7 RNA polymerase (20 U/μL) (Promega), 2 μL 10 × DIG RNA labelling mixture (Roche) and 1 μL RNase inhibitor (40 U/μL) (New

England Biolabs). The specific steps of transcription *in vitro* are as follows: incubating the mixture at 37°C for 2.5 h at first, placing it on ice for 2 min, and then digesting it with 5 U RNase-free DNase I (Thermo Fisher) at 37°C for 15 min. A SigmaSpin sequencing reaction clean-up, and postreaction clean-up columns kit (Sigma) were used to purify the probe. NanoDrop 2000 (Thermo Fisher) was used to detect the concentration and quality of the probe and then stored at -80°C.

***In situ* hybridization:**

i) The specific steps of *in situ* hybridization are as follows: dewaxing and rehydration at first, tissue sections were processed with HCl (0.2 mol/L, 20 min) and proteinase K (20 µg/mL, 30 min, 37°C) (TaKaRa). After washing with phosphate buffer containing Tween 20 (PBST), place the slides in the mixture of 500 µg/mL tRNA (Sigma), 50% formamide, 0.1% Tween 20 (Solarbio), 5 × saline citrate (SSC) (Solarbio), 1.9 g/L citric acid monohydrate and 50 µg/mL heparin sodium (Solarbio) for 4 h at 42°C to prehybridize.

ii) Hybridization was performed in the same solution mixed with 1 mg/mL DIG-labeled RNA probe at 42°C for 16 h. In order to detect probes hybridized with viral RNA, tissue sections were incubated with anti-DIG-AP Fab fragments (Roche) at 4℃ for 12 h, and then the hybridization was stained with BCIP (5-bromo-4-chloro-3-indolyl phosphate) and NBT (4-nitroblue tetrazolium chloride) (Roche). The slides were counterstained with Bismarck brown Y.

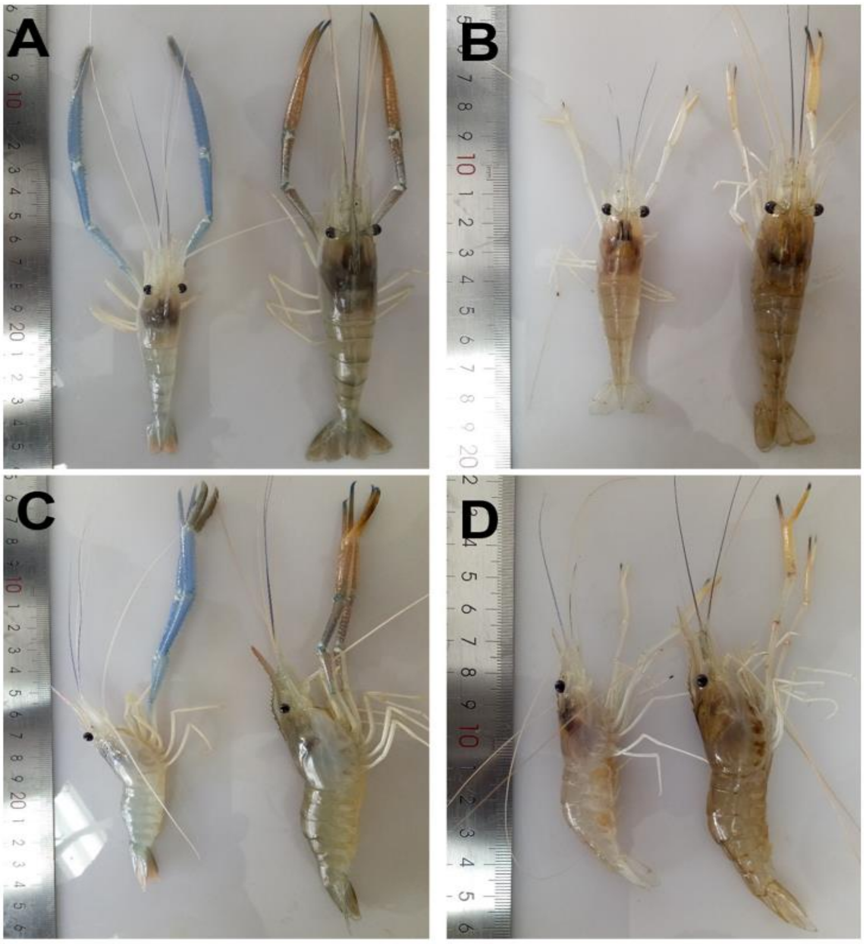

Figure 1. Gross signs of *M. rosenbergii* infected with IPV. (A and C, left) Infected male *M. rosenbergii*. (A and C, right) Control male. (B and D, left) Infected female *M. rosenbergii*. (B and D, right) Control female.

Source: (Dong et al., 2021)

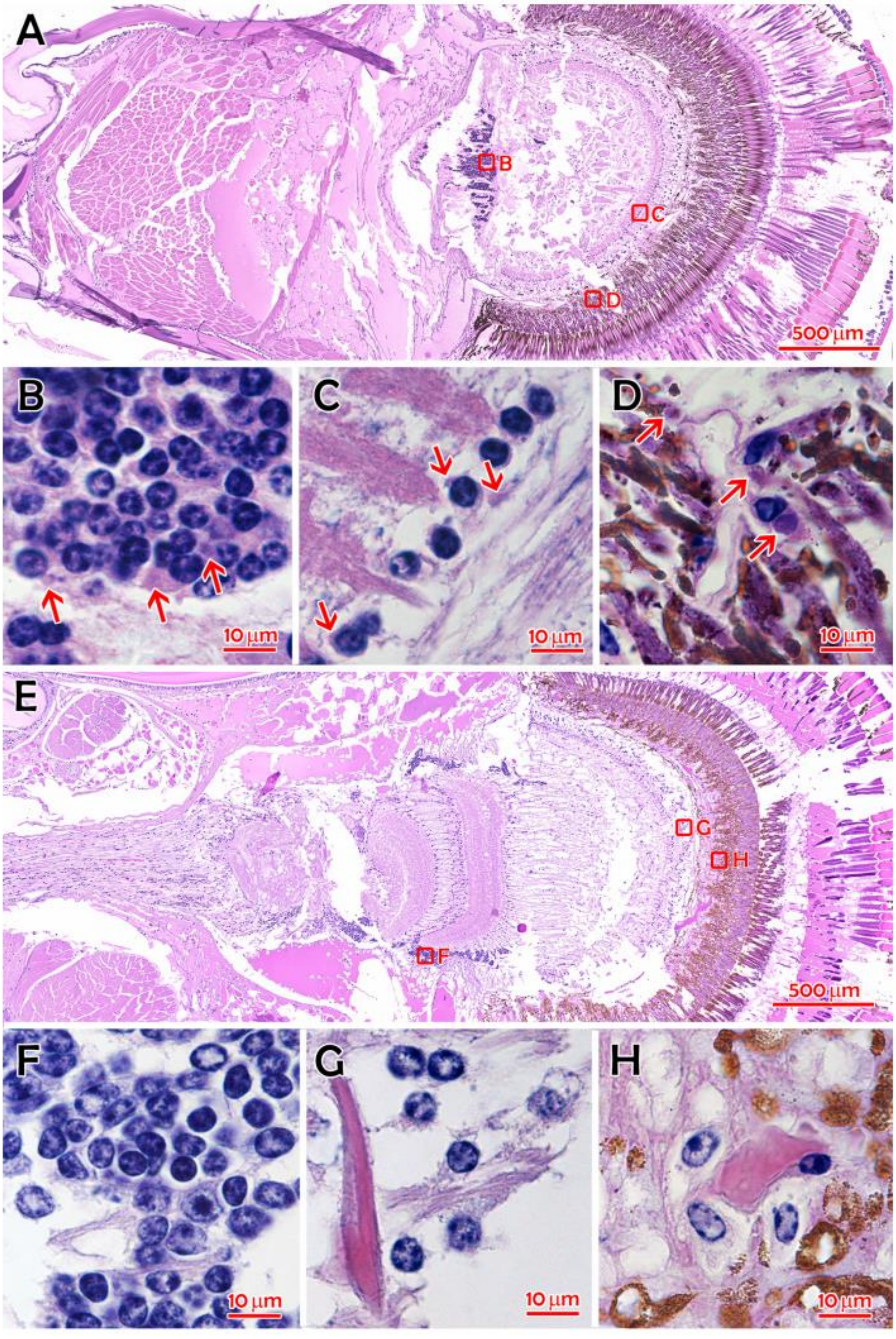

Figure 2. H&E-stained histological sections of *M. rosenbergii* tissues. (A) The overall view of a compound eye of *M. rosenbergii* infection with IPV. (B) Globuli cells in the hemiellipsoid body. (C) Cells in the lamina ganglionaris. (D) Cells in the fasciculated zone. (E) The overall view of a compound eye of healthy *M. rosenbergii*. (F) Globuli cells in the hemiellipsoid body. (G) Cells in the lamina ganglionaris. (H) Cells in the fasciculated zone. Red arrows indicate cytoplasmic inclusions. Bar in panels A and E, 500 µm; bar in panels B, C, D, F, G, and H, 10 µm.

Source: (Dong et al., 2021)

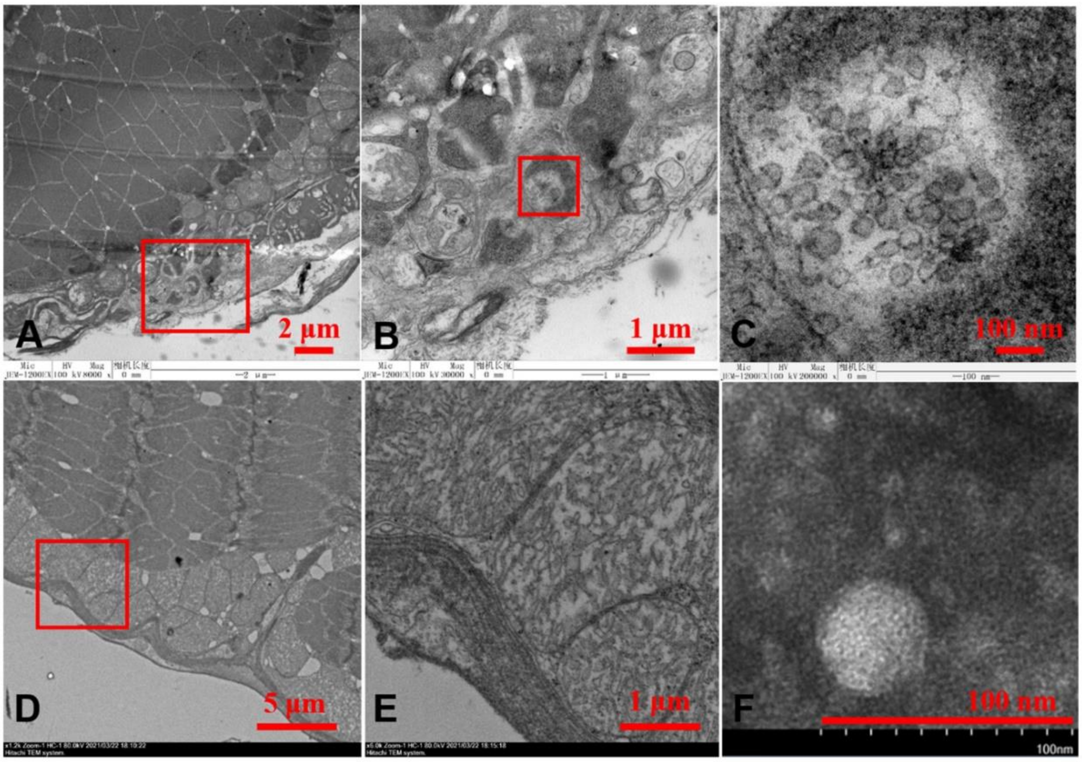

Figure 3. Transmission electron micrographs of the putative IPV particles. (A, B, and C) Spherical virions with a diameter of 40 to 60 nm in the eyestalk of *M. rosenbergii* infected with IPV. (D and E) Eyestalk from uninfected *M. rosenbergii*. (F) Purified putative IPV particles. Bar in panels A, 2 µm, Bar in panels B and E, 1 µm, bar in panels D, 5 µm, Bar in panels C and F, 100 nm.

Source: (Dong et al., 2021)

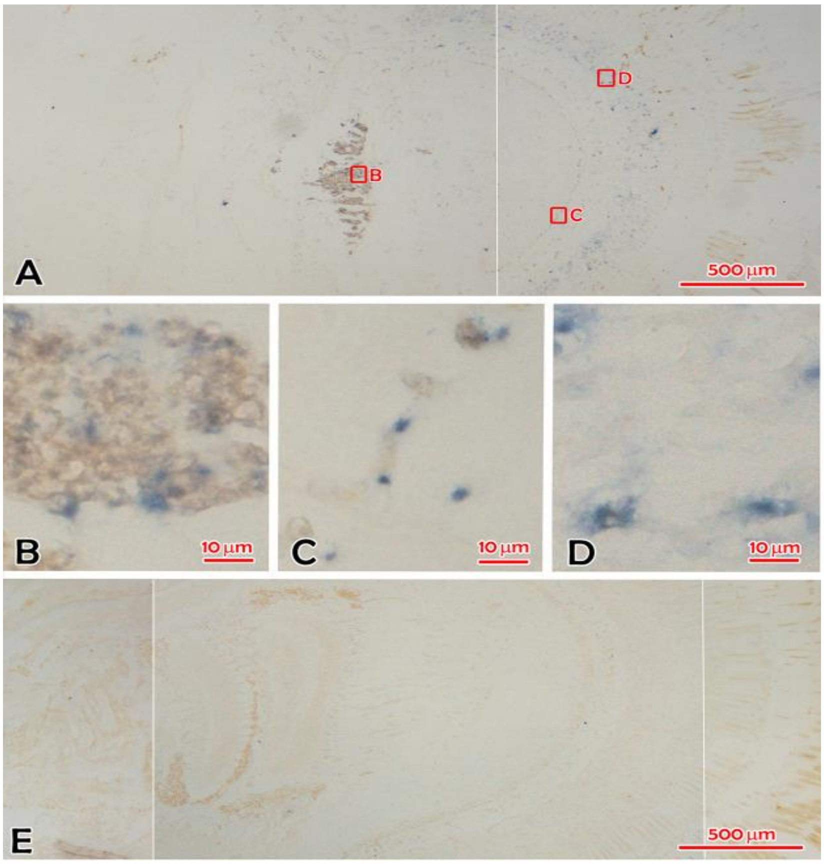

Figure 4. *In situ* hybridization (ISH) micrography of compound eyes from *M. rosenbergii*. (A) The overall view of a compound eye of *M. rosenbergii* infected with IPV. (B) Intracellular hybridization signals in globuli cells in the hemiellipsoid body. (C) Hybridization signals in cells of the lamina

ganglionaris. (D) Intracellular hybridization signals of the fasciculated zone. (E) General view hybrid section of the compound eye of healthy *M. rosenbergii*. Bar, 500 µm (A and E) and 10 µm (B, C, D).

Source: (Dong *et al.*, 2021)

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