NETWORK OF AQUACULTURE CENTRES IN ASIA-PACIFIC

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

REPORT OF THE MEETING

Centara Grand at Central Plaza Ladoprao, Bangkok, Thailand

13-14 November 2018

Prepared by the NACA Secretariat

Preparation of this document:

This report was prepared by the 17th Asia Regional Advisory Group on Aquatic Animal Health (AG) that met at Bangkok, Thailand on 13-14 November 2018.

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

Reference: NACA 2018. Seventeenth Meeting of the Asia Regional Advisory Group on Aquatic Animal Health: Report of the Meeting. Published by the Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand.

ABBREVIATIONS AND ACRONYMS

AAH	Aquatic Animal Health
AAHRDD	Aquatic Animal Health Research and Development Division of DoF Thailand
AAHSC	Aquatic Animal Health Standards Commission of the OIE
AG	Advisory Group
AGM	Advisory Group Meeting
AHPND	Acute hepatopancreatic necrosis disease
AMC	ASEAN Member Countries
AMR	Antimicrobial resistance
AMU	Antimicrobial use/usage
ANAAHC	ASEAN Network of Aquatic Animal Health Centres
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine of the P. R. China
ASEAN	Association of South East Asian Nations
AVG	Abalone viral ganglioneuritis
AVM	Abalone viral mortality
BMP	Best management practices
CA	Competent authority
CAAHRI	Coastal Aquatic Animal Health Research Institute
CMNV	Covert mortality nodavirus
COFI	Committee on Fisheries (FAO)
DAWR	Australian Government Department of Agriculture and Water Resources
DoF	Department of Fisheries (Thailand)
EU	European Union
EUS	Epizootic ulcerative syndrome
FAO	Food and Agricultural Organization of the United Nations
FAO-RAP	FAO Regional Office for Asia and the Pacific
GBS	Group B *Streptococcus*
HPM-EHP	Hepatopancreatic microsporidiosis caused by *Enterocytozoon hepatopenaei* (EHP)
ICTV	International Committee on Taxonomy of Viruses
IHHN	Infectious hypodermal and haematopoietic necrosis
IHNV	Infectious haematopoietic necrosis virus
IMN	Infectious myonecrosis
IMNV	Infectious myonecrosis virus
ISKNV	Infectious spleen and kidney necrosis virus
KHV	Koi herpesvirus
LPT	Laboratory proficiency testing
MOA	Ministry of Agriculture, PR China
MrNV	*Macrobrachium rosenbergii* nodavirus
MBV	Monodon baculovirus
NACA	Network of Aquaculture Centres in Asia-Pacific
NC	National Coordinator
NHP	Necrotising hepatopancreatitis
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
OsHV-1	Ostreid herpesvirus-1
PCR	Polymerase chain reaction
POMS	Pearl oyster mortality syndrome
RT-PCR	Reverse transcriptase PCR
SEAFDEC	Southeast Asian Fisheries Development Center

SEAFDEC-AQD	Southeast Asian Fisheries Development Center Aquaculture Department
SHIV	Shrimp hemocyte iridescent virus
SPF	Specific pathogen free
SPR	Specific pathogen resistant
SPT	Specific pathogen tolerant
SVC	Spring viraemia of carp
SVCV	Spring viraemia of carp virus
TCP	Technical cooperation project
TG	Technical Guidelines (Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals)
TiLV	Tilapia lake virus
TSV	Taura syndrome virus
VCMD	Viral covert mortality disease
VHS	Viral haemorrhagic septicaemia
VP	*Vibrio parahaemolyticus*
WAHIS	World Animal Health Information System
WAHID	World Animal Health Information Database
WFS	White faeces syndrome
WHO	World Health Organization
WSD	White spot disease
WSSV	White spot syndrome virus
WTD	White tail disease
WTO	World Trade Organization
YHV	Yellowhead virus

The 17th Asia Regional Advisory Group on Aquatic Animal Health.

Back Row (From Left to Right)

Dr. Eduardo Leaño (NACA), **Mr. Simon Wilkinson** (NACA), **Dr. Andy Shinn** (Fish Vet Group, Thailand), **Dr. Siow Foong Chang** (AVA, Singapore), **Dr. Chien Tu** (Observer, AHRI, Taiwan Province of China), **Mr. Weimin Miao** (FAO-RAP, Thailand), **Prof. Timothy Flegel** (Centex Shrimp, Thailand), **Dr. Cherdsak Virapat** (NACA), **Dr. Richard James Arthur** (FAO, Italy), **Dr. Kjetyl Fyrand** (PHARMAQ, China), **Dr. Ingo Ernst** (DAWR, Australia and AAHSC, OIE, France), **Dr. Hon Pong Ho** (OIE-RRAP, Japan).

Front Row (From Left to Right)

Dr. Eleonor Tendencia (SEAFDEC AQD, Philippines), **Dr. Janejit Kongkumnerd** (AAHRDD, Bangkok, Thailand), **Dr. Supranee Chinabut** (DOF, Thailand), **Dr. Gillian Mylrea** (OIE HQ, France), **Dr. Qing Li** (MOA, PR China), **Dr. Hong Liu** (AQSIQ, PR China), **Dr. Jing Wang** (OIE-RRAP, Tokyo, Japan), **Dr. Yan Liang** (YSFRI, PR China).

Table of Contents

OPENING SESSION

The 17th meeting of the Asia Regional Advisory Group on Aquatic Animal Health convened in Bangkok, Thailand on the 13-14 November 2018. The meeting was held back to back with the OIE Regional Expert Consultation on Aquatic Animal Disease Diagnosis and Control held on the 15-16 November at the same venue.

The meeting was opened by Dr. Eduardo Leaño, Aquatic Animal Health Programme Coordinator of NACA and Technical Secretary of the AG. Welcome remarks were given by Dr. Cherdsak Virapat, Director General of NACA. The Chair and Vice-Chair of the AG for 2018 to 2019 were elected by the group, and Dr. Siow-Foong Chang (AVA, Singapore) was elected as the Chair, while Dr. Hong Liu (AQSIQ, PR China) as the Vice-Chair.

Dr. Chang then facilitated the meeting. The meeting agenda (**Annex 1**) was adopted without amendment. The complete list of participants is attached as **Annex 2**.

SESSION 1: PROGRESS SINCE AGM-16

1.1. PROGRESS REPORT FROM NACA'S REGIONAL AQUATIC ANIMAL HEALTH PROGRAMME

Dr. Eduardo Leaño presented the progress report of NACA's Regional Aquatic Animal Health Programme since the previous AGM 16 which was held in Bali, Indonesia on 26-27 August 2017 (back-to-back with the 10th Symposium of Diseases in Asian Aquaculture (28 August–1 September). Report of the meeting (e-copy) was widely circulated among NACA member countries and partner organizations, and published at NACA website for free download. Five Quarterly Aquatic Animal Disease Reports (2nd to 4th quarters of 2017 and 1st to 2nd quarter of 2018), which are available for free download at both NACA and OIE-RRAP websites. In response to the occurrence of TiLV in the region, an Emergency Regional Consultation for Prevention and Management of TiLV in the Asia-Pacific was organized by NACA with support and in collaboration with the Ministry of Agriculture, P.R. China through the National Fisheries Technology Center, the China-ASEAN Center for Joint Research and Promotion of Marine Aquaculture Technology, and the Sun-Yat Sen University. The consultation was held in Guangzhou, China on 27-28 September 2017. Proceedings of the consultation is available at NACA website: https://enaca.org/?id=986&title=proceedings-of-the-emergency-regional-consultation-for-prevention-and-management-of-tilapia-lake-virus-in-asia-pacific.

The current increasing concern on antimicrobial resistance (AMR) in aquaculture has led to the implementation of some regional projects on antimicrobial use (AMU) and AMR in the region. One of these was the Documentation and Characterization on AMU in the Aquaculture Sector Including Current and Proposed Practices in Aquaculture and Aquatic Disease Status in Asia. The project was funded by FAO-RRAP/USAID/Fleming and included selected aquaculture species in the ASEAN: shrimps (Thailand); pangas catfish (Viet Nam); groupers (Indonesia); freshwater finfish (Myanmar); and milkfish (Philippines). Below is the summary of the findings from the farmers interview undertaken:

- Antimicrobials are commonly used in the shrimp hatchery operations in Thailand, while only few grow-out farmers use antimicrobials within the first month of culture;
- For pangas catfish, antimicrobials are widely used in both nursery and grow-out operations;
- Most milkfish farmers in the Philippines do not use antimicrobials during their culture operations; however, pond farmers were found to use chicken manure during pond preparation, which might be a source of antimicrobial residues (may contribute to the development of AMR);
- Commonly used antimicrobials are oxytetracycline (for shrimps and milkfish) and amoxicillin, doxycycline and florfenicol (for pangas catfish);
- Most farmers use antimicrobials that are approved by the proper authority of the country for use in aquaculture operations;
- Sufficient withdrawal periods (2 months for shrimps and 4 months for pangas catfish) are practiced by farmers, to make sure that the harvested products are free from any antimicrobial residues; especially those that are intended for export;
- The non-usage of antimicrobials can be correlated to the increased number of alternative chemicals, biological agents and feed supplements that are being used by the farmers to improve health of cultured stocks and to prevent diseases.

AMU/AMR Awareness Seminars were also given to local farmers and government officials in the countries where AMU surveys were undertaken. Another important activity on AMR was the Joint Regional Consultations on AMR Risk to Aquaculture in Asia, and Monitoring of AMR in Bacterial Pathogens in Aquaculture (funded by FAO/USAID). The consultations focussed on the status of AMU and AMR in aquaculture in the region including national initiatives and regulatory instruments, and on the development of a Regional Guidelines on AMR surveillance in aquaculture.

To address the emerging disease problems and disease emergencies, the ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia was held in Bangkok in August 2018. The consultation was organized by the Department of Fisheries Thailand in collaboration with SEAFDEC/AQD, ANAAHC and NACA and funded by the Japan-ASEAN Integration Fund (JAIF). The main objective of the consultation was to bring together ASEAN member states and technical experts to discuss the current status of emergency animal disease preparedness and response systems, and to identify gaps and opportunities for regional cooperation in management of transboundary diseases.

Other activities where NACA actively participated include:

- OIE Regional Meeting of National Focal Points for Aquatic Animals (12-14 December, Qingdao, P.R. China);
- FAO/MSU.WB Stakeholder Consultation on Progressive Management Pathway (PMP) for Improved Biosecurity (10-12 April 2018, Washington DC, USA);
- OIE 86th General Session of World Assembly of Delegates (20-26 May 2018, Paris, France);

- Second Global Conference on AMR and Prudent Use of Antimicrobials (29-31 October 2018; Marrakesh, Morocco).

Discussion

- It is important for the aquaculture industry to be proactive about adopting prudent use of antimicrobial agents and considering the use of alternatives. The draft regional guidelines on AMU/AMR (being developed by team of experts from FAO) are based on the global One Health approach and OIE international standards and FAO guidelines. However, this is just the first step and there is still a long way to go before these guidelines are implemented.
- The focus is mainly on a regional approach to the collection and sharing of data on AMU/AMR, as opposed to capacity building.
- OIE noted that while a lot of work on AMU/AMR was underway globally, the aquatic sector was not so visible. OIE is willing to support initiatives and collaboration in this area, particularly through the Tokyo office with HQ support.
- Singapore, as the Lead Country for ASEAN AMU/AMR, would be happy to work with OIE on the unity of approach and data analysis for AMU/AMR.
- AMR has become a hot topic and a lot of effort is going into surveillance as it is the easiest and most visible thing to do. However, surveillance is downstream from the problem and there is a need to also coordinate activities at the upstream end. Upstream enforcement is often complex and very difficult.
- As aquaculture is relatively resource-constrained compared to livestock industries, the people doing surveillance are likely to be the same people doing everything else. Focusing on surveillance takes resources away from upstream efforts, which is perhaps where the most effort is needed.
- Upstream efforts focus that on identifying and reducing stress factors are likely to be a productive area. Vaccines are not effective if the animals are stressed and their immune system is compromised. Getting vaccines registered is a significant barrier. There is a need to focus on both vaccines and environment /production system improvements.
- FAO is organizing an expert meeting on the use of risk analysis for AMR in aquaculture, to be held in Palermo, Italy, from 26-30 November. The meeting will address issues such as risk profiling, hazard identification and other questions related to the relevance of the use of risk analysis for assessing AMR risks to aquaculture.
- China is investigating antimicrobial usage patterns, including on the relative usage by livestock and aquaculture industries.
- AMR has been studied for over twenty years, but the results have seldom been utilised because practically speaking, farmers still have few alternatives to the use of antibiotics.
- Vaccine development is still very limited and registration in Asia is expensive and difficult. Long drug withdrawal periods are not practical for farmers. There is a need to find ways to improve health outcomes so that farmers would have less need to use antimicrobials.
- In risk analysis, there is a need to clearly identify the risk that is to be managed and how effectiveness in reducing risk will be measured, in order to efficiently allocate resources. On farm, improving production systems can improve productivity and the effectiveness of vaccines. For government, the risks of antimicrobial agents to human and animal health or

the environment are the concerns. Issues that need risk analysis need to be identified and ideally, they should be as simple as possible and targeted at particular sectors where pathways can realistically be demonstrated.

- There is a need to understand how antimicrobials are actually being used by industry. Some preliminary survey work is available. FAO will discuss the possibility of developing a TCP to gather more data on this issue.
- AMR is like climate change, an individual can't achieve anything, solving the problem requires a concerted effort by everyone.

RECOMMENDATIONS

- AG recommended that efforts being made and to be implemented on AMU and AMR in aquaculture should be properly coordinated in the region, through a more efficient and harmonized approach in regulating AMU and preventing AMR.
- AG recommended that key organizations like FAO and OIE continue supporting projects on AMU and AMR surveillance in aquaculture, in close coordination with some countries (e.g. Singapore, the lead country for ASEAN AMR).

SESSION 2: OIE STANDARDS AND GLOBAL ISSUES

2.1. OUTCOMES OF RECOMMENDATIONS FROM OIE GENERAL SESSION (GS) AND THE AQUATIC ANIMAL HEALTH STANDARDS COMMISSION (AHHSC)

Dr. Ingo Ernst gave a presentation on the progress of the Aquatic Animal Health Standards Commission's (AAHSC) work and the adoption of new and revised standards in the OIE Aquatic Animal Health Code and OIE Manual of Diagnostic Tests of Aquatic Animals. Since the 2017 AGM 16, the AAHSC met in several occasions including meetings in February and September 2018. Dr Ernst had also presented new and revised draft standards for adoption to the 86th OIE General Session in May 2018. Electronic works were also done in-between these meetings, and members were also observers at the *ad hoc* Groups meetings.

The AAHSC continues to consider the global situation with tilapia lake virus (TiLV) and to monitor developments. The AAHSC considers that the disease meets the OIE Aquatic Code definition definition of an emerging disease and, as such, should be reported by member countries in accordance with the requirements of the Aquatic Code. At the time of the 2017 OIE General Session no country had reported TiLV but by the time of the 2018 OIE General Session six countries had reported presence of the disease to the OIE headquarters.

The AAHSC had assessed TiLV for listing in the Aquatic Code; however, it failed to meet Criterion 3 (*a precise case definition is available and a reliable means of detection and diagnosis*). An electronic *ad hoc* Group on TiLV was convened which considered TiLV diagnostics and assay validation, reviewed available information on methods for TiLV detection, provided advice on additional method development and validation requirements, and initiated cooperative work to validate tests and distribute control materials. The technical disease card of TiLV was also revised.

For the OIE Aquatic Code and Manual, a total of 26 amended chapters were adopted. They are summarized below:

- Chapter 1.3, Diseases listed by OIE: names of finfish diseases were changed to "Infection with pathogen" format;
- Chapter 5.3, OIE procedures relevant to the agreement on the application of sanitary and phytosanitary measures of the World Trade Organization: aligned with Terrestrial Code with updates based on changes in Aquatic Code; improved readability;
- Chapter 5.4, Criteria to assess the safety of aquatic animal commodities: improved clarity on provisions;
- Chapter 8.X, New chapter for Infection with *Batrachocythrium salamandrivorans*: newly listed in 2017;
- Chapter 8.2, Infection with *Batrachochytrium dendrobatidis*: horizontal changes and improvements;
- Chapters 9.4.1 and 9.4.2, Infection with infectious hypodermal and haematopoietic necrosis virus: ICTV recognized name; *Macrobrachium rosenbergii* removed as susceptible species;
- Chapters 10.1 to 10.10, Fish disease specific chapters: name change to "Infection with pathogen agent X", revision of susceptible species;
- Aquatic Manual Chapters 2.2.8 (White spot disease), 2.3.1 (Infection with epizootic haematopoietic necrosis virus), 2.3.3 (Infection with *Gyrodactylus salaris*), 2.3.5 (Infection with salmon anaemia virus), 2.2.3 (Infection with infectious hypodermal and haematopoietic necrosis virus), 2.2.1 (Acute hepatopancreatic necrosis disease): changes made for susceptible species for each disease, some urgent updates especially on case definitions.

New Reference Laboratories were also adopted for the following diseases:

- Infectious haematopoietic necrosis, and Viral haemorrhagic septicaemia: Pacific Biological Station – Aquatic Animal Health Laboratory, Fisheries & Oceans Canada, Nanaimo, British Columbia, Canada (Dr. Kyle Garver);
- Acute hepatopancreatic necrosis disease: National Cheng Kung University, Tainan City, Chinese Taipei (Dr. Grace Chu-Fang Lo);
- Infectious haematopoietic necrosis: Animal and Plant Inspection and Quarantine Technical Centre, Shenzhen Exit & Entry Inspection and Quarantine Bureau, Guangdong Province, P.R. China (Dr. Hong Liu);
- Koi herpesvirus disease: Friedrich-Loeffler-Institut (FLI), Federal Research Institute for Animal Health, Institute of Infectology, Insel Riems, Germany (Dr. Sven M. Bergmann);
- Viral haemorrhagic septicaemia: Aquatic Animal Quarantine Laboratory, General Service Division, National Fishery Products Quality Management Service, Ministry of Oceans and Fisheries, Busan, R.O. Korea (Dr. Hyoung Jun Kim);
- Change of expert for Taura syndrome: Dr. Arun K. Dhar, Aquaculture Pathology Laboratory, School of Animal and Comparative Biomedical Sciences, University of Arizona, USA.

The OIE had implemented a requirement for all OIE reference laboratories to have a quality management system in place in accordance with ISO 17025 or an equivalent standard. Most OIE reference laboratories had worked toward obtaining accreditation by the deadline of December 2017; however, several laboratories either chose not to or were not able to meet this requirement. Reference laboratories requesting delisting included the Virginia Institute of Marine Science for three diseases (Infections with *Haplosporidium nelsoni*, *Perkinsus marinus* and *P. olseni*), and University of Washington, USA for Infection with *Xenohaliotis californiensis*. Two laboratories were suspended as OIE Reference Laboratories pending their accreditation to ISO 17025 within two years including: Inland Aquatic Animal Health Research Institute, Bangkok, Thailand for Infection with *Aphanomyces invadans*; and, C. Abdul Haleem College, Biotechnology Division, India for White tail disease.

Consultation with member countries is an important aspect of the process to develop and revise OIE standards. The AAHSC circulates draft Chapters of the Aquatic Code and Aquatic Manual for comments of member countries within each of its meeting reports which are published on the OIE website in the 3 official languages of the OIE. Comments submitted on draft texts are considered during the next AAHSC meeting and all OIE member country comments are carefully considered. In the February meeting reports each year standards that will be proposed for adoption at the May General Session are also included.

Some significant items of on-going work of the Commission include:

- the application of criteria for listing of species susceptible (Chapter 1.5) to all disease-speciifc chapters in both Aquatic Code and Manual
- to develop principles for determining the surveillance requirements for demonstrating freedom from diseases that are provided in each of the disease-specific chapters (Aquatic Code)
- to apply the new disease chapter template (Aquatic Manual) to all disease-specific chapters of the Aquatic Code.

Lastly, the organization is on-going for the 4th OIE Global Conference on Aquatic Animal Health which will be held on 2-4 April 2019 in Santiago, Chile.

2.2. UPDATES ON FAO INITIATIVES IN ASIA PACIFIC IN SUPPORT OF AQUATIC ANIMAL HEALTH

Dr. Richard Arthur (on behalf of **Dr. Melba Reantaso**) provided an overview of the on-going national, regional and global projects/activities on aquaculture biosecurity and aquatic animal health with relevance to the Asia-Pacific. On global and regional levels, the Multi-Stakeholder Consultation of Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB), a new management framework based on Progressive Control Pathway (PCP) applied to livestock diseases, was initiated in Washington DC, USA in April 2018. Co-organized by Mississippi State University and World Bank, the consultation was attended by 40 participants representing government, regional and international organizations, industry, academe, and development agencies and foundations. The consultation revolved around the four drivers of emergent disease in aquaculture which include: trading in live animals and products; knowledge of pathogens and their hosts; aquatic management and health control; and, ecosystem change. The PMB/AB will work on different progressive stages of aquatic animal health management in support of a more resilient and sustainable aquaculture. These include risk analysis (stage 1), biosecurity in specific sectors (stage 2), national biosecurity management (stage 3), and sustainable and resilient aquaculture biosecurity (stage 4).

Countries reaffirmed their commitment to develop national action plans on AMR, based on the Global Action Plan on Antimicrobial Resistance—the blueprint for tackling AMR developed in 2015 by the World Health Organization (WHO) in coordination with the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE). FAO works on the four pillars of AMR management: Awareness; Evidence; Governance; and Best practice. The lack of regulation and oversight of use make antimicrobials easily accessible, which in turn leads to overuse, misuse, self-medication, or production and availability of sub-standard medications. The use of antimicrobial drugs without restraint can result in increased health hazards and the further spread of AMR. FAO has several tools and advocacy to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR. One of the major advocacies is targeting decision makers and relevant authorities in fisheries and aquaculture. The Committee on Fisheries Sub-Committee on Fisheries is one of FAO highest statutory bodies that talks anything and everything about fisheries and aquaculture, and AMR is being addressed as one of the emerging concerns in aquaculture production. Tools currently available include the CCRF Technical Guidelines: Prudent and Responsible Use of Veterinary Medicines, and on its final stage of publication is the Responsible Management of Bacterial Diseases in Aquaculture. Other documents in preparation include the following:

- Performance of antimicrobial susceptibility testing programmes relevant to aquaculture and aquaculture products;
- Review of alternatives to antimicrobials in aquaculture (vaccines, phage therapy, quorum sensing, prebiotics, probiotics, plant therapy);
- Fisheries and Aquaculture Technical Paper on Understanding AMR in Aquaculture (compendium of papers prepared by CA and experts presented during 3 regional AMR in aquaculture workshops in 2017);
- Best practice guidance for carp, tilapia and shrimp.

In 2017, FAO organised capacity building activities to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR targeting researchers, laboratory personnel, private sector, other service providers. The commodity specific guidance tools aimed at reducing the risk of AMR through prudent and responsible use of antimicrobials is also being finalized. Another activity that is being initiated by FAO is convening an expert group meeting to undertake a scoping exercise to increase the understanding of risks of AMR in aquaculture that will be held in Palermo, Italy from 26-29 November 2018. The outcomes of this scoping exercise will be used to support a Working Document on Aquaculture Biosecurity and AMR for an agenda on Aquaculture Biosecurity and AMR that is being considered for the Tenth Session of COFI/SCA (Norway, August 2019).

On Tilapia lake virus (TiLV) occurrence in the region, there have been requests from FAO to build capacity on TiLV since the information about the disease has been released in May 2018 (by NACA, OIE, WF and FAO). Thus, in June 2018, in collaboration with China's National Fisheries Technology Extension Center and Sun Yat-Sen University, a 7-day TiLV course was implemented which was participated by 29 participants (representing competent authorities, academe and service providers) from 11 countries (Asia, Africa and South America) (http://www.fao.org/fishery/nems/41072/en). FAO also undertook TiLV Expert Knowledge Elicitation (EKE) Risk Assessment with 14 experts around the world. The experts considered that the main risk pathway is the translocation of live fish (for aquaculture, direct human consumption or ornamental/aquarium fish keeping purposes). Moreover, the risk of TiLV to Pacific island countries and territories and North America was generally considered less than the risk ot TiLV to Asia, Africa and South America, both in terms of lower likelihood of entry, establishment and spread, and associated consequences. The expert panel finally recommended that all countries that have significant tilapia populations (farmed or wild) undertake their own risk assessments to determine the need for risk management measures, and TiLV surveillance to verify disease freedom or extent of spread.

The emergency preparedness and response system (EPRS) for managing aquatic animal disease outbreaks involves contingency planning that can minimize the impacts of serious aquatic animal disease outbreaks, whether at the national, sub-national or farm level. An effective EPRS ensures that there are pre-agreed protocols and resources in place to act quickly, and to establish a clear structure for effective and rapid decision-making with clearly defined responsibilities and authority. FAO's EPRS audit is a sort of self-assessment protocol for countries, and include sets of questions covering general administration, aquatic EPRS elements, operational support systems, and other relevant information. Several efforts on EPRS were implemented by FAO around the region including Vietnam, Indonesia and Thailand covering important diseases such as IMNV, AHPND and TiLV.

Pipeline/on-going projects on aquatic animal health management in the region include the following:

- Regional TCP on AMR (pipeline) – Support mitigation of AMR risk associated with aquaculture in Asia: India, Indonesia;
- Inter-regional TCP on TiLV (pipeline): Asia: Philippines, Vietnam; LAC: Brasil, Colombia: Intensive TiLV training course; active TiLV surveillance; International Technical Seminar on TilV (Venue: Uganda proposed: March 2020);
- FSM TCP facility (ongoing): National aquatic animal health and biosecurity strategy;
- FAO/NORAD: Improving biosecurity governance and legal framework for efficient and sustainable aquaculture production.

DISCUSSION (SESSION 2)

- Where a farm becomes positive for an OIE-listed pathogen which was not previously present, disease reporting is required as set out in the Aquatic Animal Health Code, as reporting is based on a change in disease status. The appropriate response depends on the situation, including the level of risk and severity and the likely damage that would be caused by an outbreak.

- People often take a 'Rolls Royce" approach to risk assessment, but the first step is just awareness. Many small but important changes can be made to improve biosecurity on farms and more broadly. A staged or tiered approach makes sense in line with the resources that are available.
- The reliability of self-assessment of veterinary services is somehow questionable, given that nobody wants to self-assess an adverse result. The group noted that long observation of capacity building activities in aquatic animal health has shown that the real driver to change is government resolve. Some countries have had no material improvement in their aquatic animal health management capacity despite considerable funding and technical support that have been provided over a considerable period of time. Countries need to see the benefits in order to have an interest in making change. However, self-assessment is useful as a baseline when beginning the process of improving institutional arrangements.
- The OIE PVS tool is used to assess the current status of a country's Veterinary Services or Aquatic Animal Health Services. Assessments are carried out by independent experts and provide information to the country evaluation about their capacity to implement OIE standards. The reports may also be used to attract donor support to fund specific projects to improve animal health services. For more information please refer to the OIE pages at: http://www.oie.int/en/solidarity/pvs-pathway/. The independent nature of the assessment gives countries and donors confidence in the results.
- For emergency response, having capability for good decision making processes in place is a fundamental requirement. There is often a reluctance to make decisions in knowledge-poor situations which results in slow action or inaction.
- The group noted an ongoing reluctance by countries to report diseases due to the potential for trade restrictions. Disease reporting is obligatory under OIE rules, however practically speaking there is no way to enforce this. There is also no practical easy way for countries to take action against others if they feel that a risk analysis or some other work with trade implications has not been done fairly or to a satisfactory standard as the formal WTO dispute settlement process is long and expensive. However, one real consequence is a loss of trust by trading partners, as it is not possible to conceal disease status.
- Regarding amendments to the 2018 edition of the Aquatic Code and proposed amendments circulated for OIE Member Country comment please refer to the OIE website at: http://www.oie.int/en/standard-setting/specialists-commissions-working-ad-hoc-groups/aquatic-animals-commission-reports/meeting-reports/
- Some topics of interest discussed reported in the September 2018 report of the Aquatic Animals Commission and discussed by the AG include:
    - Synonimising *Gyrodactylus salaris* with another species *G. thymalli*. The OIE Reference Laboratory expert for *G. salaris* had made the Aquatic Animals Commission aware that the NCBI GeneBank has reclassified gene sequences submitted as *G. thymalli* to *G. salaris*. The Commission found there was not sufficient evidence currently to synonymise the two species in the Code and Manual.

- Splitting *Martelia refringens* into two species: *M. refringens* and *M. pararefringens*, which occurs in mussels rather than oysters. The Aquatic Animals Commission noted this proposal and that separation of the species would impact the scope of the disease-specific chapter. Infection with *Marteilia pararefringens* would not be within scope of the listed disease. The Reference Laboratory expert was requested to provide further advice on this matter. It also invited Member Countries to provide any available information or comment on this subject.
- The Aquatic Animals Commission has deferred consideration of listing TiLV until the ad hoc Group working on diagnostics has completed its task.
- Listing SHIV: In September 2018, the Aquatic Animals Commission agreed that the disease should not be considered against the criteria for listing until more information about the disease is available. The disease will be considered again by the Commission at its February 2019 meeting pending the decision of NACA.
- The Commission considers RSIV and ISKNV as separate pathogenic agents and found that even though the two viruses are genetically similar, they are epidemiologically distinct, so will remain as separate listed diseases.

RECOMMENDATIONS

- AG recommended that assessment of country's capacity for aquatic animal health management in general be continued or implemented in the region;
- AG recommended that all member countries comply conscientiously with the OIE reporting requirements for aquatic animal diseases; noting that a lack of transparency on disease status diminishes trust and substantially undermines regional and global efforts to prevent the spread of transboundary diseases.
- AG recommended NACA to keep the region updated on SHIV, which is now considered an emerging threat to the shrimp industry.

SESSION 3: REVIEW OF REGIONAL DISEASE STATUS

3.1. UPDATES ON FINFISH DISEASES IN ASIA

An update on finfish health was presented by **Dr. Siow-Foong Chang**. The key diseases highlighted were on novel viral diseases of Asian seabass (*Lates calcarifer*). These viral diseases cause similar clinical signs in seabass, with different clinical manifestation. Scale drop disease virus causes a more chronic disease, while *Lates calcarifer* herpes virus causes an acute disease with high morbidity. In both cases, these viral agents predispose the fish to secondary bacterial infection and can be easily be masked by vibriosis and marine flexibacteriosis.

An update on Group B streptococcus (GBS) food poisoning associated with consumption of raw fish caused by ST283 *Streptococcus agalactiae* was shared with the AG. This bacteria has been detected in multiple countries in the region, both in human clinical cases and in fish. The presence of GBS infection from consumption of raw fish should be highlighted. The meeting also noted the propensity of the tilapia lake virus to infect non-tilapia fish based on recent studies.

Discussion

- Herpesvirus /scale drop are not emerging diseases, since they were described by Dr. Leong Tak Seng about 30 years ago, but outbreaks have probably not been recognised.
- The seabass industry has hit a barrier in expansion due to disease. It may be that these viral diseases are initiating a disease process and then other pathogens are moving in and finishing the fish off.
- Cell culture is required to identify these (viral) pathogens of seabass. As laboratories are moving towards molecular diagnostics, these infections will be missed.
- As the disease is contained in one net cage first and spreads to others later, it is possible (but unknown) that parasites might be carriers of the virus. *Caligus* spp. have been implicated in the transfer of viral fish diseases elsewhere. Herpesvirus transfers efficiently via water, but scale drop disease may spread more slowly due to slow onset of the disease.
- If farmers have been working to control parasites, a more "pure" version of the disease may be evident, unmasked by other infections, where the fish appear very pale and ghost-like.
- Nodavirus presentation seems to be changing, affecting adult fish more often to the point where even broodstock are having problems. Unknown whether this could be a new virus or a mutation. [Maldives complained about something like this at the GC meeting, they have lost the ability to produce grouper fingerlings]

3.2. Current Status of Shrimp Diseases in Asia

Prof. Timothy Flegel gave the following presentation on recent developments in crustacean health. As with previous reviews (e.g., AGM16) levels of disease threat for *P. monodon* and *P. vannamei* (the two most cultivated species) depend on the shrimp species cultivated and on the geographical location of farms. For viral pathogens in Asia, white spot syndrome virus (WSSV) and yellow head virus type-1 (YHV-1) are still the most lethal threats for both species, although the latter has still been confined to Thailand.

As with AGM16 there has not been any news of spread of a new, lethal YHV variant (YHV-8) that was reported from China and covered in the AGM16 report. It has now been described in a publication (Dong et al. 2017. Arciv Virol 162: 1149-1152). However, there is still no disease card containing a specific detection method posted at the NACA website. Again, it would good if a comparative virulence study could be carried out with YHV-1 and YHV-8.

The disease card for covert mortality nodavirus (CMNV), also from China (Zhang et al. 2014. J Gen Virol. 95, 2700-2709), is still under revision. So far, negative impacts from CMNV have not been reported from other countries, although it has been detected by PCR in Thailand (Thitamadee et al. 2016. Aquaculture. 452, 69-87).

For *P. vannamei* only, the next most important viral threat is still infectious myonecrosis virus (IMNV). In addition to the report of outbreaks of IMNV from India (described in AGM16: Sahul Hameed et al. 2017. J Fish Dis. 40: 1823-1830), there has been a report to OIE of an outbreak (resolved) in Malaysia in June 2018. These reports indicate that IMNV is on the move in Asia after so many years of being confined to Indonesia. These developments are sufficient cause to increase the level of alert for this pathogen in other Asian countries.

It was suggested by Sahul Hameed et al. that the introduction of IMNV to India was via illegally imported stocks for aquaculture. However, we have recently obtained positive RT-PCR test results for IMNV with grossly normal, captured adult specimens of *Penaeus monodon* from the Andaman Sea (unpublished) suggesting that IMNV may now be present in wild stocks of *P. monodon* in the seas surrounding Indonesia. Since *P. monodon* is known to be unaffected by IMNV but is able to serve as an infectious carrier without showing signs of disease, there is reason for alarm, especially in countries that cultivate both *P. monodon* and *P. vannamei*. This is especially so if cultured *P. monodon* are derived from captured stocks that have not been tested for IMNV infection. The source of the infection in Malaysia was not indicated, but I was told that the outbreak in *P. vannamei* there was on a farm where *P. monodon* derived from captured broodstock was also being reared, albeit in separate ponds. The danger of possible transmission of IMNV from wild *P. monodon* must not be underestimated, and testing for IMNV in captured *P. monodon* or imported broodstock should be initiated. At the very least, I recommend that *P. monodon* originating from seas surrounding Indonesia and untested for IMNV not be reared together with *P. vannamei* in hatcheries or farms.

As with AGM 15, Taura syndrome virus (TSV) and infectious hypodermal and hematopoietic necrosis virus (IHHNV) are not serious threats to the tolerant, domesticated shrimp stocks currently being cultivated. However, deformity caused by IHHNV should not be confused with *P. vannamei* exhibiting abdominal segment deformity disease (ASDD) that is associated with an endogenous retrovirus-like agent (Sakaew et al. 2013. BMC Veterinary Research. 9, 189). For *P. monodon* only, the next most important viral pathogen is Laem Singh virus (LSNV) and an integrase-containing element (ICE) that are together associated with monodon slow growth syndrome (MSGS). So far, however, this has been reported only from Thailand (Panphut et al. 2011. BMC Vet Res. 7, 18). Less important are hepatopancreatic parvovirus (HPV) and monodon baculovirus (MBV), and only when captured *P. monodon* are used for postlarval production without implementation of proper preventative measures. As stated at AGM16, work at Centex shrimp showed that MBV was not infectious for *P. vannamei* and that work has now been published (Gangnonngiw and Kanthong. 2019. Aquaculture 499: 290-294).

Despite a recent publication from Australia suggesting that reduced growth and profit in cultivation of *P. monodon* was caused by IHHNV infection (Sellars et al. 2019. Aquaculture. 499: 160-166), there is, in my opinion no danger of IHHNV causing significant retarded growth in the currently cultivated, domesticated *P. vannamei* stocks. Nor do I believe that it would cause significant retarded growth in *P. monodon*. The conclusions from the Australian paper are suspect mainly because the shrimp studied were not examined by either histology or PCR for the possible co-presence of HPV and/or MBV, the two main viruses that have been confirmed in several publications to be associated with retarded growth in *P. monodon* (whether or not they occur in dual or multiple viral infections that include IHHNV). In addition the study conclusions are not supported by the majority of previous work on the impact of IHHNV on *P. monodon* growth.

Since AGM16 there have been no reports of spread from China of *Macrobrachium rosenbergii* Taihu virus (MrTV) from the family Dicystroviridae like TSV (Pan et al. 2016. Int J Mol Sci. 17: 204) or of *Macrobrachium nipponense* reovirus (MnRV) (Zhang et al. 2016. J Fish Dis. 39, 371-375). Nor have there been further reports of *Cherax quadricarinatus* iridovirus)(CQIV) (Xu et al. 2016. Dis Aquat Org. 120: 17-26) that was assigned to a new genus *Cheraxvirus* (Li et al. 2017. J. Gen. Virol. 98: 2589-2595). Unfortunately, CQIV was more or less simultaneously discovered in *P. vannamei* (Qiu et al. 2017. Scientific Reports. 7) and was called shrimp hemocyte iridescent virus (SHIV) that was assigned to a new genus *Xiairidovirus* (Qiu et al. 2018. Arch. Virol. 163: 781-785). To avoid confusion from the publication of two different sets of names for the same virus, I recommend that these two Chinese research groups cooperate in producing a joint document to submit to the International Committee on Taxonomy of Viruses in which they give the latest information on this virus and jointly propose a new or existing common name and a genus and species name to which they both agree. They might consider that the hematopoietic tissue lesions caused by the virus and characterized by basophilic, cytoplasmic inclusions in hematopoietic tissue are unique to this disease and thus might be called pathognomonic lesions for its histological diagnosis. As a result, I suggest that a name something like “shrimp hematopoietic iridovirus” (SHIV) for the common name and something like *Haemiridovirus* for the genus name might be considered.

A draft disease card has been prepared for SHIV and presented to NACA for consideration. So also has a revised version of the disease card for covert mortality nodavius (CMNV) (Zhang et al. 2014. J Gen Virol. 95, 2700-2709), although no disease outbreaks caused by this virus have so far been reported outside of China. Finally, a new picornavirus (Family Iflaviridae, Order Picornavirales) in red claw (*Cherax quadricarinatus*) in Australia has been reported and it has been called *Chequa iflavirus* (Sakuna et al. 2017. Virus Res. 238:148-155). So far there are no reports of it from other countries in Asia or with regard to its virulence for penaeid shrimp.

The current top bacterial disease threat for shrimp in Asia is still acute hepatopancreatic necrosis disease (AHPND) that is now a listed crustacean disease of OIE. It is caused by isolates of *Vibrio* (*V. parahaemolyticus*, *V. harveyi*, *V. owensii* and *V. campbellii*) that produce two Pir-like toxins ($Pir^{vp}A$ and $Pir^{vp}B$) that can cause massive sloughing of shrimp hepatopancreatic tubule epithelial cells (the pathognomonic lesion of AHPND). They may carry the toxin genes in a plasmid (pAP) (Kondo et al. 2015. Genome Announc. 3, e00978-00915; Xiao et al. 2017. Sci Rep 7:42177; Han et al., 2017. Aquaculture 470:84 –90) or in a bacterial chromosome (see below). Again, I emphasize that the term early mortality syndrome (EMS) is not equivalent to AHPND since AHPND is only one of the causes of EMS, albeit a major one (Sanguanrut et al. 2018. Aquaculture 493: 26-36). Work mentioned in AGM16 on AHPND-causing isolates of what were formerly named *V. harveyi* but would now be named *V. campbellii* (collected in 1999 and stored at -80^{o}C and collected more recently in 2010) has now been published (Wangman et al. 2018. Aquaculture. 497, 494-502). The genome sequence of one of these isolates revealed that its $Pir^{vp}A$ and $Pir^{vp}B$ toxin genes were in its chromosome rather than in a pAP plasmid (unpublished from our laboratory).

Our recent publication (Sanguanrut et al. 2018. Aquaculture 493: 26-36) includes discussion on isolates of VP that carry mutated pAP and do not produce $Pir^{vp}A$ and $Pir^{vp}B$ toxins but still cause approximately 50% shrimp mortality (Phiwsaiya et al., 2017. Appl Environ Microbiol, doi: 10.1128/AEM.00680-17 AEM.00680-17; Theethakaew et al. 2017. Infec Genet Evol. 51, 211-218). Since these isolates do not cause pathognomonic AHPND lesions, but instead collapsed HP tubule epithelia, histological diagnosis is uncertain and work on the virulence mechanism for these isolates still needs further investigation, particularly with respect to additional toxins that may cause shrimp mortality in their own right or potentiate the virulence of the $Pir^{vp}A$ and $Pir^{vp}B$ toxins (Sirikharin et al. 2015. PLoS ONE. 10, e0126987).

As indicated in AGM16 Thai production of farmed shrimp rebounded from a low of 180,000 metric tons in 2014 to approximately 315,000 metric tons in 2017, and it is predicted that it will be 350,000 tons for 2018. This has been aided by knowledge about the AHPND-causing bacteria, by use of PCR methods to detect AHPND bacteria so they can be eliminated from broodstock and post larvae (PL), by the use of high-biosecurity nurseries prior to pond stocking and by changes in pond management to reduce the overall quantity of organic matter in shrimp rearing pond water and sediments. Publications on epidemiological risk factors associated with EMS in Thailand (Boonyawiwat et al. 2016. J Fish Dis. 44, 649–659), a recent cohort study of pathogen prevalence in EMS ponds (Sanguanrut et al. 2018. Aquaculture 493: 26-36) and many publications have contributed to knowledge for controlling AHPND and improving production. For example, a check for AHPND publications since 2018 at Google Scholar brought up well over 200 articles. To mention just a few examples, these included genetic studies on AHPND bacteria (e.g., Restrepo et al. 2018. Sci. Rep. 8, 13080; Liu et al. 2018. J. Invertebr. Pathol. 153: 156-164; Kanrar & Dhar. 2018. Genome Announ. 6, e00497-00418), on research methods (e.g., Devadas et al. 2018. Aquaculture 499: 389-400), on host responses (e.g., Zheng et al. 2018. Fish and Shellfish Immunol 74: 10-18; Boonchuen et al. 2018. Dev Comp Immunol 84: 371-381; Maralit et al. 2018. Fish Shellfish Immunol 81: 284-296; Tinwongger 2019. Fish Shellfish Immunol 84: 178-188), on phage therapy (e.g., Angulo et al. 2018. Rev Aquacul doi: 10.1111/raq.12275 : pp 16; Jun et al. 2018. Indian J. Microbiol. 58: 114-117), on probiotics (e.g., Duan et al. 2018. J Ocean Univ China. 17: 690-696; Chomwong et al. 2018. Dev Comp Immunol. 89: 54-65), on selection of AHPND-resistant shrimp (Megahed 2018. J Appl Aquacul 23: 1-17) and on other potential control methods ranging from disinfection using ozone nanobubbles (e.g., Imaizumi et al. 2018. J. Fish Dis. 41: 725-727) to the use of extracts as feed additives (e.g., Soowannayan et al. 2019. Aquaculture. 499: 1-8; Xie 2018. Fish Shellfish Immunol 75: 316-326; Ali 2018. Sci. Rep. 8, 8836) and use of tilapia water in cultivation ponds (Sajali et al. 2019. Aquaculture. 498: 496-502). The work reported in AGM16 on 2 isolates of non-AHPND bacteria that potentiate AHPND virulence still have not been published [*Roseateles sp*. (Berkholderiales, Comamonadaceae) and *Shewanella sp*. (Alteromonadales, Shewanellaceae)] and the reason(s) why they increase virulence is still unknown.

With respect to spread of AHPND, it has more recently been reported from Australia caused by *V. harveyi* (with toxin genes apparently on the chromosome, similar to the *V. harveyi*/*campbellii* described from Thailand above). There are reports in the literature for AHPND in Mexico but its presence there has not been reported to the World Organization for Animal Health (OIE). Other countries are also reluctant to report the occurrence of AHPND, so it is difficult to estimate the actual extent of its spread.

The other major emerging disease of concern in Asia is hepatopancreatic microsporidiosis (HPM) caused by *Enterocytozoon hepatopenaei* (EHP). Please refer to the AGM16 report for a summary of developments up to November 2017 and to the review on shrimp diseases in Asia (Thitamadee et al. 2016. Aquaculture. 452, 69-87). Since that time, progress remains slower than desired and many questions still remain unanswered. To me the most urgent problem is to find the environmental reservoir(s) for EHP. The prevalence in ponds and the prevalence of infected post larvae supplied to farmers are still much higher than desired. Given the current knowledge regarding EHP, the reason for failure to consistently deliver EHP-free PL to farmers needs to be urgently determined, addressed and rectified.

The reason why very severe infections of EHP sometimes cause shrimp to sometimes exhibit white feces syndrome (WFS) (Tang et al. 2016. J Invertebr Pathol. 140, 1-7) but sometimes not (Tangprasittipap et al. 2013. BMC Vet Res. 9, 139) is still under study. One recent publication has used next generation sequencing technology to examine the microbial profile of WFS shrimp, opening the way for more detailed studies of possible microbial interactions that may result in WFS (Hou et al. 2018. Appl Microbiol Biotechnol. 102: 3701-3709).

As in AGM16, many other questions are still unanswered: Are there life stages in other host species (i.e. environmental carriers)? Do other cell or spore types exist for internal reinfection and external transmission (Vávra, J., Lukeš, J., 2013. Adv Parasitol. 82, 253-319)? Is therapeutic treatment possible? Are *Artemia* and polychaetes that are positive for EHP by PCR actually infected? What is the relationship between Asian EHP and its variant reported from Venezuela (Tang et al. 2017. Aquaculture. 480, 17-21) and possibly other countries in Central and South America? As I suggested in AGM16, it would be good if an international group of interested researchers could be assembled and funded to answer these questions in a coordinated manner so that work could be obtained quickly without excessive overlap.

The other emerging, crustacean, intracellular parasite mentioned at AGM16 (*Spiroplasma eriocheiris*) was reported to infect not only the Chinese mitten crab *Eriocheir sinensis* (Wang & Gu. 2002. Dis Aquat Org. 48:149-153; Wang et al. 2002. J Invertebr Pathol. 81: 202-204) but also *Procambarus clarkii, Machrobrachium rosenbergii, Machrobrachium nipponensis* and *Penaeus vannamei* (Wang et al. 2011. Int J Syst Evol Microbiol. 61:703-708). However, I have seen no reports of disease outbreaks caused by *Spiroplasma eriocheiris* in cultivated *P. vannamei* from other countries. We found infections in *M. rosenbergii* from Thailand and Bangladesh (Srisala et al. 2018. Aquaculture. 493: 93-99) but our oral challenge tests with *P. vannamei* fed infected HP tissue of *M. rosenbergii* did not result in detectable infection or disease (unpublished).

Discussion

- Genetic improvement of shrimp broodstock for resistance to TSV has been developed by CP by testing the offspring of families in a disease testing facility. A wide range of tolerance was found and they took the top families and kept selecting until they got very high tolerance. During this process the stocks also gained high tolerance to IHHNV with no stunting or adverse signs of disease. This makes these lines useless for experimental challenge tests with TSV and IHHNV.
- A similar approach to the development of tolerance/resistance to AHPND toxins has also been used in some SPF stocks.
- Families of *P. monodon* that are apparently refractory (i.e., not susceptible) to infection with White Spot Syndrome Virus have also been reported from Taiwan Province of China. Another stock of *P. vannamei* highly tolerant to WSSV infection was apparently developed in Saudi Arabia by screening and selecting survivors from WSSV disease outbreaks.
- Prevalence of EHP is about 20-30% in growout ponds in Thailand, reduced from the former level of about 60%.
- The feasibility of developing EHP resistant families of shrimp is not known.

Recommendations

- AG recommended that NACA should invite scientists to produce disease cards for newly emerging crustacean pathogens whether they are listed diseases or not. This would be of great assistance to stakeholders in countries where the relevant pathogens have not yet been reported.
- AG recommended that NACA issue a warning to its members that IMNV has been detected in captured adult specimens of *Penaeus monodon* from the Andaman Sea, that *P. monodon* is highly tolerant to IMNV and shows no gross signs of infection but can serve as an infectious carrier. AG further recommended that countries in seas adjacent to Indonesia require that *P. monodon* captured or imported as broodstock be tested for IMNV infection and not be used if positive if *P. vannamei* is being cultivated. Additionally, AG recommended that they prohibited by law the rearing of IMNV-positive *P. monodon* together with or in close proximity to cultivated *P. vannamei*.
- Two Chinese research groups more or less simultaneously discovered a new crustacean virus unbeknownst to one another. Thus, two different sets of common and scientific names [i.e., Shrimp hemocyte iridovirus (SHIV) plus genus *Xiairidovirus* and *Cherax quadricarinatus* iridovirus (CQIV) plus genus *Cheraxvirus*] were proposed for it. Due to the possibility for confusion as a result, AG recommended that the two research groups make a single joint proposal to avoid confusion from the publication of two different sets of names for the same virus.
- AG further recommended that these two Chinese research groups cooperate in producing a joint document to submit to the International Committee on Taxonomy of Viruses in which they jointly give the latest information on this virus and jointly propose a single new or existing common name and a genus/species name to which they both agree.
- AG recommended that a concerted effort be supported and made to find the environmental reservoir(s) for the microsporidian parasite *Enterocytozoon hepatopenaei*.

3.3. Updates on Amphibian and Molluscan Diseases in the Asia-Pacific Region

Dr. Andy Shinn reported current updates on amphibian and molluscan diseases in the region.

Molluscs

Perkinus olseni. Although there were no notable mortality events associated with infections of the apicomplexan *Perkinsus* reported over the past 12 months, there have been three major studies published that have looked at the seasonal occurrence of *Perkinsus* species throughout Asia. The first, a survey of Manila clams in Korean coastal waters conducted by Kang *et al.* (2017), found a 100% prevalence of *P. olseni* in clams collected from the west and south coasts (n=19 sites) extending south-easterly to Geoje. Samples collected from the east coast (n=4 sites), however, were free of infection. A study conducted by Cui *et al.* (2018) looking at the seasonal occurrence of *Perkinsus olseni* in the tissues of wild clams, *Hiatula* [*Soletellina*] *acuta*, collected from the coastal waters of Wuchuan County, southern China found that prevalences ranged from 9.4% to 50.6% with the highest infection in March, lowest in June with an apparent preference for the mantle and gill tissues. The third study by Shamal *et al.* (2018) investigated the prevalence of *P. olseni* in wild populations of short neck yellow clams, *Paphia malabarica*, collected from six sites along a 500 km stretch of the southwest coast of India. The prevalence of infection was 87.86% across all sites (range 75-100%). The three studies highlight that the prevalence of *P. olseni* in wild populations of mollusc across Asia and the potential threat it poses.

Marteilia. Two species of *Marteilia*, *M. refringens* and *M. sydneyi*, can impact on the growth performance, gaping and mortality of susceptible species. A comprehensive 7 year-long study investigating infections in 13 different species from 7 culture sites in China representing the analysis of 11,581 samples was reported on by Xie and Xie (2018). Infections of *Marteilia* were found in 9 species with prevalences ranging from 0% to 6.67% (the latter in *Ruditapes philippinarum*). Positive samples were commonly positive (i.e. 2628%) for other protozoans as well (*Haplosporidium nelsoni* and *Perkinsus* spp.). In 2003, an infection of *Marteilia sydneyi*, responsible for QX disease, in Hawkesbury, New South Wales, Australia almost wiped out production of rock oysters, *Saccostrea glomerata*. An 18 year-long selective breeding programme from oyster families that are resistant to QX has led to the production of a highly resistant line (ca. 80% survival) that is being trialled this year with 500,000 oysters (Murphy, 2018).

Pacific Oyster Mortality Syndrome (POMS). Pacific Oyster Mortality Syndrome (POMS), a contagious viral disease of Pacific oysters with ostreid herpesvirus-1 microvariant (OsHV-1 µvar) results in high rates of mortality within days of infection. Following infection of the oysters' haemocytes, immune-suppression by the OsHV-1 viral infection causes fatal bacteraemia in Pacific oysters (de Lorgeril *et al.,* 2018). In 2017, a study conducted by de Kantzow *et al.* (2017) documented an av. 78% mortality (range 37-92%) across six Tasmanian sites in March-April 2016. The study found a 96% mortality rate in small, 0–20 mm sized animals compared to 33% mortality in larger oysters (61–115 mm). The study found that generally, the longer the time oysters were reared on site, the lower the mortality, consistent with the increasing age and size of the oysters. Stocking at the standard density resulted in lower mortality than high or low stocking densities (notably spat). Mortality was nearly twice as likely when oysters were handled for routine husbandry in the 7 days prior to the outbreak compared to not those that were not handled. Environmental and husbandry factors including water temperature and clip height on inter-tidal long-lines were found to be associated with the occurrence and severity of POMS outbreaks. The study recommended that decreasing the immersion time by raising the height of growing infrastructure by 300 mm above the industry standard reduced mortality of adult oysters due to POMS in New South Wales by half. A subsequent study by Ugalde *et al.* (2018) looked at management strategies following POMS outbreaks at 30 leases across 21 commercial businesses in 4 bays in Tasmania. The study's findings supported those of de Kantzow *et al.* (2017) with handling regimes and water temperatures (18-20°C) being ranked as the most important factors influencing OsHV-1-associated mortalities.

While one of the recommendations to mitigate against OsHV-1 infection is to raise the current height of the culture baskets so that they are out of the water for short periods and allowed to dry. Although the air-drying process is crucial to product quality, it is not risk-free. The exposure of oysters to elevated air temperatures, interrupts their filter feeding, and under these conditions levels of *Vibrio* can rise (2018a). Once the baskets are submerged, *Vibrio* levels gradually subside, but the concern of increased bacterial loads remains. There are, therefore, human seafood safety concerns regarding the potential bacterial-related health impacts. *Vibrios* are Gram-negative, rod-shaped bacteria that occur naturally in estuarine or marine environments. Infection is usually from exposure to seawater or consumption of raw or undercooked seafood. Vibrio infection results in an estimated 80,000 illnesses, 500 hospitalizations, and 100 deaths each year in the United States alone (see Newton *et al.,* 2012; Heng *et al.,* 2017).

An outbreak of POMS in Tasmania at the start of 2016, led to a ban on the movement of spat and equipment into South Australia (Neindorf, 2017). In March 2018, however, an infection was reported in South Australia’s Port River (Neindorf, 2018a) which was subsequently declared free in April (Anon 2018b,c) but then found to be reinfected in October (Anon, 2018d). To address disease losses, a trial with POMS-resistant oysters being stocked in the Port River began in April 2018 (Neindorf, 2018b).

As an alternative means of addressing OsHV-1 infection, the application of dsRNA-mediated genetic interference (RNAi) technology is being explored. In a study conducted by Pauletto *et al.* (2017), the induction of an immune response in *C. gigas* was possible. During OsHV-1 infection, Cg-IKB2 mRNA levels were found to vary significantly depending on the amount of viral DNA detected. The study used dsRNAs targeting Cg-IKB2 and green fluorescent proteins (GFP) were injected into oysters prior to challenge. The survival of injected oysters appeared close to 100% suggesting that the long dsRNA molecules, both Cg-IKB2- and GFP-dsRNA, may have induced an anti-viral state controlling the OsHV-1 replication.

A method for the rapid capture and detection of OsHv-1 is described by Toldrà *et al.* (2018). Magnetic beads are coated with an anionic polymer that is used to capture viable OsHV-1 from two types of naturally infected matrix: oyster homogenate and from seawater. Adsorption of the virus on the magnetic beads (MB) and characterisation of the MB-virus conjugates is then analysed by real-time quantitative PCR (qPCR).

It has not been definitively determined how the OsHV-1 virus sustains itself in the marine environment. A study conducted by Bookelaar *et al.* (2018) found that the transmission of the virus could occur to naïve Pacific oysters, *Crassostrea gigas*, within 4 days, from shore crabs, *Carcinus maenas* previously exposed to the virus in the wild. The virus was detected only in the gill tissues in 89.9% (241/268) of the crabs screened, only in the internal tissues in a further 7.1% of crabs (19/268), and in both the gill and internal tissues in the remaining 3.0% of crabs (8/276). The viral loads were low, with up to 100 viral copies μl^{-1} of genomic DNA in most crabs. In a second study by the same author group, found that that OsHV-1 µVar was detected in wild *Mytilus* spp. at *C. gigas* culture sites and, more significantly, that the virus was detected in mussels at non-culture sites. Cohabitation of exposed wild mussels and naïve *C. gigas* resulted in viral transmission after 14 days (O'Reilly *et al*., 2018).

Bonamia ostreae. *Bonamia ostreae* is a haplosporidian parasite that infects the haemocytes subsequently releasing parasites into the haemolymph with the consequential infection leading to massive abscess-like lesions and high rates of mortality. *Bonamia ostreae* was discovered for the first time in New Zealand in 2016 and then in two oyster farms in Big Glory Bay in May 2017. The infection was subsequently found at Stewart Island which led to the Ministry for Primary Industries pulling millions of potentially infected oysters from the sea in a bid to halt the spread of the disease (Anon, 2017) – this was completed in September 2017 (Bonthuys, 2017). No illegal movement of stock was implicated in the spread of the disease (Kearns, 2018).

Endocrine disruptors and mollusc health. In considering the wider health status of mollusc populations, a study conducted by Ocharoen *et al.* (2019) determined levels of two endocrine disruptors, bisphenol A (BPA) and 17β-estradiol (E2), in several populations of green mussels, *Perna viridis*, cultured in the Gulf of Thailand. Levels in farm sites close to intense industrial activity such as the Map Ta Phut Industrial Estate - the world's eighth largest petrochemical hub which produces ca. 150,000 tons of BPA product annually, were found to be among the highest in SE Asia. Bisphenol A is a xenoestrogen that is used in the manufacture of polycarbonate plastics, epoxy resins and the protective lining of food and drink containers. In 2008, the US FDA set a No Observed Adverse Effect Level (NOAEL) at 5000 µg kg bdy wt day^{-1} (i.e. 247,000-437,000 µg adult day^{-1}). In 2010, the US EPA then set a chronic reference dose at 50 µg kg bdy wt day^{-1}. Later in 2018, the European Food Standards Agency set a Tolerable Daily Intake of 4 µg kg bdy wt day^{-1} BPA. From the recent study of Ocharoen *et al.* (2019), the levels of BPA (ng g-1) in the Gulf of Thailand were found to range from <1.3 - 109.97 ng g^{-1} compared to published concentrations of 1.1-1.9 ng g^{-1} in Cambodia, 1.1-13.7 ng g^{-1} in India, 0.32-1.8 ng g^{-1} for Indonesia, 0.51-4.2 ng g^{-1} for Malaysia, 1.1-4.7 ng g^{-1} for the Philippines, 3.3 ng g^{-1} for Singapore, and, 0.58-1.3 ng g^{-1} for Vietnam. 17β-estradiol is a natural potent estrogen that is frequently used in menopause hormone therapy - high levels of 62.99 ± 5.03 ng L^{-1} were found in freshwater sites from runoff from domestic waste. While the bioaccumulation of both endocrine disruptors in mollusc tissues raises concern for human food safety, high levels may also shape the sex ratio within mollusc populations (74-89% of the mussels at high E2 sites in the current study were female). Low turnover flush rates within the Gulf (av. flush rate of 80-170 days; particle flush rate of only 17% in >730 days). The study highlights the impact of non-disease agents on the health of cultured populations of mollusc and the need for surveillance of farm sites near highly populated urban areas and or sites of industrial activity.

Rickettsia-like organism (RLO). An RLO was implicated in the mass mortality of pipi, *Paphies australis*, and tuatua, *Paphies subtriangulata*, in New Zealand between March and May 2107 (Shand, 2017).

Other noteworthy mollusc-based findings. The analysis of mussel samples collected from the coast of Washington, USA, found that 3 of the 18 samples tested were positive for oxycodone, a semi-synthetic opioid derived from the baine found in Persian poppies which induces an effect approximately 1.5 times to that of morphine (Boucher, 2018). This study highlights that in assessing the health of populations of aquatic animal populations, that in addition to the surveillance of pathogenic agents, it is important to also consider other agents, toxicants and products that may impact on their sustainability and their safety as animals for human consumption. One further noteworthy piece of mollusc-focused news centres around the activity of a company in California who has started to farm giant keyhole limpets, *Megathura crenulata* (see Kisken, 2017). The interest in farming stems from a protein within its blood – keyhole limpet hemocyanin (KHL) - a copper containing respiratory protein, similar to haemoglobin in humans that has application in human medicine as a cancer vaccine carrier protein.

Amphibians

Batrachochytrium dendrobatidis. Chytrid fungus has already driven over 200 amphibian species to extinction or near extinction. The causative agent *Batrachochytrium dendrobatidis* (*Bd*) has been quoted as "... *the worst pathogen in the history of the world, as far as we can tell, in terms of its impacts on biodiversity*" [Matt Fisher in Greshko, 2018). Within the aquaculture and ornamental trade, frogs are regularly traded; American bullfrogs, *Lithobates catesbeianus*, which are widely distributed are thought to be carriers of Bd due to their low inherent susceptibility to infection. Bullfrogs often escape captivity and can establish feral populations. Research conducted by O'Hanlon *et al.* (2018) found that samples of *Bd* shared the most genetic information with a group obtained from frogs that live on the Korean Peninsula. The pathogen most likely arose on the Korean Peninsula 50 to 100 years ago and spread through global trade. One interesting approach in the surveillance of *Bd*, is to use an eDNA-based approach as was conducted by Kamoroff & Goldberg (2017), who were able to detect *Bd* in water samples a full month prior to an observed die-off of yellow-legged frogs.

Elizabethkingia miricola. Since May 2016, farms culturing black spotted frogs, *Pelophylax nigromaculatus*, in south-central China have experienced an emerging contagious disease caused by *Elizabethkingia miricola*, a Gram negative, non-motile, non-spore forming bacilli that occasionally causes infections in humans. The clinical signs of disease include swimming in circles, disorientation, cataracts, agitation or lethargy and then death. Many farms in the region reported having problems, with over 60% of the frogs at infected farms displaying clinical signs. From a study conducted by Hu *et al.* (2017) at 7 farms in Hunan Province, between 60-90% of these diseased frogs subsequently died (over a few days to a few weeks. In Hunan, 3,945 acres is used for frog culture with an av. 240 kg frogs acre^{-1} (946.8 tons). If a 60% mortality in the region is assumed (i.e. 568 tons at USD 3.62 kg) then the loss can be estimated at USD 2.06 M. In China, however, 70,000 tons of frogs are farmed. By applying a proportional allocation of frogs to districts (Hunan is 29.93%, i.e. 20,951 tons of national prod.) and if a provincial mortality of 60% is assumed, then the loss due to disease could be as high as USD 45.51 M.

References cited:

Anon (2017) Marlborough oyster cull almost done. Radio New Zealand, 5th September, 2017. http://www.radionz.co.nz/news/national/338757/marlborough-oyster-cull-almost-done.

Anon (2018a) Auburn researcher wins USDA grant to study oyster farm bacteria. Available at: https://www.intrafish.com/aquaculture/1552104/auburn-researcher-wins-usda-grant-to-study-oyster-farm-bacteria.

Anon (2018b) POMS found in South Australia. ABC News, 30th October, 2018. https://www.abc.net. au/news/rural/2018-10-30/oyster-disease-found-in-south-australia/10446430.

Anon (2018c) South Australia free of 'devastating' oyster disease. Undercurrent News. 16th April 2018. https://www.undercurrentnews.com/2018/04/16/south-australia-free-of-devastating-oyster-disease/

Anon (2018d) Industry found POMS free. Port Lincoln Times, 11th April 2018. https://www.portlincolntimes.com.au/story/5335568/industry-found-poms-free/

Bonthuys, E. (2017) Wild Bluff oysters clear of bonamia. Southland Times. 31st October 2017. https://www.stuff.co.nz/southland-times/news/98403288/wild-bluff-oysters-clear-of-bonamia

Bookelaar, B.E., O'Reilly, A.J., Lynch, S.A. & Culloty, S.C. (2018) Role of the intertidal predatory shore crab *Carcinus maenas* in transmission dynamics of ostreid herpesvirus-1 microvariant. *Diseases of Aquatic Organisms*, **130**, 221-233.

Boucher, M. (2018) Traces of oxycodone found in mussels off the Coast of Washington. Addiction Now, 12th June 2018. https://www.drugaddictionnow.com/2018/06/12/traces-of-oxycodone-found-in-washington-mussels/

Cui, Y.-Y., Ye, L.-T., Wu, L. & Wang, J.-Y. (2018) Seasonal occurrence of *Perkinsus* spp. and tissue distribution of *P. olseni* in (*Soletellina acuta*) from coastal waters of Wuchuan County, southern China. *Aquaculture*, **492**, 300-305.

de Kantzow, M.C., Hick, P.M., Dhand, N.K. & Whittington, R.J. (2017) Risk factors for mortality during the first occurrence of Pacific Oyster Mortality Syndrome due to ostreid herpesvirus–1 in Tasmania, 2016. *Aquaculture*, **468**, 328-336.

de Lorgeril, J., Lucasson, A., Petton, B., Toulza, E., Montagnani, C., Clerissi, C., Vidal-Dupiol, J., Chaparro, C., Galinier, R., Escoubas, J.M., Haffner, P., Degremont, L., Charriere, G.M., Lafont, M., Delort, A., Vergnes, A., Chiarello, M., Faury, N., Rubio, T., Leroy, M.A., Perignon, A., Regler, D., Morga, B., Alunno-Bruscia, M., Boudry, P., Le Roux, F., Destoumieux-Garzon, D., Gueguen, Y. & Mitta, G. (2018) Immune-suppression by OsHV-1 viral infection causes fatal bacteraemia in Pacific oysters. *Nature Communications*, **9**, 4215.

FAO (2018) FishStatJ, a tool for fishery statistics analysis. Release: 3.04.12. Berger, T., Sibeni, F. and Calderini, F. (Eds.) FAO Fisheries and Aquaculture Department, Rome. http://www.fao.org/fishery/statistics/software/fishstatj/en.

Greshko, M. (2018) Ground zero of amphibian 'apocalypse' finally found. *National Geographic*, 10th May, 2018. https://news.nationalgeographic.com/2018/05/amphibians-decline-frogs-chytrid-fungi-bd-animals-science/

Heng, S.-P., Letchumanan, V., Deng, C.-Y., Ab Mutalib, N.-S., Khan, T.M., Chuah, L.-H., Chan, K.-G., Goh, B.-H., Pusparajah, P. & Lee, L.-H. (2017) *Vibrio vulnificus*: an environmental and clinical burden. *Frontiers in Microbiology*, **8**, 997.

Hu, R., Yuan, J., Meng, Y., Wang, Z. & Gu, Z. (2017) Pathogenic *Elizabethkingia miricola* infection in cultured black-spotted frogs, China, 2016. *Emerging Infectious Diseases*, **23** (12), 2055-2059.

Kamoroff, C. & Goldberg, C.S. (2017) Using environmental DNA for early detection of amphibian chytrid fungus *Batrachochytrium dendrobatidis* prior to a ranid die-off. *Diseases of Aquatic Organisms*, **127**, 75-79.

Kang, H.-S., Yang, H.-S., Reece, K.S., Cho, Y.-G., Lee, H.-M., Kim, C.-W. & Choi, K.-S. (2017) Survey on *Perkinsus* species in Manila clam *Ruditapes philippinarum* in Korean waters using species specific PCR. *Fish Pathology*, **52** (4), 202-205.

Kearns, M. (2018) Authorities investigate spread of deadly oyster parasite in New Zealand. Seafood Source, 2nd April 2018. https://www.seafoodsource.com/news/supply-trade/authorities-investigate-spread-of-deadly-oyster-parasite-in-new-zealand

Kisken, T. (2017) Port Hueneme firm farms limpets for medicine. VC Star. 25th November 2017. https://www.vcstar.com/story/news/local/2017/11/25/port-hueneme-firm-farms-limpets-medicine/830656001/

Murphy, S. (2018) Once crippled, rock oyster industry forges ahead with disease-resistant technology. ABC News, 4 Nov 2018. https://www.abc.net.au/news/2018-11-04/rock-oyster-industry-forges-ahead-disease-resistance/10455440

Neindorf, B. (2017) POMS outbreak in Tasmania gives South Australian oyster farmer something to think about. ABC News, 3rd February 2017. https://www.abc.net.au/news/rural/2017-02-03/poms-outbreak-tasmania-one-year-on-in-south-australia/8234040

Neindorf, B. (2018a) Pacific Oyster Mortality Syndrome found in South Australia's Port River. ABC News, 1st March 2018. https://www.abc.net.au/news/rural/2018-03-01/poms-found-port-river-south-australia/9500308

Neindorf, B. (2018b) Disease-resistant oysters released in Adelaide's Port River in new trial. ABC News, 4th April 2018. https://www.abc.net.au/news/rural/2018-04-04/poms-resistant-oysters-to-be-released-in-adelaide-port-river/9613014

Newton, A., Kendall, M., Vugia, D.J., Henao, O.L. & Mahon, B.E. (2012) Increasing rates of vibriosis in the United States, 1996–2010: review of surveillance data from 2 systems. *Clinical Infectious Diseases*, **54** (5), S391-S395.

Ocharoen, Y., Boonphakdee, C., Boonphakdee, T., Shinn, A.P. & Moonmangmee, S. (2018) High levels of the endocrine disruptors bisphenol-A and 17β-estradiol detected in populations of green mussel, *Perna viridis*, cultured in the Gulf of Thailand. *Aquaculture*, **497**, 348-356.

O'Hanlon, S.J., Rieux, A., Farrer, R.A., et al. (2018) Recent Asian origin of chytrid fungi causing global amphibian declines. *Science*, **360** (6389): 621 DOI: 10.1126/science.aar1965.

O'Reilly, A.J., Laide, C., Maloy, A., Hutton, S., Bookelaar, B., O'Sullivan, K., Lynch, S.A. & Culloty, S.C. (2018) The role of the mussel *Mytilus* spp. in the transmission of ostreid herpesvirus-1 microVar. *Parasitology*, **145**, 1095–1104.

Pauletto, M., Segarra, A., Montagnani, C., Quillien, V., Faury, N., Le Grand, J., Miner, P., Petton, B., Labreuche, Y., Fleury, E., Fabioux, C., Bargelloni, L., Renault, T. & Huvet, A. (2017) Long dsRNAs promote an anti-viral response in Pacific oyster hampering ostreid herpesvirus 1 replication. *Journal of Experimental Biology*, **220**, (20), 3671-3685.

Shamal, P., Zacharia, P.U., Binesh, C.P., Pranav, P., Suja, G., Asokan, P.K., Pradeep, M.A., Rithesh, R., Vijayan, K.K. & Sanil, N.K. (2018) *Perkinsus olseni* in the short neck yellow clam, *Paphia malabarica* (Chemnitz, 1782) from the southwest coast of India. *Journal of Invertebrate Pathology,* **159**, 113-120.

Shand, M. (2017) MPI suspects bacteria cause of mollusc die-off. Stuff. 26th September 2017. https://www.stuff.co.nz/environment/97154982/mpi-suspects-bacteria-cause-of-mollusc-dieoff

Shinn, A.P., Pratoomyot, J. Metselaar, M. & Bastos Gomes, G. (2018) Diseases in aquaculture: counting the costs of the top 100. Biomin World Nutrition Forum 2018, Cape Town, South Africa, 227-262.

Toldrà, A., Andree, K.B., Bertomeu, E., Roque, A., Carrasco, N., Gairin, I., Furones, M.D. & Campàs, M. (2018) Rapid capture and detection of ostreid herpesvirus-1 from Pacific oyster *Crassostrea gigas* and seawater using magnetic beads. *PLoS ONE*, **13** (10), e0205207.

Ugalde, S.C., Preston, J., Ogier, E. & Crawford, C. (2018) Analysis of farm management strategies following herpesvirus (OsHV-1) disease outbreaks in Pacific oysters in Tasmania, Australia. *Aquaculture*, **495**, 179-186.

Xie, L. & Xie, Z. (2018) Prevalence of *Marteilia* spp. in thirteen shellfish species collected from China coast. *Turkish Journal of Fisheries and Aquatic Sciences*, **18**, 753-759.

Discussion

- As mussels are at the bottom of the food chain, it is possible that contamination with BPA would get worse at higher trophic levels. The source of BPA is not clear but micro-plastics are a possibility wherein histological investigations are needed for confirmation. Micro-plastics are being found in shrimps though. BPA levels in fish have not been investigated yet, but high levels have been reported from other places around the world.
- Diseases of molluscs and amphibians are often overlooked, but certain pathogens such as Bd have had severe impacts including extinction, especially in frogs. At present, very few countries are reporting chytrid disease to both OIE and QAAD, and it is not clear if they have a problem with it.
- Sea urchins and sea stars are also suffering mortalities from amoebid diseases.
- No known chemotherapeutic treatment is known for chytrid infection at present. Resistant populations have emerged in some places (Panama). Temperature manipulation may be effective.
- Chytrids have free swimming stage (zoospores) that can spread efficiently.
- There is a need to monitor what is happening with Ranavirus in wild populations as well as in farmed animals.
- Mollusc industries are often relatively a low value industry, so they attract little support from government for disease surveillance, etc.
- *Elizabethkingia miricola* related frog mortalities require surveillance.

Session 4: Reports on Aquatic Animal Health Programmes from Partner Agencies

4.1. Aquatic Animal Health Activities of the Fish Health Section, SEAFDEC/ AQD

Dr. Eleonor Tendencia presented highlights of Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC AQD) Fish Health Section (FHS) activities which include both Research and Extension. For the Extension, Fish Health Management is included in all training courses offered by SEAFDEC/AQD. Specialized Course on Fish Health Management is also offered upon request. Aside from training, the FHS also accept samples (aquatic organism, soil, water) from the private sector, as well as from SEAFDEC research studies, for disease detection under its diagnostic services. Treatment/Prevention is also recommended.

Under Research, there are four studies on penaeids, four on finfishes and one on seaweed as listed below:

- Establishment of threshold infection levels for WSSV and other pathogens such as VP_{AHPND} in penaeid shrimp.
- Application of adjuvants, carriers and RNAi technology to enhance the antiviral immune response of shrimp to WSSV.
- Epidemiology of the Early Mortality Syndrome (EMS).
- Production of *Penaeus vannamei* using biofloc system with sludge removal facility (SRF) to demonstrate the productivity of old earthen ponds during the wet season.
- Enhancement of vaccine efficacy for the prevention of viral nervous necrosis in high value marine fish.
- Establishment of protective measures against persistent and emerging parasitic diseases of tropical fish.
- Efficacy of different therapeutants against *Caligus* sp. infestation in tropical fish under laboratory conditions.
- Detection, quantification, and viability of Tilapia Lake Virus (TiLV) in pond soil and water as influenced by water quality parameters and culture management.
- Safeguarding the future of the Seaweed Industry of the Philippines: Disease and Pest Detection.

Another activity of the FHS of SEAFDEC/AQD in 2018 is the ASEAN Regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems (ASEAN RTC on AEPRS) for Effective Management of Transboundary Disease Outbreaks in Southeast Asia which was on 20-22 August 2018 in Bangkok, Thailand. The RTC was a collaboration between the Department of Fisheries-Aquatic Animal Health Research and Development Division (DOF-AAHRDD), Thailand, the Network of Aquaculture Centres in Asia-Pacific (NACA), and SEAFDEC/AQD with funding support from the Government of Japan through Japan-ASEAN Integration Fund. The ASEAN RTC on AEPRS aimed to bring together the representatives of ASEAN Member States and technical experts to examine the status of aquatic emergency preparedness and response systems currently being practiced in the region in order to identify gaps and other initiatives for regional cooperation. Seventy representatives from AMS, FAO, NACA, PDC, SEAFDEC, Academe, Private sectors participated in the ASEAN RTC on AEPRS. The ASEAN RTC on AEPRS consisted of presentations of AMS representatives on the current status of aquatic EPRS including existing laws, legislations, SOPs, national aquatic animal health management strategies; presentations by invited experts on the status of aquatic EPRS for effective management of aquatic animal disease outbreaks in the ASEAN including emerging diseases, as well as other regional initiatives on EPRS; a workshop to identify the gaps and priority areas for R&D collaboration as well as formulate recommendations with policy implications; and a field trip. The participants were requested to complete the FAO EPRS Audit.

DISCUSSION

- On prevention and control studies on parasites and VNN, commercial and well-studied solutions for sealice and VNN are already available, including vaccines and chemotherapeutants. It would be useful to make/facilitate these products' availability in Asia.
- Allicin study will be complimented with a histopathology study (in progress). The study does not presently look at impacts on *Caligus* and non-target species but this will be considered.
- Most disease cases tested/studied came from the cultured stocks within the station. It is recommended that research studies should focus more on the diseases affecting the local farms instead, which represents more the aquaculture industry of the country and/or the region.
- On WSSV, as the pore size in gastric sieve of shrimp is around 1 micron in size, it is best to use particles smaller than that to target the hepatopancreas.
- Soil samples positive for TiLV suggest the possibility of a host or reservoir organisms, as the virus usually cannot survive for a long period of time without a living host, which can explain the negative viral detection from the water samples tested.
- The availability of veterinary chemicals is an ongoing issue due to the diversity of species in aquaculture and the need to test for each. Species-specific registration protocols are not economically viable in many cases.
- Biological control of parasites may be an option in some cases. For example, using a nested cage structure with *Scatophagus argus* in the outer cage to clean the net and reduce parasite loads. There is also interest in cleaner shrimp.

RECOMMENDATIONS

- AG recommended that research studies on aquatic animal diseases should focus more on the disease problems encountered at the farm level, and not just on the diseases of cultured stocks (usually not for commercial purposes) at the SEAFDEC AQD station.
- AG recommended that published data from research studies on aquatic animal health should be shared widely with relevant authorities and institutes.

4.2. AAH ACTIVITIES OF OIE REGIONAL REPRESENTATION IN ASIA AND THE PACIFIC

Dr. Jing Wang presented updates on aquatic animal health activities by OIE Regional Representation in Asia and the Pacific. Several regional meetings were organized by OIE-RRAP on aquatic animal health management in the region, as well as other related topics. The OIE Regional Commission Conference held in Putrajaya, Malaysia on 20-24 November 2018 tackled an important issue on how to enhance the engagement of aquatic animal sectors in the OIE activities. Sharing of national strategies on aquatic biosecurity, whether developed or still being developed, in the Pacific Region was the main topic discussed during the 4th SPC/FAO/OIE Sub-Regional Meeting of Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) for SPC Members.

The Regional Workshop for OIE National Focal Points for Aquatic Animals (FP) was held in Qingdao, China on 12-14 December 2018. The workshop addressed important issue on what can OIE, Delegate and FP do to improve the role of FP. Some of the recommended strategies are: increase awareness of the role and responsibility of FP and organize training for the OIE delegates in how to get support from FP; encourage the Delegate to provide FP with direct access to WAHIS; draft a guideline/recommendation for Delegate on how to appoint and appropriate FP; make aquatic animals more visible on the OIE website; keep close communication with each of the country's eight FPs; improve aquatic animal disease diagnostic and reporting capacity; and, develop effective transition procedures from the predecessor to the new appointed FP.

Other regional meetings conducted in 2018 include the following:

- Expert Group Meeting on Antimicrobial Resistance and Prudent Use of Antimicrobials (14 May, Tokyo, Japan);
- OIE Regional Expert Consultation Meeting on Aquatic Animal Disease Diagnosis and Control (15-16 November, Bangkok, Thailand);
- 2nd OIE Global Conference on AMR and the Prudent Use of Antimicrobials in Animals, and the Regional Meeting on Antimicrobial Resistance Control in Animals (29-31 October, Marrakesh, Morocco).

For the Global Conference on AMR, a prominent theme of the discussion was the need for cross-sector, national level coordination through national action plans, to prevent the development and spread of AMR. Two AG members were invited in the plenary including Dr. Melba Reantaso (FAO) who talked on Country level implementation: FAO experience including aquaculture, and Dr. Eduardo Leano (NACA) as one of the panellists in the session "Driving private sector engagement in the global response to AMR". The Regional Meeting (conducted as a side-event) in particular aims to: introduce OIE activities and possible areas of support the OIE can provide to the member countries in implementing their National Action Plans on AMR; and, strengthen regional collaboration for AMR control activities among OIE member countries and OIE partners in the region.

A regional teleconference about the AAHSC Report was undertaken with Dr. Ingo Ernst (President of AAHSC) as speaker. The Regional Delegates' Secure Access System was also initiated wherein Delegates and FPs are encouraged to get involved in the OIE standard setting process through this system. To better understand the internal procedures on reporting listed and emerging aquatic animal diseases, a questionnaire on aquatic animal disease reporting and control was circulated among OIE member countries to identify gaps and issues of concern and provide valuable information for OIE in planning of future activities. Currently, there are two platforms for collecting and publishing aquatic animal disease information: WAHIS/WAHID; and, QAAD. The new WAHIS+ is expected to be launched in May 2019 which can be used for immediate disease notification, follow-up report, six-monthly reports, local reports, and interconnection with ADIS. By December 2019, the WAHIS+ can be fully utilized for annual report, wild annual report, Alert App, and e-learning. Improvements made in WAHIS+ include user-friendly interface, new mapping system, modern data mining system, and data extraction.

DISCUSSION

- On disease reporting to NACA-FAO-OIE QAAD, China had not been able to locate old documents supporting the formal relationship between China and NACA for QAAD reporting. Participating governments should advise NACA when the national coordinator has been changed. NACA undertook to write to China and re-formalise arrangements, or to provide documentation if it could be located. Arrangements were the result of an FAO TCP project conducted around 1997 with the participation of China.
- The forthcoming WAHIS Plus system will incorporate both OIE and NACA lists of notifiable diseases. Earlier attempts to incorporate NACA regional list didn't work out. The new system will incorporate data from different regional reporting systems and should also make reporting easier.
- OIE is working on a portable/exportable (HTML) version of the OIE manual/code.
- NACA is developing a proposal with the Pacific Disaster Center on an early warning system for aquatic animal disease emergencies.

RECOMMENDATIONS

- AG recommended that QAAD should be properly integrated into the WAHIS Plus system of OIE to facilitate online disease reporting by member governments and downloading of necessary data for encoding in the QAAD Report.

4.3. ACTIVITIES OF AAHRDD ON AQUATIC ANIMAL HEALTH

Dr. Janejit Kongkumnerd presented the aquatic animal disease status and management in Thailand. The overall aquatic animal disease management in the country is under the Department of Fisheries (DOF) and encompasses disease prevention and control, and disease surveillance. Biosecurity is the key component for disease prevention and control which are applied for importation, production and exportation of aquatic animals and products. For disease surveillance, both passive and active surveillance are being undertaken in the country for the national list of reportable diseases. In order to undertake such activity, two national reference

(NRL) and 19 regional (RL) laboratories located all over the country has the capacity for diagnosis of important aquatic animal diseases. Moreover, to strengthen the manpower capacity, staff training on disease diagnosis, management, monitoring and reporting, antimicrobial use and regulations, registration of aquaculture establishments were undertaken by the DOF for the year 2018. A disease reporting network was also established in August 2018.

Thailand, through its DOF, is the lead country for the ASEAN Network of Aquatic Animal Health Centres (ANAAHC), and in 20-22 August 2018, it co-organized the ASEAN regional Technical Consultation on Aquatic Emergency Preparedness and Response Systems for Effective Management of Transboundary Disease Outbreaks in Southeast Asia. This is in collaboration SEAFDEC AQD and NACA with financial support from JAIF. The DOF has linkages with international (OIE) and regional (NACA) organizations, with trade partners, and with a university in Japan for a joint research project. Locally, DOF is fully coordinating some activities such as research (with universities), and disease prevention and management (with farmer associations and the private sector).

Active and passive disease surveillance in 2018 showed that Thailand is positive for AHPND, WSSV, IHHNV, YHV, MrNV and EHP (for crustacean diseases), and VNN, TiLV and *Streptococcus* sp. Infection (for finfish diseases). No positive cases were reported for molluscs and amphibians. On TiLV surveillance, epidemiological survey was undertaken between August to September 2017 through random sampling of 907 tilapia farms. Samples collected were tested for presence of TiLV by PCR, while farm owners were interviewed to gather important information about the farm (e.g. survival rate). Binary logistic regression revealed that there was no significant difference in production of infected and non-infected farms, indicating that TiLV has no impact in the tilapia production of Thailand. Measures to manage the spread of TiLV include control of exportation of live tilapia (farms should be registered under Aquaculture Establishment for Exportation of Aquatic Animals, and comply with biosecurity measures as well as disease surveillance), support for tilapia hatcheries for production of TiLV-free fry, educate farmers on the use of biosecurity in aquaculture, and research studies with emphasis in virulence, associated factors, detection, prevention and treatment strategies.

Discussion

- On TiLV, about 10% of national tilapia production goes for export. Thailand was not taking special measures with infected farms as there is no food safety risk and production is presently good. Many infected fish have no signs of the disease and are active and healthy. Most mortalities are at the fry/fingerling stage, so it is usually the hatchery that is affected not the grow-out farms. The red hybrid tilapia is more sensitive than the black non-hybrid varieties. Many tilapia hatcheries have already introduced biosecurity practices for disease prevention.
- TiLV is not presently on the epidemic control list of Thailand but is in process of being listed. If a listed disease occurs, then eradication can be undertaken as an option (eg. KHV). No compensation is available but farmers usually understand the need to eradicate the stocks when necessary, to protect their business and the industry as a whole.

- For shrimp diseases, eradication is also an option without compensation. However, farmers may be permitted to emergency harvest and cook or dry the shrimps to mitigate disease risk, and sell the product.
- Shrimp farms with positive tests for listed diseases can opt to improve practices or be subjected to movement controls. If mortalities are present, then eradication and farm disinfection is recommended.
- Thai farmers tend to stop culturing when there is a disease emergency and make changes to their management system to cope.
- Only registered farms can export. One of the requirements for a registered farm is to apply the Thai GAP and they fall under the surveillance programme of DOF.

RECOMMENDATIONS

- AG recommended that a risk factor study be carried out among shrimp farms that are negative or positive to important diseases, to find our if there are any differences in farm practices, especially on disease prevention measures that are being applied on-farm.

4.4. AAH ACTIVITIES OF AUSTRALIA

Dr. Ingo Ernst presented updates on aquatic animal health program of Australia under the Department of Agriculture and Water Resources (DAWR). The responsibilities of the AAH program include:

- National coordination of aquatic animal health management, e.g. national plan, surveillance, diagnostic capability, disease reporting and training;
- Emergency disease preparedness and response including contingency planning and testing, and national coordination of responses to disease emergencies;
- International engagement such as reporting of disease status, involvement in standards setting, and regional capacity building.

Other areas of DAWR also have responsibility for aquatic animal health including biosecurity policy, risk assessments and export of aquatic animal products.

Australia's national strategic plan for aquatic animals (AQUAPLAN) aims to strengthen aquatic animal health management systems to support fisheries and aquaculture. AQUAPLANs 1998-2003 and 2005-2010 have built most of the country's national systems for managing aquatic animal health, and AQUAPLAN 2014-2019 is currently being implemented. The current AQUAPLAN encompasses five objectives: Improving regional and enterprise-level biosecurity; Strengthening emergency disease preparedness and response capability; Enhancing surveillance and diagnostic services; Improving availability of appropriate veterinary medicines; and, Improving education, training and awareness. More details on the current AQUAPLAN can be obtained at http://www.agriculture.gov.au/animal/aquatic/aquaplan.

The Australian Government had supported a regional laboratory proficiency testing (LPT) program in 2012-2014 which was successfully completed. DAWR has since implemented a second LPT program for 5 years in the Asia-Pacific region which commenced in 2018. The current LPT has a similar format as the previous one and is open to national laboratories of competent authorities in the region. The first round of testing has been completed and the second round is underway. A workshop for all the participating laboratories is also being planned to be held in 2019.

A WSD outbreak occurred in Australia in late 2016 and initiated a coordinated emergency response that aimed to eradicate the disease from all affected farms. All affected farms were destocked and decontaminated. The virus was eradicated from all affected farms which remained fallow for 18 months. Surveillance conducted in the nearby Logan River produced consistent negative results expect. However, some positive results were obtained in northern Moreton Bay which is within the restricted area. A national risk-based surveillance program for WSSV covers over 50 sites around the country. All surveillance has resulted in negative results outside of the restricted area. There are substantial R&D programs that are underway in order to support control of the disease and prevent further spread.

DISCUSSION

- A cost sharing agreement between all aquatic industries, state and Commonwealth governments for funding emergency responses and compensation for stock destruction is being developed. Commercial insurance is not available for this purpose, as insurance companies see destruction of stock as a sovereign risk, where the government can make a decision to destock without having any investment loss. The funding model for the agreement takes an approach that governments will fund things of public benefit, while industry is expected to fund things of benefit to the private sector. Within the proposed agreement there are obligations for all parties to cooperate to implement appropriate biosecurity measures.
- There are no criminal or civil penalties if a party does not honour their obligations under an agreement, as the purpose of the agreements are to encourage partnerships. The agreement does have mechanisms that enable parties to request another to show cause as to how they are meeting their obligations, and to remove a party from the agreement. The agreements are secondary to existing laws.
- On WSD outbreaks, demarcation of the restricted area is legally supported by a regulation under the Queensland Biosecurity Act. There have been some prosecutions for breaking the restrictions. [China requested a copy of the relevant laws for study].
- The Australian Integrated Incident Management System is used to coordinate emergency response between state/federal governments. The system breaks down capabilities so that teams can be assembled for different functions (e.g. operations, communications, policy) in a scalable manner. Positions and roles are described with job cards. The system facilitates the deployment of staff between jurisdictions to respond to emergencies.For example, as the response to the WSD outbreak escalated, Queensland requested the support of epidemiologists and other jurisdictions provided expertise for these job roles.
- One lesson from the WSD response was that we need to know in advance what chemicals will be used for destruction or disinfection and where to source them in adequate quantities.

4.5. AQUATIC ANIMAL HEALTH ACTIVITIES OF P.R. CHINA

Dr. Qing Li presented updates on aquatic animal health activities of China. China has a big aquaculture industry, with various cultured species and multiple aquaculture systems. In 2017, 64.5 million tons of aquatic products came from China, among which 49 million tons were from the aquaculture industry, accounting for 76% of the total aquatic products. The ratio of mariculture area to freshwater aquaculture area was around 1 to 1.6. Pond culture was the most popular one in multiple aquaculture systems, which produce around 49% of the total aquatic products. Fish, crustaceans and shellfish are the three main groups of cultured species. For fish, cultured species are Chinese carps, bream, tilapia, *Larimichthys crocea*, flatfish and trout. Crustaceans include *Penaeus vannamei*, *Macrobrachium rosenbergii*, crayfish and hairy crab, while shellfish include oyster and scallop. China values the healthy and sustainable development of aquaculture industry, spare no effort to work on aquaculture biosecurity, aquatic product quality and safety, and ecological safety. At present, there is great improvement in the health management of aquatic animals.

<u>Aquatic animal health management system.</u> Jurisdictional responsibility for animal health services is under Ministry of Agriculture and Rural Affairs (MARA). Both Bureau of Veterinary (BOV) and Bureau of Fisheries (BOF) are under MARA, while national aquatic animal health management is among the duties of BOF. For disease prevention and control system, the National Fisheries Technology Extension Center (NFTEC) is in charge of the state-level management, and is responsible for national aquatic animal disease monitoring, surveillance, forecast and prevention. There are two scientific and technical committees that work as advisory groups. One is the Expert Committee of MARA on Aquatic Animal Disease Control, and the other is the National Standardization Technical Committees of Aquatic Animal Epidemic Prevention which develops and update the standardization plan for aquatic animal health. Under the aquatic animal health management system, there are four groups that work as foundations: Disease Prevention and Control System in provincial, city and county levels; Research Institutions; Fishery Industrial Technology System; and, Higher Education System. Under the Fishery Industrial Technology System, there are 6 groups according to cultured species: Conventional Freshwater Fish; Characteristic Freshwater Fish; Crustaceans; Shellfish; Marine Fish; and, Algae. Each industrial technology system contains institutes and specialists for related disease research, which play important supporting roles in research and prevention of aquatic animal diseases. China has four OIE aquatic animal disease reference laboratories, and a range of other government and academic diagnostic facilities. The 2017 statistics also show that there are 2,000 Official Fishery Veterinarian, 4,002 Veterinary Practitioners and 13,768 Village Veterinarians.

<u>National Surveillance and Monitoring</u>. China has a National Surveillance System spanning in five jurisdictional levels (State, Province, City, County and monitoring points). There are also designated aquatic animal disease surveillance spots and reporting personnel for aquatic animal diseases in key aquaculture areas. In 2017, there were more than 4,000 monitoring points, around 6,000 people involved in monitoring and reporting work, and 30,000 hectares of aquaculture area that were monitored and inspected for major aquatic animal diseases. The National Surveillance

Project on major aquatic animal diseases has been started since 2005, while the Aquatic Animal Health in China and Analysis on Epidemiology of Major Aquatic Animal Diseases in China have been published annually since 2013, which are based on the data collected from National Surveillance Project. China's national reference laboratories and chief experts were given responsibility by the MARA for analyzing surveillance data and writing an annual report for each major disease. Since 2000, the National Monitoring and Forecast on aquatic plants and animal diseases have been carried out.

System Capacity and Capability Building. To improve the hardware strength of the whole system, the animal protection capacity improvement project and construction plan is currently being implemented. Under this project, one National Epidemiology Center, one National Reference Material Center, 34 Provincial Epidemic Prevention Centers, 36 Regional Monitoring Centers of Aquatic Animal Disease Prevention and Control, 5 National Comprehensive Laboratory on Aquatic Animal Diseases, 7 Research Bases on Aquatic Animal Diseases, 12 Specified Laboratory on Aquatic Animal Diseases, and one Exotic Aquatic Animal Disease Sub-Center are being established.

Personnel Capacity and Capability. Annual trainings for farmers, farmer associations, health professionals, fisheries extension officers and officers of local disease control centers are being undertaken. In 2014, the BOF commissioned the NFTEC to organize the national aquatic animal epidemic prevention system's laboratory testing capability. This is to strengthen testing proficiency, promote accreditation, speed up the establishment of the laboratory assessment management system, and to improve the accuracy of disease surveillance and detection. A program of re-educating, registering and certification of aquatic veterinarians was also implemented, while aquatic animal disease surveillance spots and reporting personnel for aquatic animal diseases were properly designated in key aquaculture areas.

Standardization of Aquatic Animal Health. The Aquatic Animal Health Working Group under the Aquaculture Standardization Committee develops and update the standardization plan for aquatic animal health. Scientists can apply funding for establishment or revision of the standards according to the plan. From 2013, 138 standards on aquatic animal health have been set and revised. Nineteen national standards and 79 industry standards have been published and implemented.

Technical Extension Services. China has a remote diagnostic network which provides real-time online technological information services on aquatic animal disease prevention and control which started from 2012. The network takes advantage of computer technology and aquatic animal disease diagnostic techniques, which is supported by 18 national platform experts and 184 provincial platform experts. At present, this network has acquired more than 600 thousand consultations, and become a popular platform for public service. Serial Publications, free booklets on Aquatic Animal Health and internet media are widely used to provide technical services and national information sharing.

Establishment of Specific Disease-free Compartment. To control the spread of diseases and pathogen proliferation, the establishment of specific disease free compartments were carried out in Beijing, Tianjin, Hebei, Zhejiang and Qinghai since 2014. A series of good management measures have been summarized from the try-out trials. Code of Practice for specified epidemic disease free hatchery is drafted.

International Cooperation. To strengthen international cooperation, China actively participates in international affairs, pays high attention to join and support works with OIE, FAO and NACA. In the last two years, several regional meetings were co-organized and/or hosted by China. These include Emergency Regional Consultation for Prevention and Management of Tilapia Lake Virus in the Asia-Pacific held in September 2017 in Guangzhou; Regional Workshop for OIE National Focal Points for Aquatic Animals held in December, 2017 in Qingdao; and, FAO/China Intensive 7-day course on Tilapia Lake Virus held in June 2018 in Guangzhou. China also actively contributes in the revision of OIE Aquatic Animal Health Code and Manual of Diagnostic Tests for Aquatic Animals. From 2013 to 2017, a total of 119 comments were submitted wherein around 50% were accepted by OIE.

DISCUSSION

- Aquatic animal disease surveillance is highly active in China, and disease reports are submitted to OIE through the WAHIS system (but not to NACA-OIE-FAO QAAD).
- The active involvement of China in the OIE commenting process for the Aquatic Code and Manual is a good example that should be followed by other major aquaculture-producing countries in the region.

RECOMMENDATIONS

- AG recommended that NACA should send an official communication to China to renew their commitment to the Asia Regional Aquatic Animal Health Programme, for the implementation of important aquatic animal health management projects as well as disease reporting in the region.
- AG recommended that China to consider extending support for human resource capacity building on aquatic animal health in the region, considering the significant role of China in the aquaculture industry. This is through provision of (free) training to young professionals in the region in key institutes, laboratories and universities in the country. NACA can co-facilitate such training and capacity building programmes.

SESSION 5: DISEASE REPORTING

5.1. ASSESSMENT FOR LISTING OF INFECTION WITH SHRIMP HEMOCYTE IRIDESCENT VIRUS (SHIV) IN ASIA-PACIFIC QAAD REPORT

Dr. Hong Liu presented the assessment of a new crustacean disease, Infection with Shrimp Hemocyte Iridescent Virus (SHIV), for listing in QAAD. SHIV has been identified as the cause of mass mortality in farmed white-leg shrimp *Penaeus vannamei* in Zhejiang Province of China in 2014 (Qiu et al., 2017a). The complete genome sequencing revealed that SHIV and *Cherax quadricarinatus* iridovirus (CQIV) (a new iridescent virus identified from freshwater lobster *Cherax quadricarinatus*) are different strains or genotypes of the same virus (Xu et al. 2016; Li et al. 2017; Qiu et al. 2017b; Qiu et al. 2018). Currently known susceptible species of SHIV include *P. vannamei*, *Macrobrachium rosenbergii*, *Penaeus chinensis*, *Exopalaemon carinicauda*, *Macrobrachium nipponense*, *Procambarus clarkii*, and *Cherax quadricarinatus*.

<u>Criteria.</u> The criteria for listing aquatic animal diseases followed Chapter 1.2 of Aquatic Animal Health Code (OIE, 2018) as indicated in the Table below:

No		**Criteria for listing**	**Shrimp hemocyte iridescent virus**
1		International spread of the pathogenic agent (via aquatic animals, aquatic animal products, vectors or fomites) is likely.	The virus has been detected in affected *P. vannamei*, *P. chinensis*, *M. rosenbergii*, *P. clarkii* and *C. quadricarinatus* in many coastal provinces in China. Personal communication indicated that one other country in South East Asia also detected positive samples for SHIV. Historically, *P. vannamei* have been traded internationally for production in new regions. Nowadays shrimp broodstocks, postlarva and products of *P. vannamei* are traded internationally thus, a risk of transmission should be expected. **Criteria met**
2	And	At least one country may demonstrate country or zone freedom from the disease in susceptible aquatic animals.	Currently, the disease has only been reported in China. Mortalities associated with this virus have not been reported from other regions. The distribution of the virus may be wider (mortality may not have been investigated in other regions); however, due to the broad distribution of *P. vannamei*, *M. rosenbergii*, and other susceptible species to SHIV (Asia and South America), it is almost certain that some countries or establishments are currently free. **Criteria met**
3	And	A precise case definition is available and a reliable means of detection and diagnosis exists.	The infection with shrimp hemocyte iridescent virus is caused by SHIV. Diseased *P. vannamei* exhibited empty stomach and guts in all diseased shrimp, slight loss of color on the surface and section of hepatopancreas, and soft shell in partially infected shrimp. Some individuals had slightly reddish body. The moribund shrimp lost their swimming ability and sank to the bottom of water. Diseased *M. rosenbergii* exhibited a significant white triangle inside the carapace at the base of rostrum which is the location of hematopoietic tissue. To date, a nested PCR method (Qiu et al., 2017a), a TaqMan probe based real-time PCR (TaqMan qPCR) method (Qiu et al., 2018), and *in situ* hybridization method (Qiu et al., 2017a) were published and available for SHIV detection. Histopathology and electron microscopy were also reported (Qiu et al., 2017a). **Criteria met**
4	And	Natural transmission to humans has been proven, and	Not applicable.

		human infection is associated with severe consequences.	
5	Or	The disease has been shown to affect the health of cultured aquatic animals at the level of a country or a zone resulting in significant consequences e.g. production losses, morbidity or mortality at a zone or country level.	High mortality (>80%) have been observed in affected *L. vannamei* and *M. rosenbergii* populations in farms. Laboratory infection tests mimic the natural infection pathway (per os and reverse garvage) in *P. vannamei* which showed 100% cumulative mortality within 2 weeks (Qiu et al., 2017a). Injection challenges in *P. vannamei*, *C. quadricarinatus*, and *P. clarkii* also exhibited 100% cumulative mortalities (Xu et al. 2016; Qiu et al., 2017a). Since 2014, some events with massive losses of *P. vannamei*, *P. chinensis* and *M. rosenbergii* in coastal provinces in China have been attributed to infection with SHIV. Losses are significant at a country level. **Criteria met**
6	Or	The disease has been shown to, or scientific evidence indicates that it would affect the health of wild aquatic animals resulting in significant consequences e.g. morbidity or mortality at a population level, reduced productivity or ecological impacts.	The infection with SHIV could affect the health of cultured shrimp, crayfish, or lobsters, and cause significant consequences including morbidity and mortality. But no surveillance data is available yet on SHIV affecting wild aquatic animals. **Criteria not met**

Conclusion. Infection with SHIV clearly meets criteria with respect to routes for international spread (criteria 1). Currently, the disease has only been reported in China and it is almost certain that some countries are currently free of the disease (criteria 2). A precise case definition and two repeatable robust means of diagnosis are currently available (criteria 3). Infection with SHIV has been shown to affect the health of cultured shrimp, crayfish, or lobsters resulting in production losses at a country level (criteria 5).

Definition of suspected case. At least one of the following cases have been met.

1) Shrimp, crayfish, or lobsters show gross signs, which include high levels of mortality in *P. vannamei*, associated with empty stomach and guts in all diseased shrimp, slight loss of color on the surface and section of hepatopancreas, and soft shell in partially infected shrimp; some individuals had slightly reddish body; the moribund shrimp lost their swimming ability and sank to the bottom of water; diseased *M. rosenbergii* exhibited a significant white triangle inside the carapace at the base of rostrum).
2) Histopathological observation reveals basophilic inclusions and karyopyknosis existed in hematopoietic tissues and hemocytes in gills, hepatopancreatic sinus and periopods on histopathological section stained by H-E.
3) SHIV positive detected by nested PCR or TaqMan qPCR.

Definition of confirmed case. At least two of following cases have been met:

1) Shrimp, crayfish, or lobsters show gross signs and meet histopathological or cytopathological

characteristics of the disease.

2) Positive results verified by the nested PCR.
3) Positive results verified by TaqMan qPCR.
4) Positive results verified by *in situ* hybridization.

References:

Li F, Xu L, Yang F. Genomic characterization of a novel iridovirus from redclaw crayfish *Cherax quadricarinatus*: evidence for a new genus within the family *Iridoviridae*. J Gen Virol, 2017, 98(10).

OIE. Aquatic Animal Health Code. Paris: World Organization for Animal Health (2018).

Qiu L, Chen M M, Wan X Y, et al. Characterization of a new member of *Iridoviridae*, Shrimp hemocyte iridescent virus (SHIV), found in white leg shrimp (*Litopenaeus vannamei*). Sci Rep, 2017a, 7(1):11834.

Qiu L, Chen M M, Wang R Y, et al. Complete genome sequence of shrimp hemocyte iridescent virus (SHIV) isolated from white leg shrimp, *Litopenaeus vannamei*. Arch Virol, 2017b, 130(9):1-5.

Qiu L, Chen M M, Wan X Y, et al. Detection and quantification of Shrimp hemocyte iridescent virus by TaqMan probe based real-time PCR. J Inverteb Pathol, 2018, 154.

Xu L, Wang T, Li F, et al. Isolation and preliminary characterization of a new pathogenic iridovirus from redclaw crayfish *Cherax quadricarinatus*. Dis Aquat Org, 2016, 120(1):17.

DISCUSSION

- SHIV meets the criteria for listing. The development of a disease card is timely, it would be useful to publish it as soon as possible as there is a lot of interest on this new disease from the industry. Suggestions for the disease card are to:
  - Add a scale to indicate the size of the shrimp in the gross signs photo.
  - As the disease causes distinctive lesions in the haematopoietic tissue, it would be useful to emphasise these as a distinctive/presumptive sign. The histology images could otherwise be confused with Infection with Yellow Head Virus and the early mortality in the pond could be mistaken for AHPND.
  - Increase the size of the photo of haematopoietic tissue.
  - Remove the reference to Thailand including the map, as no data to support this.
  - Add host range.
  - Add a recommendation that if a positive PCR result for SHIV is found, it is necessary to sequence the amplicon too.
- The crayfish iridovirus added to the regional disease list in 2017 is the same virus as SHIV, so the listing/description needs to be amended to cover all hosts.

RECOMMENDATIONS

- AG recommended that SHIV be included in the 2019 QAAD List of Diseases to replace the "Iridovirus in Crayfish".
- AG recommended that the two groups of authors to consult and develop an alternative informative/descriptive name for the virus to which they both agree (maybe based on the signs of the disease instead of the characteristics of the virus). See the presentation on shrimp diseases for further details.

5.2. QAAD REPORTING AND REVISION TO THE QAAD LIST

Dr. Eduardo Leaño presented the status of QAAD Reporting in the Asia-Pacific region. There are now a total of 80 QAAD reports published since its inception way back 1998. At present, only e-copies of the report is published at both NACA and OIE-RRAP websites. Table 1 summarizes the number of downloads of QAAD reports at NACA website since the printing of hard copy was stopped.

Less than 50% of the 34 countries have submitted reports in 2017 and 2018, with 11 countries regularly submitting every quarter, 5 countries submitting irregularly (missing some quarterly reports), and 18 countries not submitting the report at all. This current scenario of decreasing numbers of countries submitting the quarterly reports is alarming, and ways to convince the countries to resume reporting should be formulated immediately. The Tilapia lake virus (TiLV) was the newly listed disease included from 2017 reporting, and as of second quarter of 2018, five countries in the Asia-Pacific have reported the presence of the disease: Thailand, Chinese Taipei, India, Malaysia, Philippines. Reported diseases for finfish include Infectious haematopietic necrosis, Viral haemorrhagic septicaemia, Infection with *Aphanomyces invadans*, Red seabream iridovirus, Koi herpesvirus disease, Grouper iridoviral disease, Viral encephalopathy and retinopathy, Enteric septicaemia of catfish, Carp edema virus disease, and TiLV. For crustaceans, reported diseases were Infections with viruses including Taura syndrome virus, White spot syndrome virus, Yellowhead virus genotype I, Infectious hypodermal and haematopoietic necrosis virus, and Infectious myonecrosis virus. Also reported were bacterial disease AHPND, and parasitic disease Hepatopancreatic microsporidiosis caused by *Enterocytozoon hepatopenaei* (EHP).

For molluscs, three parasitic diseases were reported (Infections with *Bonamia exitiosa*, *B. ostreae* and *Perkinsus olsenii*), while two for amphibians (Infections with *Ranavirus* and *Batrachochytrium dendrobatidis*). Other reported diseases include Megalocytivirus in marine and ornamental fish, Mycobacteriosis, *Nocardia* sp. Infection, *Streptococcus iniae* infection, *Tenacibaculum* infection, hepatopnacreatitis in prawns, and Enteric red mouth disease.

Dr. Ingo Ernst reported that the only changes in the OIE list of diseases is the change in the name of finfish diseases to “Infection with (pathogen)” (refer to Session 2.2).

RECOMMENDATIONS

- AG recommended to adopt the OIE changes in the names of finfish diseases (Infection with “pathogen”) in the QAAD Form for 2019 reporting;
- Based on previous discussion after the AGM 16, AG recommended that Infection with *Batrachochytrium salamandrivorans* be added in QAAD list under the OIE-listed diseases of amphibians.

SESSION 7. OTHER MATTERS AND CLOSING

7.1. DISEASE CARDS: VIRAL COVERT MORTALITY DISEASE (VCMD) AND SHRIMP HEMOCYTE IRIDESCENT VIRUS DISEASE (SHIVD)

Two disease cards were presented during the meeting: the second revision of VCMD; and the first draft of SHIVD.

For VCMD:

- Figure 2: specify what the black arrow indicates (might be empty gut?);

- Host range: what criteria were used for the "susceptible" host? Does it follow OIE criteria?
- Presence in Asia-Pacific: Reference citation for Thailand is Thitamadee et al., 2016); delete Vietnam, India and Indonesia. Reference source for Mexico and Ecuador which were found positive for CMNV;
- Similar disease: use the correct name for IMN and White tail disease (based on OIE list);
- Horizontal Transmission: check if it fits OIE susceptibility criteria, if only PCR for some, just say so.

For SHIVD:

- Disease name to be changed to *Cherax quadricarinatus* Iridovirus (CQIV) and SHIV Disease (as these two refers to the same virus);
- Presence in Asia-Pacific: remove Thailand (also from the map);
- Disease Agent:

RECOMMENDATIONS

- AG recommended that the two disease cards be returned to the authors (experts from China) and be finalized and published soon by NACA, as these diseases are already included in the QAAD list.

7.2. ADOPTION OF REPORT AND DATE OF NEXT MEETING

Report of the meeting (Discussions and Recommendations) was circulated by e-mail to all AG members, co-opted members and observer for comments and adoption.

The next meeting will be held in Bangkok, Thailand in November 2019 (dates to be decided)

.

ANNEX A

17TH MEETING OF ASIA REGIONAL ADVISORY GROUP ON AQUATIC ANIMAL HEALTH (AGM 17)

13-14 NOVEMBER 2018

CENTARA GRAND AT CENTRAL PLAZA LADPRAO, BANGKOK, THAILAND

AGENDA

Day 1 (13 November, Tuesday)

09:00 – 12:00

Opening Session

- Welcome address: **Dr. Eduardo Leaño**, Coordinator, Aquatic Animal Health Programme, NACA
- Opening Remarks: **Dr. Cherdsak Virapat**, Director General, NACA
- Self introduction
- Selection of Chair and Vice Chair

(AG Chairperson, will take over)

Session 1. Progress Reports

- Progress since AGM 16 **(Dr. Eduardo Leaño**, NACA)

DISCUSSIONS AND RECOMMENDATIONS

Session 2. OIE Standards and Global Issues

- Outcomes of recommendations from OIE General Session and the Aquatic Animal Health Standards Commission (**Dr. Ingo Ernst**, AAHSC, OIE)
- Updates on FAO initiatives in Asia-Pacific in support of aquatic animal health (**Dr. Richard Arthur**, FAO)

DISCUSSIONS AND RECOMMENDATIONS

Group Photo
Lunch

13:30 – 17:00

Session 3. Review of Regional Disease Status

- Updates and emerging threats on finfishes (**Dr. Siow Foong Chang,** AVA, Singapore)
- Updates and emerging threats on crustaceans (**Prof. Tim Flegel**, Centex Shrimp, Thailand)
- Updates on other diseases (molluscs and amphibians) (**Dr. Andy Shinn**, Fish Vet Group, Thailand)

DISCUSSIONS AND RECOMMENDATIONS

NACA hosted dinner (18:30 - ; Laem Charoen Seafood Restaurant, Central Plaza Ladprao)

<u>Day 2 (14 November, Wednesday)</u>

<u>09:00 – 12:00</u>

Session 4. Reports on Aquatic Animal Health Programmes from Partner Agencies

- Fish Health Section, SEAFDEC Aquaculture Department, Philippines (**Dr. Eleonor Tendencia,** SEAFDEC AQD)
- OIE-Regional Representation in Asia and the Pacific (**Dr. Jing Wang**, OIE-Tokyo)
- Aquatic Animal Health Research and Development Division, Thailand (**Dr. Janejit Kongkumnerd,** AAHRDD)
- Australian Department of Agriculture and Water Resources (**Dr. Ingo Ernst**, DAWR-Australia)
- Aquatic animal health activities of China (**Dr. Qing Li**, MoA-PR China)

DISCUSSIONS AND RECOMMENDATIONS

Lunch

<u>14:00 – 17:00</u>

Session 5. Special Session: Aquatic Animal Health Activities of Private Sectors

- PHARMAQ (Zoetis)-Asia (**Dr. Kjetil Fyrand**)
- Fish Vet Group Asia (**Dr. Andy Shinn**)

Session 6. Disease Reporting

- SHIV in shrimps: Assessment for Listing (in QAAD Asia-Pacific) (**Dr. Hong Liu**, AQSIQ, P.R. China)
- QAAD Reporting: status and updates (**Dr. Eduardo Leaño**, NACA)
- New OIE Disease List and revisions to the QAAD List for 2018 (**Dr. Ingo Ernst**, AAHSC, OIE)

Session 7. Other Matters

DISCUSSIONS AND RECOMMENDATIONS

Session 8. Closing

ANNEX B

List of Participants (AGM 17)

I. Advisory Group Members
World Organisation for Animal Health (OIE) / Australia
Dr. Ingo Ernst (AAHSC; DAWR-Australia) Director, Aquatic Pest and Health Policy Animal Division Australian Government Department of Agriculture and Water Resources GPO Box 858, Canberra ACT 2601 Australia Ingo.Ernst@agriculture.gov.au
Food and Agriculture Organization of the United Nations (FAO)
Dr. James Richard Arthur Aquaculture Management and Conservation Service (FIMA) Department of Fisheries and Aquaculture Food and Agriculture Organization of the United Nations Rome, Italy
OIE Regional Representation for Asia and the Pacific, Tokyo, Japan
Dr. Jing Wang OIE Regional Representation for Asia and the Pacific Food Science Building 5F The University of Tokyo 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan j.wang@oie.int; rr.asiapacific@oie.int
Aquatic Animal Health Research and Development Division, Department of Fisheries, Thailand
Dr. Janejit Kongkumnerd Director Aquatic Animal Health Research and Development Division Department of Fisheries, Kasetsart University Campus Ladyao, Jatujak, Bangkok 10900, Thailand kjanejit@yahoo.com
SEAFDEC AQD, Philippines
Dr. Eleonor Tendencia Head, Fish Health Section SEAFDEC Aquaculture Department Tigbauan, Iloilo, Philippines gigi@seafdec.org.ph
Private Sector
Dr. Kjetil Fyrand Director, R&D Aqua-China PHARMAQ AS Harbitzaléen 2A, N-0213 Oslo Norway kjetil.fyrand@zoetis.com
Thailand
Dr. Supranee Chinabut Bangkok, Thailand supraneecb@yahoo.com

Prof. Timothy Flegel Centex Shrimp, 4th Floor Chalermprakiat Building Faculty of Science, Mahidol University Rama 6 Road, Bangkok 10400, Thailand tim.flegel@gmail.com
China
Dr. Qing Li Division Head, National Fisheries Technology Extension Center Ministry of Agriculture, Beijing P.R. China qingli2@qq.com
II. Co-opted members
Dr. Hong Liu The Laboratory of Aquatic Animal Diseases, Shenzhen Exit & Entry Inspection and Quarantine Bureau, AQSIQ Room 908, 1011 Fuqiang Road Futuan, Shenzhen The People's Republic of China 709274714@qq.com
Dr. Yan Liang Yellow Sea Fisheries Research Institute Qingdao, P.R. China liangyan@ysfri.ac.cn
Dr. Siow-Foong Chang Agri-Food and Veterinary Authority of Singapore MND Complex Singapore siowfoongchang@yahoo.com
Dr. Andy Shinn Fish Vet Group Asia Ltd. 99/386, Chaengwattana Building (Building C) Chaengwattana Road, Bangkok, Thailand andy.shinn@fishvetgroup.com
Dr. Gillian Elizabeth Mylrea World Organisation for Animal Health (OIE) 12 rue de Prony, F 75017 Paris France g.mylrea@oie.int
Dr. Hon Pong Ho OIE Regional Representation for Asia and the Pacific Food Science Building 5F The University of Tokyo 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan j.ho@oie.int
Mr. Weimin Miao Aquaculture Officer FAO Regional Office in Asia and the Pacific (FAO-RAP) 39 Phra Athit Road Bangkok, Thailand Weimin.Miao@fao.org

III. Observer
Dr. Chien Tu Chief, Biological Research Section Animal Health Research Institute Council of Agriculture 376 Chung-Cheng Rd Tamsui, New Taipei City 25158 Taiwan Province of China ctu@mail.nvri.gov.tw
IV. NACA Secretariat
Suraswadi Building, Department of Fisheries Compound Kasetsart University Campus, Ladyao, Jatujak Bangkok 10900, Thailand **Dr. Eduardo Leaño**, Coordinator, Aquatic Animal Health Programme, eduardo@enaca.org **Dr. Cherdsak Virapat**, Director General, cherdsak.virapat@enaca.org **Dr. Derun Yuan**, Coordinator, Training and Education, yuan@enaca.org **Mr. Simon Wilkinson**, Coordinator, Information and Communication, simon@enaca.org **Ms. Wella Udomlarp**, Administrative/Finance Officer, wella@enaca.org **Ms. Lyn Pothimon**, Secretarial, lyn@enaca.org **Ms. Patcharaut Ponglumyai**, Secretarial, keng@enaca.org

Annex C:
List of Diseases in the Asia-Pacific

Quarterly Aquatic Animal Disease Report
(Beginning January 2019)

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