

Emergency Preparedness and Contingency Plans to Aquatic Animal Disease Emergencies

Melba G. Bondad-Reantaso

Food and Agriculture Organization of the United Nations (FAO)

Viale delle Terme di Caracalla, 00153 Rome, Italy

E-mail: Melba.Reantaso@fao.org

Abstract

Emergency preparedness is the ability to respond effectively and in a timely fashion to aquatic animal disease emergencies (e.g. disease outbreaks, mass mortalities). It is a key element of a National Strategy on Aquatic Animal Health and an important consideration of the Progressive Management Pathway for improving Aquaculture Biosecurity.

The important principles, requirements and elements and components of emergency preparedness and contingency plans are briefly described. The emergency preparedness response system audit is also presented as contingency planning arrangements that can provide useful insights and guidance in improving response action to disease emergencies.

The paper concludes that many important lessons and insights learned from dealing with disease epizootics in the early 2000 remains valid after more than two decades when the aquaculture sector continues to be plagued with emerging diseases. Past lessons and more recent experiences demonstrated the value of rapid response, reporting/notification by competent authorities, continuous development of knowledge base and capacities in diagnostics, epidemiology, risk analysis, advanced financial planning and the important roles of governments and producer sectors in co-managing disease outbreak events as they both remain the critical entities responsible for launching rapid response.

Skills and knowledge need to be passed on to locals as they are in the frontline of any disease emergency. Share key lessons from experiences by state and non-state actors (producer and academic sectors and other important players in the value chain), the international players that launch emergency responses, disease investigations and field situation assessments as well as financial entities that support these actions need to be continued. However, we also need to do — a stock taking exercise to evaluate what worked, what did not work, what resources are needed and to understand what are the new drivers for aquatic animal disease emergence in order to move forward with the right and timely response actions to disease emergencies in aquaculture.

Key questions remain: Are we prepared for the next outbreak/mortality event? What are the minimum preparedness and advance preparedness actions needed?

Keywords: Contingency plans, emergency preparedness and response system audit, National Strategy on Aquatic Animal Health

Introduction

Addressing biosecurity requires significant resources, strong political will and concerted international action and cooperation. National strategic planning for aquatic animal health and biosecurity is vital; without it, a country can only react in a piecemeal fashion to new developments in international trade and serious trans-boundary aquatic animal diseases (TAADs), and its aquaculture and fisheries sectors will remain vulnerable to new and emerging diseases.

The FAO encourages Member Countries to develop and formalize national strategy on aquatic animal health (NSAAH) and health management procedures (FAO, 2007). A new initiative called the Progressive Management Pathway (PMP) for improving aquaculture biosecurity (PMP/AB) is an extension of the 'Progressive Control Pathways' (PCP) used for controlling major livestock and zoonotic diseases. The PMP/AB refers to a pathway aimed at enhancing aquaculture biosecurity capacity by building on existing frameworks, capacity and appropriate tools using risk-based approaches and public-private partnerships. This new initiative has four stages, namely:

- Stage 1: Biosecurity strategy (risk) defined;
- Stage 2: Biosecurity systems implemented;
- Stage 3: Enhanced biosecurity and preparedness; and
- Stage 4: Sustainable biosecurity and health management systems established to support national aquaculture sector.

The PMP/AB puts strong emphasis on emergency preparedness, e.g. at Stage 1 where one of the key considerations is basic capacity in emergency management. At Stage 3, it is expected that efficient and effective disease outbreak management is in place. The PMP/AB addresses the lack of effective national plans through a focus on national aquaculture biosecurity strategy development processes (mid- to long-term) and promoting a co-management approach (problems are well recognized and management solutions are identified) with the greater use of planning processes to actively engage stakeholders.

The information presented in this paper are taken from several key publications particularly Arthur *et al* (2005), Baldock (2005), FAO (2005), Bondad-Reantaso *et al* (2007), Perera *et al* (2018), and Arthur and Reantaso (2018).

Emergency preparedness and contingency plans as a component of a National Strategy on Aquatic Animal Health (NSAAH)

A NSAAH is a broad yet comprehensive strategy to build and enhance capacity for the management of national aquatic biosecurity and aquatic animal health. It contains the national action plans at the short-, medium- and long-term using phased implementation based on national needs and priorities; outlines the programs and projects that will assist in developing a national approach to overall management of aquatic animal health; and includes an Implementation Plan that identifies the activities that must be accomplished by government, academia and the private sector (Arthur and Reantaso, 2018; FAO, 2007).

The development of a NSAAH includes a gap analysis [achieved through a self-assessment survey and a SWOT (strengths, weaknesses, opportunities, threats) analysis] conducted by any existing structure [e.g. national or regional focal points, a committee or a task force, a working group on aquatic animal health (AAH)] that fits the country. Such entity will have specific terms of reference. The technical elements that may be considered in the strategic framework will vary depending on an individual country's situation, and thus may not include all the program elements listed below (alternatively, additional programs may be identified as having national and/or regional importance and thus need to be included):

- i. Policy, Legislation and Enforcement,
- ii. Risk Analysis,
- iii. Pathogen List,
- iv. Border Inspection and Quarantine,
- v. Disease Diagnostics,
- vi. Farm-level Biosecurity and Health Management,
- vii. Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance (AMR),
- viii. Surveillance, Monitoring and Reporting,
- ix. Communication and Information Systems,
- x. Zoning and Compartmentalization,
- xi. Emergency Preparedness and Contingency Planning,
- xii. Research and Development,
- xiii. Institutional Structure (Including Infrastructure),
- xiv. Human Resources and Institutional Capacity, and
- xv. Regional and International Cooperation.

An NSAAH provides a country with a comprehensive plan of action for a clearly elaborated and agreed upon programs to achieve national objectives for AAH and biosecurity. It provides clear objectives for all relevant activities, define the activities that need to be accomplished to reach these objectives, and give an indicative time-frame and priority for each activity. Its development involves an extensive process during which the current national AAH capacity and future goals are first assessed; and then, policies, priorities and needs are identified. An iterative process, the development of a NSAAH requires active engagement ideally led by the national Competent Authority in collaboration with other relevant aquaculture governance authorities, key stakeholders from other government agencies, academia and the private sector. Special attention to the needs and empowerment of small-scale producers should be accorded priority, as they represent the weak link in any biosecurity system.

Emergency preparedness and contingency planning

Emergency preparedness is the ability to respond effectively and in a timely fashion to disease emergencies (e.g. disease outbreaks, mass mortalities). The capability to deal with emergency disease situations requires a great deal of planning and coordination (including establishing operational, financial and legislative mechanisms) and making available required resources (i.e. skilled personnel and essential equipment). As long as there is importation of live aquatic animals, the possibility of serious disease outbreaks due to exotic pathogens will exist. Even under the best of circumstances, pathogens will occasionally escape detection, breach national barriers, become established, spread and cause major losses. The extent to which losses occur often depends on the quickness of detection and the rapidity and effectiveness with which governments recognize and react to the first reports of serious disease. The former depends on the effectiveness of disease surveillance, diagnostics and reporting processes. As quick and effective reaction (containment and/or eradication) is largely dependent upon contingency planning, all countries need to develop such plans for key cultured species and diseases (Arthur and Reantaso, 2018). The elements of an Emergency Response are listed in **Box 1**.

BOX 1. ELEMENTS OF EMERGENCY RESPONSE

- **National planning and coordination**
- **Operational capability**
 - Responsibility for aquatic animal disease emergencies
 - Aquatic animal disease contingency planning as a component of a National Disaster Plan
 - Legislation and enforcement
- **Early warning**
- **Early detection**
- **Risk analysis**
- **Disease surveillance**
- **Early response**
- **Contingency plans**
 - Technical plans: Control Centers Management Manual, Enterprise manual, Destruction manual, Disposal manual, Disease strategy manuals, Job descriptions
 - Surge support
 - Operational capability: Response management manuals, Diagnostic resources, Training resources, Awareness and education, Simulated response exercises
- **Recovery from an emergency disease**
 - Verification and international acceptance of disease freedom
 - Rehabilitation of farming and fishing communities
- **Staying free**

The objectives of an emergency response are to:

- prevent the incursion of exotic pathogens and pests
- put in place a rapid, well-organized and appropriate response to an emergency disease incident
- have a successful management of disease outbreaks

Early warning, early detection and early response are some of the most important elements of an effective emergency response.

Early warning

Advance knowledge of high risk diseases likely to threaten national biosecurity before pathogens enter territory is a requirement. The effectiveness of early warning depends strongly on the responsible authority having excellent awareness of the current disease situation of the country's primary trading partners and on emerging diseases at global level. It requires good communication linkages (e.g. trading partners, aquatic animal health professionals, aquaculture producers and other stakeholders) and access to disease information (disease reports both from grey and scientific literature, disease databases and from scientific meetings, workshops and other

communication media). Awareness and early warning for Tilapia lake virus (TiLV), for example, came in the form of Network of Aquaculture Centres in Asia-Pacific (NACA) TiLV Disease Advisory, World Organisation of Animal Health (OIE) TiLV Disease Card, FAO GIEWs 338 Special Alert on TiLV, WorldFish FAQ on TiLV, scientific reports, OIE notification and even social media including press releases, blogs and interviews.

Early detection

This refers to an early detection of an emerging disease situation within a country's national territory within the shortest possible time frame possible. The purpose is to ensure detection of the introduction of, or sudden increase in the incidence of, any disease of aquatic animals that has the potential of developing to epizootic proportions and/or causing serious socio-economic consequences. It also refers to rapid recognition of signs of a suspicion of: (i) a listed disease, (ii) an emerging disease situation, or (iii) unexplained disease mortality in aquatic animals in an aquaculture facility or wild populations. An immediate action is the rapid communication of the event to the Competent Authority in order to activate disease investigation with minimum delay. Early detection covers all initiatives that lead to improved awareness and knowledge of the distribution and behavior of disease outbreaks (and of infection) and that allow forecasting of the source and evolution of the disease outbreaks and the monitoring of the effectiveness of disease control campaigns. The key components of early detection include: (i) broad awareness of characteristic signs of diseases (exotic, endemic, emerging); (ii) experienced veterinarians and/or aquatic animal health professionals trained in recognizing and reporting suspicious disease occurrence; (iii) ability of competent authorities (CA) to undertake rapid and effective disease investigation; and (iv) access of CA to expertise and laboratory facilities that are able to diagnose and differentiate exotic, endemic, emerging diseases.

Early response

This pertains to all actions targeted at rapid and effective containment of, and possibly elimination of, an emergency disease outbreak. The objective of early response is preventing a disease from spreading and becoming an uncontrollable epizootic. How this is done depends on many factors and the particular disease scenario. The three types of control options are eradication, containment and mitigation.

Eradication

It is the highest level of response but not always possible especially in an aquatic environment. Eradication is the elimination of pathogens from an affected population or from the country, including sub-clinical infections. Eradication is a big challenge and may not be possible if the disease is already well established prior to initial detection, if intermediate or carrier hosts are unknown and the source of infection is unknown.

Containment

It refers to containing the disease within specified compartments/zones; control measures are in place at infected compartments that will prevent the spread to uninfected populations.

Mitigation

It means reducing the impacts (occurrence and severity) of the pathogen/disease through control measures targeted to stocks in infected zone at the farm level or affected population through, for example, treatments, husbandry or vaccines, if available.

Early warning, early detection, early response and effective and timely disease outbreak investigation are crucial for working toward preventing disease outbreaks and further spread.

Contingency plan

An aquatic animal disease contingency plan is a documented work plan designed to ensure that all needed actions, requirements and resources are provided in order to bring under control outbreaks of infectious diseases of significance to aquatic animal productivity and/or market access. Efforts should concentrate on specific, high-priority emergency diseases, with a series of generic plans focused on activities or programs shared by the various specific disease contingency plans (e.g. national and local disease control centers). The components of a contingency plan are listed in **Box 2**.

Effective contingency plans need stable resources and financial support, along with legislative backing for all control actions (access to sites, animals, fishery closure enforcement, etc.). The contingency plans need to be reviewed and agreed upon in advance by all major stakeholders, including the political and

BOX 2. COMPONENTS OF A CONTINGENCY PLAN (BALDOCK, 2005)

- **Summary document**
- **Technical plans**
 - Disease strategy manuals (one for each high priority disease)
 - General procedures manuals
 - Enterprise manuals
 - Job descriptions
- **Support plans**
 - Finance
 - Resource
 - Legislation
 - Other agencies
- **Operational capability**
 - Management manuals
 - Diagnostic resources
 - Field personnel
 - Training resources
 - Awareness and education
 - Response exercises

bureaucratic arms of government and the private sector, particularly representative farmer, fishery and community organizations that have a stake in the resources falling under contingency plan protection. Contingency plans should be refined on a regular basis through simulation exercises and personnel should be trained in their individual roles and responsibilities. The frequency of such revisions should be determined by the rate of development of vulnerable resources or any changes in human activities that change vulnerability (e.g. changes to species grown on leases, regulatory responsibility or environmental changes).

Examples of technical plans, disease strategy manuals, support plans, many from Australia, are detailed in Arthur et al (2005). The Aquaculture Branch (FIAA) of FAO is currently finalizing disease strategy manuals for infectious myonecrosis virus (IMNV) and acute hepatopancreatic necrosis disease (AHPND) and planning to prepare such manuals for epizootic ulcerative syndrome (EUS) and TiLV.

Emergency preparedness and response (EPR) system audit

Emergency preparedness and response (EPR) systems audit for managing aquatic animal disease outbreaks are contingency planning arrangements that can minimize the impacts of serious aquatic animal disease outbreaks, whether at the national, subnational or farm level — such systems have the objective of containing (preventing the further spread) or eradicating emergency disease outbreaks, thereby greatly reducing the impact, scale and costs

of outbreaks. An effective EPR system ensures that there are pre-agreed protocols and resources in place to act quickly in responding to suspected outbreaks of emergency diseases. Importantly, they established a clear structure for effective and rapid decision-making with clearly defined responsibilities and authority.

The EPR system audit (see Annex 3) was an initiative that was carried out as part of the FAO project TCP/INT/3501 Strengthening biosecurity governance and capacities for dealing with the serious IMNV disease.

The four sections comprising the questionnaire, are: (1) general administration, (2) operational components, (3) support systems and (4) additional information. Section 1 (General Administration) contained questions aimed at generating information on the administrative structure and the scope of responsibilities of the Competent Authority on various elements (e.g. communication, risk analysis, contingency plan, personnel skills, etc.) that are essential when dealing with an aquatic emergency response. Section 2 (Aquatic EPR System Elements) contained questions on the priority system elements identified by the OIE; namely, early warning, early response and early detection systems. Section 3 (Support Systems) contained questions about broader supporting systems in relation to legislation, information management, communications and resourcing. Section 4 (Additional Information) presented an opportunity for countries to provide any information or raise issues not adequately addressed in the questionnaire.

The EPR system audit has the ability to provide system strengths and weakness of a country in terms of three broad systems components: administration (e.g. resource allocation and legislation), operational components (including early warning, early detection and early response systems) and operational support systems (such as information management and communications systems).

The EPR system audit through a self-assessment survey conducted by FAO for the six countries participating in the above-mentioned project (namely: Brazil, Ecuador and Mexico representing South/Central America and China, Indonesia and Thailand representing Asia) - provided insights into each country's capabilities in terms of policies, procedures and institutional capabilities in place to detect the incursion of an emergency aquatic animal

disease and to take appropriate response to that incursion. It identified six areas of need where EPR systems were not well developed. These included:

- stakeholder consultation,
- systems audit/review,
- simulation exercises,
- education/awareness building,
- documentation and dedicated resourcing.

These are important areas that may be considered in the process of improving the EPR system audit. Application of the EPR system audit to additional countries may provide further guidance on what types of advocacy and tools will be needed.

Conclusions and moving forward

Bondad-Reantaso *et al* (2005) in a review paper on disease and health management in Asian aquaculture highlighted that the most significant disease emergencies at the time included EUS, shrimp viral diseases [white spot disease (WSD), yellowhead diseases (YHD), infectious hypodermal and hematopoietic necrosis (IHHN), etc], Akoya pearl oyster mortalities, koi herpes virus (KHV) disease and abalone mortalities. It identified some of the important lessons and insights learned from dealing with those epizootics. They include the following: regional and international cooperation; increased awareness on emerging diseases in other parts of the globe and the possibility of their spread to the Asian region; improved diagnostic capabilities at both national and regional levels; pro-active reporting of serious disease outbreaks as a mechanism for early warning; contingency plans; improved compliance and implementation of policies reached at regional and international levels; emergency preparedness as a core function of government services; and advanced financial planning such that adequate funds can be immediately provided to address serious emergency disease situations at both national and regional levels.

These recommendations are still valid, after more than two decades until present when the aquaculture sector continues to be plagued with emerging diseases. These diseases could be known diseases that has spread to new geographical locations (e.g., WSD in Mozambique, KHV in Iraq) and new susceptible species (many for EUS-susceptible species since its incursion into Africa) or new diseases that has not been previously recognized or reported (unknown

diseases) until its diagnosis [e.g. AHPND, TiLV, *Enterocytozoon hepatopenaei* (EHP), and shrimp hemocyte iridescent virus (SHIV)].

Above past lessons and more recent experiences demonstrated the value of rapid response, reporting/notification by competent authorities, continuous development of knowledge base and capacities in diagnostics, epidemiology, risk analysis and the important roles of governments and producer sectors in co-managing disease outbreak events as they both remain the critical entities responsible for launching rapid response. The EPR system audit may provide useful guidance and insights that can be used in improving response actions to disease emergencies in aquaculture.

Skills and knowledge need to be passed on to locals as they are in the frontline of any disease emergency. Share key lessons from experiences by state and non-state actors (producer and academic sectors and other important players in the value chain), the international players that launch emergency responses, disease investigations and field situation assessments as well as financial entities that support these actions need to be continued. However, we also need to do a stock taking exercise to evaluate what worked, what did not work, what resources are needed and to understand what are the new drivers for aquatic animal disease emergence in order to move forward with the right and timely response actions to disease emergencies in aquaculture.

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