

Report of the

**FAO WORKSHOP ON THE DEVELOPMENT OF AN AQUATIC
BIOSECURITY FRAMEWORK FOR SOUTHERN AFRICA**

Lilongwe, Malawi, 22–24 April 2008



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PREPARATION OF THIS DOCUMENT

This document is the final report of the FAO Workshop on Developing of an Aquatic Biosecurity Framework for Southern Africa held in Lilongwe, Malawi, from 22 to 24 April 2008. This is part of FAO's continuing assistance to improve aquatic biosecurity in Africa to complement the ongoing FAO Technical Cooperation Programme TCP/RAF/3111 Emergency Assistance to Combat Epizootic Ulcerative Syndrome (EUS) in the Chobe-Zambezi River and the Aquatic Biosecurity Project under the D.1 Objective of the Programme Cooperation Agreement with Norway.

This report was prepared by Dr Melba B. Reantaso (Fishery Resources Officer, Aquaculture Management and Conservation Service, FIMA) and Dr Rohana P. Subasinghe (Senior Fishery Resources Officer, FIMA) with the assistance of Dr Ramesh Perera, FAO Consultant.

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ABSTRACT

The Workshop on the Development of an Aquatic Biosecurity Framework for Southern Africa held in Lilongwe, Malawi, from 22 to 24 April 2008 was participated by a total eighteen officials representing nine countries (Angola, Botswana, Kenya, Malawi, Mozambique, United Republic of Tanzania, Uganda, Zambia and Zimbabwe) and including representatives from the Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE).

The aims of this regional workshop were: (i) to present the outcomes of the survey on national aquatic animal biosecurity capacity; (ii) to provide a platform to discuss an aquatic biosecurity framework for southern Africa based on survey findings and ensuring workshop discussions; and (iii) to identify regional capacity-building needs to address aquatic biosecurity gaps or lapses in the region.

A number of key regional capacity building activities and actions to address aquatic biosecurity in the region were identified. Foremost is a request to FAO to develop a follow-up project, possibly to be funded under FAO's Technical Cooperation Project modality, to assist in reviewing institutional and legal frameworks to enable countries to better address current aquatic biosecurity issues, especially addressing aquatic animal health management, transboundary movement of live aquatics and maintaining aquatic biodiversity. Additional recommendations include the following: (i) for countries in the region to work closely in collaboration with FAO and OIE and regional partners to collectively address matters pertaining to aquatic animal health and biosecurity; (ii) to recognize the University of Zambia's School of Veterinary Medicine as a potential regional diagnostic centre and Uganda as a regional coordinating centre; (iii) to develop a regional model/template on import risk assessment for introductions and transfers of live aquatic animals; and (iv) to convene a ministerial level meeting for southern African countries to raise the issue of aquatic animal biosecurity.

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BACKGROUND

1. Global production from aquaculture has grown substantially, contributing evermore to the world's supply of finfish, shellfish, algae and other aquatic organisms for human consumption. Aquaculture now nearly equals that which is harvested from wild capture fisheries. The production of farmed aquatic organisms is projected to increase to 83 million tonnes by 2030, a staggering 37.5 million tonnes increase from 2004 production figures.

2. The current and future dependence on farmed fish presents an ideal opportunity for the African region's aquaculture sector to contribute to its own food security, poverty reduction and economic development with, under appropriate management, minimum impact on the environment and maximum societal benefit. However, taking full advantage of this opportunity requires the trade in aquatic animals and products within and between countries. This trade carries with it attendant biosecurity risks¹ associated with the introduction or spread of pathogens that cause disease in aquatic organisms and pests or invasive species. Unless appropriately managed, these risks can seriously hinder the economic and societal benefits of aquaculture, as well as have deleterious environmental impacts.

3. In a stark reminder of what could go wrong, serious fish disease outbreaks have been reported since December 2006 in several countries sharing the Chobe-Zambezi river system. A preliminary investigation by a team from the Rhodes University commissioned by Botswana's Department of Wildlife and National Parks reported epizootic ulcerative syndrome (EUS²) as a likely cause of disease. This was confirmed in June 2007 by an International Emergency Disease Investigation Task Force (Task Force) organized by the Food and Agriculture Organization of the United Nations (FAO) at the request of the Government of Botswana for technical assistance. The Government of the Republic of Botswana formally reported these findings to the World Animal Health Organisation (OIE) in July 2007.

4. The Task Force made recommendations to: (i) assist in training key staff from southern African countries on the basic diagnosis of EUS including field collection of fish samples for laboratory analysis and implementing a surveillance and monitoring programme for EUS; (ii) assist in raising awareness to enable better understanding of the disease through regional consultations and national level public awareness campaigns; (iii) assist in preparing extension and educational materials to support good health management practices at extension and farm/producer levels; and (iv) assist in developing a regional strategy and a regional proposal aimed at establishing a medium to long-term biosecurity programme to include as a priority an emergency response preparedness to disease epizootics and an overall strengthening of human and institutional capacities for fish disease diagnosis, control and aquatic animal health management.

5. Following the successful Task Force mission and confirmation of the disease, several governments in the region requested FAO for emergency technical assistance to deal with this serious disease outbreak, paving the way for a Technical Cooperation Programme (TCP) involving 7 countries bordering the Chobe-Zambezi river system. The 1-year TCP was approved in October 2007 and focuses on aspects of the Task Force recommendations, particularly those short-term actions needed prior to the anticipated start of the next EUS outbreak. This work is under way.

¹ The term "biosecurity" can by definition cover a range of matters including pathogens, invasive pest species, genetically modified organisms and food safety. In this document, biosecurity refers specifically to managing the risks associated with exotic or emerging pathogens of aquatic organisms and managing risks associated with invasive aquatic pest species.

² EUS is designated an internationally notifiable disease by the World Animal Health Organisation and is caused by the fungus *Aphanomyces invadans*.

OPENING OF THE WORKSHOP

6. Opening presentations were delivered by Mr Alex Bularini, the Director Fisheries, Department of Fisheries, Malawi Ministry of Agriculture and Food; Mr Mazlan Jusoh, FAO Representative in Malawi; and Dr Rohana Subasinghe, FAO Senior Fishery Resources Officer (Aquaculture).

7. The opening addresses elaborated on the importance of aquaculture globally, the role that aquaculture could play in Africa in food security, poverty alleviation and generating income. The potential for the development of aquaculture in Africa, the threat posed by aquatic animal disease and pathogen incursions to this development and the importance of maintaining strict biosecurity, particularly addressing aquatic animal health and biodiversity, through establishing and implementing a sound biosecurity strategy for southern Africa was highlighted.

PURPOSE OF THE WORKSHOP

8. The objectives of the workshop, as presented by Dr Rohana P. Subasinghe, were to:

- present the outcomes of the National Aquatic Animal Biosecurity Capacity Assessment Questionnaire;
- provide a platform for discussion of an aquatic biosecurity framework for southern Africa based on survey findings and ensuing workshop discussions; and
- identify regional capacity-building needs to address aquatic biosecurity gaps or lapses in the southern African region.

The objective of the National Aquatic Animal Biosecurity Capacity Assessment Questionnaire was to evaluate national capacities for managing aquatic biosecurity, i.e. capacity to manage risks associated with exotic or emerging pathogens of aquatic animals and invasive aquatic species.

WORKSHOP PARTICIPATION

9. A total of 18 participants representing nine countries (Angola, Botswana, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe) and representatives from the World Animal Health Organisation (OIE) and FAO took part in the regional workshop (see workshop photographs). The list of participants is attached as **Annex 1** of this report.

WORKSHOP HIGHLIGHTS – TECHNICAL PRESENTATIONS

10. A total of nine presentations (including workshop objectives) (see **Annex 2**) were provided by FAO and OIE resource persons, followed by nine country presentations on the outcome of the country questionnaire on national biosecurity policies. The country presentations included information on the status of EUS surveillance, a major activity that is part of TCP/RAF/3111 (E) Emergency assistance to combat the disease in the Chobe/Zambezi River system (Angola, Botswana, Malawi, Mozambique, Namibia, Zambia, Zimbabwe). A detailed programme is attached as **Annex 3** of this report.

11. Dr Rohana P. Subasinghe (FAO) in a presentation on Introduction to biosecurity provided a definition of biosecurity as a strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) that analyse and manage the risks associated with food safety and animal and plant life and health, including environmental risks. He emphasized the importance of biosecurity and its relationship to trade and market access, and described the key components of a biosecurity framework. A bullet point description of his presentation can be found in **Annex 4**.

12. Dr Melba B. Reantaso (FAO), in her presentation on International agreements and treaties relevant to aquatic biosecurity and their compliance described biosecurity within the context of aquaculture as a collective term that refers to the concept of applying appropriate measures (e.g. proactive disease risk analysis) to reduce the probability of a biological organism or agent spreading to an individual, population, or ecosystem, and to mitigate the adverse impacts that may result – an analysis that is done in a way that incorporates the best information available on aspects of husbandry, epidemiology and sound science. The drivers of the process were enumerated, and a discussion on why there is an increasing focus on biosecurity, the many stakeholders involved and the need for an integrated approach was presented. She described the World Trade Organization's Sanitary and Phytosanitary Agreement (or SPS Agreement) as the main regulatory instruments (and the standards and sectors concerned, treaties and agreements) and other instruments related to biosecurity outside the human health perspective. Examples of binding (obligatory) and voluntary agreements related to international trade in aquatic animals and their products were provided. The need for compliance, the importance of needs assessment were emphasized and specific examples of experiences in the Asia-Pacific and national actions on biosecurity were provided. The presentation was concluded with examples of consequences of enhanced biosecurity. A bullet point description of the presentation can be found in **Annex 5**.

13. Dr Ramesh Perera (FAO Consultant) in his presentation on Diagnostics and surveillance: tools for improving aquatic biosecurity summarised the skills, physical infrastructure and supplies, and system requirements for effective national/regional aquatic animal biosecurity, with a view to identifying disease surveillance and diagnostic capacity building requirements for southern Africa. The importance of detecting and identifying emerging diseases was highlighted with discussion on the need for general as well as targeted surveillance. The various types of diagnostic capacity needs were described with emphasis given to the need for building less resource intensive level I (gross clinical signs) and II (parasitology, microbiology, mycology, histopathology) capabilities in the first instance. A bullet point description of his presentation can be found in **Annex 6**.

14. Dr Melba B. Reantaso (FAO), in her presentation on Application of risk analysis and emergency response: tools for improving aquatic biosecurity, described risk and hazards in the context of biosecurity, the historical and current application of risk analysis, and the relationship between risk analysis and biosecurity. She presented the steps in risk analysis using the OIE framework, the importance of pathway analysis and scenario diagrams, the application of the precautionary approach in the risk analysis process, the importance of risk communication and future challenges. The second part of the presentation focussed on emergency response discussed the objectives, framework and detailed requirements for emergency response systems (i.e. national planning and coordination, operational capability, early warning, early response, recovery and staying free) and risk analysis within the context of contingency planning. The presentation also included important lessons from terrestrial disease emergencies and was concluded with some important issues and challenges. A bullet point description of his presentation can be found in **Annex 7**.

15. Prof. Eli Katunguka-Rwakishaya (OIE) introduced his presentation on Developments in aquatic animal health by indicating the increasing importance of aquatic animal health with the steady expansion of aquaculture worldwide. He described the aquatic animal health standards developed by OIE (the aquatic animal health code, manual on diagnostic tests, aquatic animal welfare and other manuals on surveillance and risk analysis), the OIE list of diseases, and other developments within the OIE (e.g. concept of safe commodities, harmonisation of aquatic and terrestrial codes, standards for aquatic animal welfare, cooperation between veterinary and fisheries officers, and amphibian diseases). He concluded his presentation with a statement of the need for veterinary authorities to take a serious interest in aquatic animal diseases and called for more cooperation between veterinary and fisheries authorities in the control and reporting of aquatic animal diseases. A bullet point description of his presentation can be found in **Annex 8**.

16. Dr Ramesh Perera (FAO Consultant), in his presentation on Requirements for a national biosecurity programme – the Australian experience identified the elements of a comprehensive aquatic

animal health management programme, including biosecurity, based broadly on Australia's system. The presentation covered the need for national border controls (including risk based import controls, international reporting requirements and export attestation), incident response systems, control of high risk activities such as fishing bait use and seafood processing, farm level biosecurity, and managing live animal translocations. A bullet point description of his presentation can be found in **Annex 9**.

17. Dr Ramesh Perera (FAO Consultant), in presenting the Southern African aquatic biosecurity issues: a presentation based on national surveys, provided the outcomes of the national survey based on questionnaire returns from the nine participating countries (Angola, Botswana, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe). The survey findings, which included strengths and weaknesses of current national systems and challenges identified by each country, are summarized in **Annex 10**.

18. Dr Rohana Subasinghe (FAO), in a final presentation on *Establishing a biosecurity framework for southern Africa: constraints and challenges* emphasized that recognizing the importance of aquatic animal health in African aquaculture development programmes is paramount to establishing a biosecurity framework. He stressed the need for political and policy support for maintaining biosecurity and that significant efforts are required to build human and institutional capacities. He recognized that a thorough review of the existing policy, institutional and legal frameworks addressing aquatic animal health management, biosecurity, trade and movement of aquatic species is necessary in developing an effective aquatic biosecurity framework. Therefore, all concerned parties, development partners and other civil society groups must work together to achieve this.

WORKSHOP HIGHLIGHTS – COUNTRY PRESENTATIONS

19. Nine country presentations were made summarising country responses to the FAO National Aquatic Animal Biosecurity Capacity Assessment Questionnaire.

20. Ms Esperanza Justiz Silva, Head of Artisanal Fisheries and Aquaculture (Angola), presented the National biosecurity status in Angola. Angola is a member of WTO and OIE; the Veterinary Services Institute under the Ministry of Agriculture and Rural Development is the competent authority for reporting of animal health status and is also responsible for risk analysis. Two laws are relevant to export and import with respect to animal health: Law of Animal Health No. 4/04 and Law of Health Regulations No. 5/87. Angola exports fish, crustaceans, molluscs and other aquatic invertebrates, with Europe as the main international market. Imports of young larvae of Nile tilapia comes from Brazil and Singapore. Angola imports other fisheries and aquaculture products from China, Mozambique, India and Thailand. Currently the Ministry of Fisheries is developing an Executive Decree that will enable the establishment of standards concerning introduction and culture of exotic species, prevention of escapees, avoidance of contamination of indigenous genetic heritage, preventing degradation of habitats and conditions allowing for extensive aquaculture. Surveillance and monitoring programmes exist for transboundary animal diseases but none for aquatic animal diseases, pests and invasive aquatic species. Relevant laws to support fisheries and aquaculture development include the Law on Aquatic Biological Resources supported by the Fisheries General Regulation Decree No. 41/05 and the Aquaculture Regulation, Decree No. 39/05; while that pertaining to the environment are contained in the Law Bases of the Environment No. 5/98; Law of Associations in Defence of the Environment No. 3/06 and the Law of Health Regulations No. 5/87. The Institute of Development of Artisanal Fisheries and Aquaculture carries out biological studies and evaluation of potential environmental and social impacts of aquaculture developments and provides technical support to communal fish farmers. The Veterinary Research Institute has the responsibility for disease diagnosis and has expertise in parasitology, general bacteriology/mycology, tissue culture, immunoassay and water quality analysis. However, there is no expertise available on diagnosis of aquatic animal diseases, identification of invasive aquatic species and pests.

21. Mr Shaft M. Nengu, Principal Scientific Officer (Botswana), in presenting Biosecurity status in Botswana described Botswana as a land-locked country bordered by South Africa, Namibia,

Zimbabwe and Zambia; many of its main river systems also being shared with these countries. Botswana is a member of the World Trade Organization (WTO) and OIE and the Department of Veterinary Services (DVS) is the competent authority for animal disease reporting, which also issues health certificates and import permits. Botswana exports crocodile skin to Europe and the United States of America (health certificate and export permit required); and imports fish and crocodile skins from neighbouring southern African countries (no health certificate required from exporting countries). Other official controls include release of imported organisms into the natural environment which is not allowed. There is no expertise on risk analysis although there is some expertise within the DVS concerning WTO's SPS Agreement. Surveillance and monitoring programmes exist for the aquatic weed, *Salvinia molesta*, as well as programmes for terrestrial animal diseases under the responsibility of the DVS. Emergency response plans for containment or eradication of aquatic animal diseases are not yet in place; but exist for terrestrial animal diseases such as foot and mouth disease (FMD). Explicit policy and legislation concerning aquaculture is lacking and only implied under the Fish Protection Act of 1975; import permits are issued by the DVS through the Fisheries Division of the Department of Wildlife and National Parks. The Fish Protection Act of 1975 empowers the responsible minister to enact regulations; the Fish Protection Regulations is still a draft, thus, capture fisheries are not yet regulated. Aquaculture is still in its infancy with a fish hatchery established by the government aimed at producing fingerlings for farmers and for reservoir stocking, and to act as a demonstration centre for various user groups. Extension in the capture fisheries sector is more pronounced in the Okavango Delta where fishing activities are intense, with 18 officers doing extension work. Veterinary extension is also active, assisting on various aspects of animal husbandry and disease control. Compliance for disease control exists only for the livestock industries. In terms of diagnostic capacity, there is none for aquatic animal diseases but there are many experts available in terrestrial animal health. There are no activities on biosecurity nor research or training in aquaculture. As part of the FAO project, fish disease sampling surveys were initiated in Chobe River, Kwando-Linyanti and Okavango delta. Current challenges presented include biosecurity, inadequate surveillance and monitoring, inadequate legislation and enforcement and lack of collaboration among riparian states.

22. Ms. Beatrice Nyandat, Chief Fisheries Officer (Kenya) in her presentation on National biosecurity status of Kenya, reported that Kenya is a member of the WTO and OIE and the competent authority for animal health status reporting is the Veterinary Department of the Ministry of Livestock. The Animal Diseases Act 364 Laws of Kenya is the relevant legislation which regulates imports and exports with respect to animal health. A detailed account was provided of aquatic animals and aquatic animal product exports to the European Union (EU), Israel, Australia, the United States of America (USA), the United Arab Emirates (UAE), Egypt and China (e.g. live freshwater fish, marine aquarium fish) and imports from Asia, UK, Norway and East African countries (live aquarium fish and aquatic animal products) including official controls, human resource capacities on IRA and the SPS Agreement. Health certificates are required for both exports and imports. Surveillance and monitoring programmes exist for terrestrial animal diseases; no surveillance or emergency response plans exist for aquatic animal diseases, pests and invasive aquatic species. The Fisheries Act, Regulation 25 of the Fisheries General regulations contains several provisions which control live fish movement and commercial, subsistence and recreational fisheries. With respect to aquaculture, an environmental impact assessment (EIA) is required for any aquaculture venture; other relevant regulations include The Fisheries Act Cap 378, the Fisheries Regulations 2007, and the Environmental Management and Coordination Act No. 8 of 1999. Extension services exist but not specifically supporting aquaculture; veterinary/animal health extension services support livestock production. The Ministry of Fisheries Development is responsible for inspection of farms, production units, equipment and product as contained in the Fisheries Act Cap 378 of 1991 and the Fisheries (safety of fish, fishery products and fish feed) Regulations 2007. There is currently no available aquatic animal health or invasive aquatic species expertise. Research work and training activities on aquatic biosecurity is also lacking.

23. There were two presentations from Malawi; one on National biosecurity status presented by Dr Gilson Nyunga, Principal Animal Health and Livestock Development Officer; and another on the Status of invasive alien species in Malawi presented by Mr Geoffrey Kanyerere, Biologist, Fisheries

Department. The first presentation reported that EUS had not yet been reported in Malawi and indicated that the Shire River, the biggest river which drains into the Zambezi River basin, a potential source of infection, has the highest risk when flooding occurs. National EUS preparedness plan and surveillance (both active and passive) are not available in Malawi and public awareness building on the disease has not yet been implemented. Malawi is a member of WTO and OIE and the Department of Animal Health and Livestock Development (DAHLD) is the competent authority for disease reporting. There is currently no expertise on aquatic animal health; policies and legislation focus on terrestrial animal health with a number of supporting legislations (e.g. Control and Animal Diseases Act, Meat and Meat Products Act, Hides and Skin Act, Veterinary and Para-veterinary Practitioner's Act, Slaughter of Animals Act). Surveillance and monitoring exist for transboundary animal diseases such as avian influenza; there also exists a tsetse fly control programme. An avian influenza rapid response team fully equipped with test antigens and protective clothing is available anytime to investigate suspected outbreaks of the disease; the Department of Animal Health and the Ministry of Health are both responsible for this activity. The Central Veterinary Laboratory (CVL) has the capacity for microbiological, histopathological, parasitological and biochemical analysis of samples. Molecular diagnostics and electron microscopy are not available at CVL, but such facilities are available at the College of Medicine. Water quality analysis is done at the Lilongwe Water Board Laboratory. Aquaculture research and training is done at the University of Malawi where a full aquaculture unit is established. Veterinary science (non-aquatic) expertise is available at doctoral, masters, bachelors and diploma levels.

24. The second presentation from Malawi reported on the problems caused by invasive alien species (IAS) in Africa, such as loss of land and water, water and soil pollution, loss of biodiversity, reduction in crop and animal yields, competition with local plants and animals and severe negative environmental and socio-economic impacts. Malawi has not been spared of alien species invasions; these include aquatic plants (e.g. water hyacinth, red water fern, water fern, parrot's feather, Kariba weed, water lettuce); fish (e.g. common carp, black bass, rainbow trout). Potential control methods (physical, mechanical, chemical and biological) exist but effective implementation is limited due to inadequate policies and legislation, weak institutional arrangements and other economic constraints. No act or policy exist specific to IAS, however, there are a number of acts relevant to the control of IAS (e.g. 1996 Environmental Management Act, 1997 Fisheries Management and Conservation Act, 1997 Forestry Act, the National Parks and Wildlife Act) of which the Environmental Management Act of 1997 is the most relevant as it empowers the Minister to control the importation of alien plant and animal species. Other setbacks include conspicuous absence of risk analysis, low visibility and lack of strategic approach in biodiversity planning. It was suggested that the way forward to address issues pertaining to IAS is to use the Environmental Management Act as the overarching legal framework, to review the sectoral policies and acts with a view to mainstreaming IAS issues and to formulate an appropriate policy and act on IAS. The presentation also indicated availability of experts from government, parastatal, academic, research and non-governmental organization groups.

25. Mr Rafael Rafael (Mozambique) presented the results of National Aquatic Biosecurity Assessment in Mozambique. The country is a member of WTO and OIE with the Ministry of Agriculture, National Directorate of Veterinary Services as the competent authority for reporting animal health status. Mozambique exports shrimp, lobster, crabs, fish, squid and ornamental fish to Europe (France, Portugal, Spain) and African countries (Botswana, South Africa, Malawi and Mauritius) and imports aquatic animal commodities, e.g. mackerel (from Namibia, New Zealand, Spain and Peru) and tuna and sardine (South Africa and Thailand). The Instituto Nacional de Investigação Pesqueira (INIP) issues health certificates to importing countries; health certificates are required of exporting countries according to Article 21 No. 2 (Decree 8/2004). Surveillance/monitoring and incident/emergency response programmes are available only for terrestrial diseases; none for aquatic animal diseases or control for high-risk activities. Extension activities are carried out by the Department of Aquaculture, Ministry of Fisheries jointly with non-governmental organizations and provincial directorates of agriculture; for the livestock sector, veterinary services are in charge of disease control. There is currently no available expertise in aquatic animal health.

26. Mr Kitojo Wetengere , Lecturer and Labour Studies Department Coordinator, presented the National aquatic biosecurity capacity assessment – Tanzania. Tanzania is a member of WTO and OIE and the competent authority for reporting of aquatic animal health status is the Department of Fisheries (DF) under the Ministry of Livestock and Fisheries Department (MLDF). The main legislation controlling exports and imports of aquatic animals and products is contained in Fisheries Regulation of 2005 and Fisheries Act No. 22 of 2003, which also regulates high risk activities, licensing of sports fisheries, and aspects of environmental pollution (together with the Environment Act No. 20 of 2004). Aquaculture activities need to be registered with the DF and approved by the National Environment Management Council (NEMC) which also undertakes enforcement, compliance, review and monitoring of environment impact assessment (EIA), research, facilitation of public participation in environment decision-making, raising environment awareness and collecting and disseminating information. He also described the status of extension services in the country and presented information on human resources capacity (institutional, disease diagnostics, research and training). A bullet point description of the presentation can be found in **Annex 11**.

27. Mr Wilson Waiswa Mwanja, Principal Fisheries Officer, Ministry of Agriculture, Animal Industry and Fisheries (Uganda) in a presentation entitled Republic of Uganda national aquatic animal biosecurity capacity, reported that the fisheries sector in Uganda ranks second to coffee in export earnings bringing USD 200 M annually with 92 percent coming from capture fisheries and 8 percent from aquaculture. However, the aquaculture sector is growing at an annual rate of 300 percent with intense movement of fish and fishery products between watersheds and across borders for aquaculture and ornamental trade, production and research. The responsibility for the development and management of the sector lies with the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). Uganda is a member of the WTO and OIE, and the Directorate of Animal Resources under MAAIF is the competent authority for animal health. Detailed information was provided on aquatic animal trade, animal health controls, human resources (expertise, knowledge base, diagnostics and extension), surveillance, monitoring and emergency response programmes, regulatory controls for high-risk aquaculture and capture fisheries activities including waste disposal from processing plants, compliance and enforcement. The presentation was concluded pointing out a number of important challenges for dealing with pathogens/diseases of aquatic animals (information, human resource, technology and infrastructure), pathogens/diseases or pests of plants/algae (expertise), invasive aquatic species (expertise) and biosecurity management (human, technological and infrastructure requirements). A bullet point description of the presentation can be found in **Annex 12**.

28. Dr Hang-Ombe Bernard Mudenda of the School of Veterinary Medicine, University of Zambia, School of Veterinary Medicine, presented the National biosecurity status of Zambia. Zambia is a member of the WTO and OIE and the Department of Veterinary and Livestock Development (DVLD) is the competent authority providing reports to OIE and exerts control of imports and exports with respect to animal health. Zambia's aquatic products exports (crocodile meat, ornamental fish) and imports (fresh fish, dry fish, mackerel, prawns and other seafood) are accompanied by export and import health certificates. Expertise concerning WTO and SPS matters are with the National Livestock Epidemiology and Information Centre (NALEIC). Surveillance and monitoring of EUS are being jointly undertaken by the Department of Fisheries and the University of Zambia where EUS has been documented in six species (*Seranochromis angusticeps*, *S. robustus*, *Barbus poechii*, *Schilbe mystus*, *Clarius gariepinus* and *C. ngamensis*). Current diagnostic capacity include that of histopathology and general bacteriology and mycology. Aquaculture regulation is done by the Department of Fisheries and the Zambia Police with respect to imposition of annual fish ban, control of fishing methods, monitoring of fish farms, ecological and biological aspects of fisheries. Extension is the primary responsibility of the Department of Fisheries at provincial, district and area levels. Current challenges include lack of competence and inadequate regulation on aquatic animal diseases, low priority given to enforcement and revision of laws concerning the aquaculture sector, and general low awareness on biosecurity.

29. Mr Gilbert Hope Moyo, Senior Ecologist of the Parks and Wildlife Management Authority (PWMA), Lake Kariba Fisheries Research Institute, presented the Zimbabwe Country Report.

Zimbabwe is a member of WTO and OIE; the Zimbabwe Veterinary Services under the Ministry of Agriculture is the competent authority for reporting aquatic animal health status. Zimbabwe aquatic animal exports include Nile tilapia, rainbow trout, Nile crocodile and sardine, where health certificates issued by the Veterinary Services Department are provided to importing countries. Inspections are also undertaken for parasites and chemical residues in aquatic products; the Standards Association of Zimbabwe is involved in quality assurance. Imports include shrimps, crabs, salmon, carps and crocodiles (eggs and juveniles); health certificates are required from exporting countries. A number of agencies are involved: Zimbabwe Revenue Authority controls imports at ports of entry and liaises with Veterinary Services and PWMA; the Environmental Management Agency (EMA) regulates invasive alien species. Current surveillance and monitoring activities include the following: (i) EUS in freshwater fish by PWMA and Veterinary Services; (ii) water hyacinth and Kariba weed invasions by PWMA and University of Zimbabwe (UZ); (iii) impact of Nile tilapia on indigenous ciclid species by PWMA and UZ; and (iv) foot and mouth disease and anthrax outbreaks by the Veterinary Services. Incident/emergency response mechanisms are available for aquatic weeds and terrestrial diseases but not for aquatic animal diseases. Regulation of capture fisheries is done by PWMA basically concerning protection of fish stocks through a licensing system and controls on the use of fishing gears. With respect to aquaculture, the EMA requires a comprehensive environmental impact assessment prior to any aquaculture venture. Tertiary fishery training programmes include Diploma courses and Master of Science (MSc) degrees at agricultural colleges and university; MSc and doctoral degrees are undertaken outside the country. Animal disease diagnostic capacities (parasitology, histopathology, general bacteriology/mycology, electron microscopy, tissue culture, molecular diagnostics) are available at the Veterinary Services and at the UZ, while water quality analysis skills are available at UZ, EMA, PWMA and Zimbabwe National Water Authority.

WORKSHOP HIGHLIGHTS – WORKING GROUP SESSION

30. Facilitated by resource experts from FAO and OIE, participants were divided into four working groups and were provided guidance on how to conduct the group discussions. **Annex 13** shows the topics, guidelines and membership of the working groups.

31. The working groups were tasked to identify capacity building needs and projects or initiatives aimed at meeting such needs with respect to four key areas of deficiency which were identified in the national biosecurity capacity survey. Consideration was asked to be given to both regional and national needs ranging from small projects achievable in the short term to more ambitious long term projects, including consideration of who would drive the projects, timeframes, resource needs and priorities.

32. The focus areas were: risk analysis and translocation (national/domestic); extension and enforcement (compliance); diagnostic capacity and technical expertise; and surveillance and emergency response.

33. Following the working group sessions, a plenary discussion was held on the final day to identify priority aquatic biosecurity capacity building projects as an outcome of the workshop. The following projects/actions were identified as priority capacity building needs.

- building regional appreciation on import risk analyses (IRA) through a workshop/s and the establishment of a website.
- establishment of a regional biosecurity forum/secretariat.
- establishment of an exchange programme for managers responsible for IRAs.
- development and decimation of information material on IRA.
- establish e-mail networking group on IRA.
- training programme covering IRA and aquatic animal health.
- commissioning of an IRA on high-risk translocations – to act as template/model for region.
- creation of an inventory of regional experts on IRA and aquatic animal health.
- establishment/sponsoring of studentship/s in aquatic animal health.

- collation of existing information on known aquatic animal diseases in the region.
- regional review of regulatory frameworks for translocation.
- regional high-level conference to review existing declarations and protocols on translocation.
- building industry awareness in relation to farm level biosecurity risks.
- consideration of mechanisms to share existing regional expertise and facilities.
- establishment/improvement of national aquatic animal health facilities and training.

34. The general discussion session of the Lilongwe Workshop resulted in a number of recommendations, outputs and agreed follow-up actions. These are presented as **Annex 14**.

CLOSING OF THE WORKSHOP

35. The workshop organizers thanked the representatives from FAO and OIE, all regional and local participants for their contribution to a very productive workshop. The FAO Representation in Malawi and the local hosts, the Department of Fisheries, its officials and staff were also gratefully acknowledged for excellent hosting of the workshop.

ANNEX 1

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ANNEX 2

List of presentations

Presentation 1: Workshop objectives (Dr Rohana P. Subasinghe, FAO)

Presentation 2: Introduction to biosecurity (Dr Rohana P. Subasinghe, FAO)

Presentation 3: International agreements and treaties relevant to aquatic biosecurity and their compliance (Dr Melba B. Reantaso, FAO)

Presentation 4: Diagnostics and surveillance: tools for improving aquatic biosecurity (Dr Ramesh Perera, FAO Consultant)

Presentation 5: Application of risk analysis and emergency response: tools for improving aquatic biosecurity (Dr Melba B. Reantaso, FAO)

Presentation 6: Developments in aquatic animal health (Prof. Eli Katunguka-Rwakishaya, OIE)

Presentation 7: Requirements for a national biosecurity programme – the Australian experience (Dr Ramesh Perera, FAO Consultant)

Presentation 8: Southern African aquatic biosecurity issues: a presentation based on national surveys (Dr Ramesh Perera, FAO Consultant)

Presentation 9: Establishing a biosecurity framework for southern Africa: constraints and challenges (Dr Rohana P. Subasinghe, FAO)

Presentation 10: National biosecurity status in Angola (Ms Esperanza Justiz Silva, Angola)

Presentation 11: Biosecurity status in Botswana (Mr Shaft M. Nengu, Botswana)

Presentation 12: National biosecurity status in Kenya (Ms Beatrice Nyandat, Kenya)

Presentation 13: Malawi presentation on development of an aquatic biosecurity framework in southern Africa (Dr. Gilson, Malawi)

Presentation 14: Aquatic biosecurity capacities in Malawi (Mr Geoffrey Kanyererae, Malawi)

Presentation 15: Mozambique country report (Mr Rafael Rafael, Mozambique)

Presentation 16: National aquatic biosecurity capacity assessment – Tanzania (Mr Kitojo Wetengere , Tanzania)

Presentation 17: Republic of Uganda National aquatic animal biosecurity capacity (Mr Wilson Waiswa Mwanja, Uganda)

Presentation 18: National biosecurity status in Zambia (Dr Hang'Ombe Bernard Mudenda, Zambia)

Presentation 19: Zimbabwe country report (Mr Gilbert Hope Moyo, Zimbabwe)

ANNEX 3

Workshop programme

Date/Time	Activity
22 April, Tuesday	
09.00–09.15	Opening remarks from FAO, OIE and Government of Malawi
09.15–09.30	Introduction to the workshop – Dr Rohana Subasinghe (FAO)
09.30–10.00	Aquatic biosecurity: an introduction – Dr Rohana Subasinghe (FAO)
10.00–10.30	Tea/Coffee
10.30–11.00	International agreements and treaties relevant to aquatic biosecurity and their compliance – Dr Melba Reantaso (FAO)
11.00–11.30	OIE and its role in aquatic biosecurity – Prof Eli Katunguka-Rwakishaya (OIE/AAHSC)
11.30–12.00	Diagnostics and surveillance: tools for improving aquatic biosecurity – Dr Ramesh Perera (FAO)
12.00–12.30	Discussion
12.30–14.00	Lunch
14.00–16.00	6 x 20 minutes presentation of national status based on questionnaire
16.00–16.30	Tea/Coffee
16.30–17.30	3 x 20 minutes presentation of national status based on questionnaire
17.30–18.00	Application of risk analysis and emergency response: tools for improving aquatic biosecurity – Dr Melba Reantaso (FAO)
23 April, Wednesday	
09.00–09.30	Southern African aquatic biosecurity issues: a presentation based on national surveys – Dr Ramesh Perera (FAO)
09.30–09.45	Introduction to Group Work – Dr Ramesh Perera (FAO)
09.45–12.30	Working groups <ol style="list-style-type: none"> 1. Risk assessment, translocation controls (national/domestic) and enforcement 2. Diagnostic capacity, technical expertise and capacity building 3. Surveillance and emergency response
12.30–14.00	Lunch
14.00–15.30	Working groups continue
15.30–16.00	Tea/Coffee
16.00–16.30	Aquatic animal health management framework for Africa: based on the Australian model – Dr Ramesh Perera (FAO)
16.30–18.00	Working groups continue
24 April, Thursday	
09.00–09.30	Establishing a biosecurity framework for Southern Africa: constraints and challenges – Dr Rohana Subasinghe (FAO)
09.00–10.30	Working groups continue
10.30–11.00	Tea/Coffee
11.00–12.30	Working groups continue
12.30–14.00	Lunch
14.00–15.30	Working group presentations
15.30–16.00	Tea/Coffee
16.00–17.30	General discussion on future work
17.30–18.00	Closing remarks

ANNEX 4

Introduction to biosecurity (Dr Rohana P. Subasinghe)

Definition of *biosecurity*?

- *Strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) that analyse and manage risks in the sectors of food safety, animal life and health, and plant life and health, including associated environmental risks.*

Why *biosecurity* important?

- Human health – related to food safety
- Animal health – related to pathogens
- Plant health – related to pathogens
- Food production – crop or animal losses due to disease
- Economy – crop or animal losses, product rejections and trade restrictions
- Livelihoods – crop or animal losses, loss of income, loss of employment
- There are many examples!

Markets and trade

- Food and agriculture markets are increasingly global as consumers demand a diversity of products, all year round.
- Eating food grown elsewhere in the world requires trust in the *Biosecurity* systems of exporting countries.
- Common product standards provide a basis for trade between countries.
- As confidence between trading partners builds through experience, the rate of product testing is reduced and transaction costs go down.

Biosecurity framework

Biosecurity describes the concept, process and objective of managing – in a holistic manner – biological risks associated with food and agriculture, with “agriculture” in its broadest sense

- **The sectors include:**
 - food production and processing in relation to food safety,
 - the introduction of plant pests, animal pests and diseases, and zoonoses,
 - the introduction and release of genetically modified organisms (GMOs) and their products,
 - and the introduction and safe management of invasive alien species and genotypes.

Components of an aquatic *biosecurity* framework

- Food safety assurance measures
- Avoidance/reduction of entry, exit and national spread of pathogens, management of alien species, etc.
- Compliance to relevant international treaties
- Facilitation of responsible trade

Food safety

- Use of veterinary drugs
 - FAO/WHO – (Codex Alimentarius Commission CAC)
 - WTO/SPS Agreement
 - Compliance to trading standards
 - Veterinary drug control
 - Prevention of disease
 - Vaccines
 - Research

Avoidance/reduction of entry of pathogens, alien species, etc.

- **Species introduction**
 - National policy
 - Guidelines based on risk assessment
 - ICES, FAO, OIE, etc.
- **Alien invasive species**
 - National policy and strategy
 - National guidelines
 - International standards
 - Compliance to Convention on Biological Diversity (CBD)
 - Capacity building

Avoidance/reduction of entry of pathogens, alien species, etc.

- **International trade**
 - WTO/SPS Agreement and compliance
 - OIE standards
 - Surveillance
 - Live fish and fish product trade
 - Broodstock and seed supply chain
 - Feed supply chain
- **Emergency preparedness and response**

ANNEX 5

International agreements and treaties relevant to aquatic biosecurity and their compliance (Dr Melba B. Reantaso)

What is biosecurity

- A *strategic* and *integrated* approach that encompasses both policy and regulatory frameworks; biosecurity is aimed at analyzing and managing the RISKS of the sectors dealing with:
- Human life and health (including food safety)
- Animal life and health (including fish)
- Plant life and health
- Environment

Biosecurity and aquaculture

- In aquaculture, biosecurity is a collective term that refers to the concept of applying appropriate measures (e.g. **proactive disease risk analysis**) to reduce the probability of a biological organism or agent spreading to an individual, population, or ecosystem, and to mitigate the adverse impact that may result (Arthur *et al.*, 2004).
- This analysis is done in a way that incorporates the best information available on aspects of husbandry, epidemiology, and sound science.

Drivers of the process

- **Transboundary** issue (introduction and movement of live aquatic animals, shared waterways, potential for very rapid spread irrespective of national boundaries)
- **Globalization of trade** (increasing volume and diversity, changing human and behavioural ecology, efficient transportation methods, trading partner requirements)
- **Biosecurity** concerns (integrated approach)
- **Compliance** to international agreements and national actions on biosecurity
- Planning is essential, planning **reduces risks, informs decision-making, establishes trust and conveys information**

Reasons for international trade in live aquatic animals (Arthur, 2004)

- live food market (seafood restaurants)
 - from producing countries to consuming countries
- aquaculture development or sustainment
 - shipment of all stages (gametes, fertilized eggs, fry, fingerlings, spat, broodstock)
- ornamental fish trade
 - 2 000 species moved annually, 10 M ornamental marine fish (70-100 MT) imported globally; 1993-1997 value of ornamental fish imports to EU = Euro 67 B; highly unregulated; involves high amount of transshipment
- other reasons (development of capture and sport fisheries, **use of bait and as biological control agent**)

Different goals and pathways - *Involve different levels of risks*

Why is there an increasing focus on biosecurity?

- Increasing volume and diversity of trade
- Globalization
- Legal obligations for signatories of relevant international agreements
- Advances in communications and global access to biosecurity information

- Scarcity of technical and operational resources
- Increasing travel and movement of people across borders
- High dependence of some countries on food imports
- Greater public attention to biodiversity, the environment and the impact of agriculture on both

Many sectors are involved! Therefore an integrated approach to biosecurity is needed

- Competent authorities for agriculture, forestry, fisheries, food safety and public health
- Other government activities (e.g. trade, customs, tourism, marine conservation, etc.) Primary producers of food and agricultural commodities (e.g. farmers, aquafarmers, fishers)
- Scientific research institutes and universities
- Industry including importers and exporters
- Scientific research institutes and universities
- NGOs, special interest groups, the media
- Public opinion and representation

WTO SPS Agreement - Main Regulatory Instrument

International standards	Sectoral concerns/issues
Codex Alimentarius Commission (FAO/WHO)	Food safety
World Organisation for Animal Health (OIE)	Animal life health
International Plant Protection Convention	Plant life health

Relevant Instruments

International instruments/guidelines	Sectoral concerns/issues
Convention on Biological Diversity (CBD)	Management of invasive alien species
Cartageena Protocol (supplement to CBD)	Biosafety, i.e. protecting the environment and human health from the effects of modern biotechnology

Other instruments dealing with aspects of biosecurity outside human health perspective

Ramsar Convention on Wetlands (1971)	Framework for the conservation of wetlands and their resources
International Treaty on Plant Genetic Resources for Food and Agriculture (2004)	Conservation and sustainable management of plant genetic resources
FAO Code of Conduct for Responsible Fisheries (1995)	Principles and standards for the effective conservation, management and development of living aquatic resources

Important treaties and agreements related to international trade in aquatic organisms and their products

Binding	Non-binding
Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) Aquatic Animal Health Code (OIE)	ICES Code of Practice on the Introduction and Transfers of Marine Organisms
Convention on Biological Diversity and the Cartagena Protocol on Biosafety (UNEP)	EIFAC Codes of Practice and Procedures for Introductions and Transfers of Marine and Freshwater Organisms
Convention on International Trade in Endangered Species (CITES)	Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals in Asia (TGBCIS)
European Union (EU) related legislation and directives	FAO Code of Conduct for the Responsible Fisheries (CCRF)

Compliance

- Needs assessment
- Implementation at regional and national levels
- National level:
 - system level
 - organizational level
 - individual level

Biosecurity capacity assessment

- better protect animal and plant life and health and environment
- improve food safety
- clarify biosecurity roles and responsibilities and avoid duplication
- support the development of a national strategy or sectoral strategy
- respond to a challenging event (e.g. disease outbreak, ban on a food export)
- demonstrate compliance with international agreements and treaties
- take advantage of trade opportunities (e.g. access to a new market or consolidate a market position)

Needs assessment

- provides a means to identify country level requirements and priorities and explicit trade opportunities
- ensure that activities to improve biosecurity capacity are demand driven and tailored to specific national circumstance
- enable governments to set priorities, organize their work, improve use of available resources and raise additional funds

Enabling biosecurity system level

- relevant policies, strategies and regulations, organizational arrangement and communications (including relationships, interdependencies and interactions)

Organizational level

- competent and other responsible authorities: leadership, strategic focus, operational principles, [procedures, resources (human, financial, information), culture, infrastructure

Individual level: people in the organization

- knowledge, skills, competencies, work ethics

Examples

- Asia-Pacific region
 - regional strategy
 - national strategy
 - capacity building
- Easter Europe
 - regional strategy taking lessons from one country model
- Gulf region
 - aquatic animal health capacity and performance assessment
 - regional programme and national strategy
- South Africa
 - aquatic biosecurity assessment
 - regional framework/strategy??
- *Different levels of socio-economic development, different levels of aquaculture development*

Asia-Pacific

- Regional TCP involving 21 countries in Asia region (1999-2002)
- Regional strategy “Safe movement of live aquatic animals”
- Regional Working Group of Experts
- National Coordinators
- Numerous capacity building activities both at national, regional and international levels
- Enhanced regional and international cooperation

Biosecurity and national strategies

Policy, legislation and enforcement	Zoning
Risk analysis	Emergency preparedness
Pathogen list	Research
Information system	Institutional structure
Health certification and quarantine	Human resource development
Surveillance, monitoring and reporting	Regional and international cooperation

Impacts of national strategies

Australia’s AQUAPLAN	Australia remains free of major diseases affecting aquatic animals, thus comparative advantage
Thailand’s National Strategy	Thailand remains top producer of shrimp
Singapore’s strategy	Singapore remains to be the top exporter of ornamental fish

Important lessons from Asian epizootics

Regional and international cooperation	National strategies and contingency plans
Increased awareness of emerging epizootics	Improved compliance with treaties and agreements
Improved diagnostics	Emergency preparedness as a core function of government
Pro-active surveillance and reporting of diseases	Advanced financial planning

Essential factors to success

- Good driver of the process: competent authority, commission, committee, task force, focal person
- Clear objectives
- Clear terms of reference
- Assessment of needs and priority setting
- Internal stakeholder consultation
- Approval from highest authority
- Implementation strategy
- Monitoring and review
- Proposal development
- Funding
- Need for an integrated approach

National actions on biosecurity

- Standardization of science-based identification of all risk pathways and high-risk organisms
- Implementation of pre-border, border and post-border measures to prevent pests and diseases from entering the country;
- National frameworks to regulate, manage and control biosecurity
- Surveillance programmes and diagnostic services to detect and identify the arrival and spread of pests and diseases;
- Timely assessment of the threats from new or expanding species;
- Rapid response to eradicate new pests and diseases before they establish and spread

Consequence of enhanced biosecurity?

- Improved human health
- Environmental protection
- Improved food safety
- Agricultural development
- Maintenance of biodiversity
- Increased trade
- Genetic improvement
- Freer market access

ANNEX 6

Diagnostics and surveillance: tools for improving aquatic biosecurity (Dr Ramesh Perera)

Overview

- The focus of this presentation is on information that may assist in workshop discussions on developing an aquatic animal biosecurity framework for southern Africa – capacity building
- Specifically, focus will be on: skills/know-how; physical infrastructure/supplies; and systems

What is surveillance?

- A systematic investigation of a population of aquatic animals to detect the occurrence of disease for control purposes, and which may involve testing of samples of a population [FAO]
- The structured collection and analysis of data for the purpose of detecting incursions of new or emerging disease or infection in an area, or for demonstrating freedom from a disease or infection” [Australia – National Aquatic Animal Health Technical Working Group]

What is the purpose of surveillance?

- “The primary purpose of aquatic animal disease surveillance is to provide scientifically accurate, cost-effective, information for assessing and managing risks of disease transfer associated with trade (intra- and international) in aquatic animals and animal production efficiency and public health” [FAO]
- Surveillance based information can assist demonstration of freedom and early detection of new incursions

Surveillance versus monitoring

- Surveillance is aimed at demonstrating freedom or detecting new incursions
- Monitoring is conducted for the purpose of assessing changes in the level or distribution of disease in an area
- Surveillance is concerned with exotic disease, and monitoring is concerned with endemic disease

General versus targeted surveillance

- Passive versus active surveillance? Degree of inconsistency in the literature about these terms
- Definition for purpose of this workshop is that adopted by FAO:
 - General (passive) surveillance is an ongoing observation of the endemic disease profile of a susceptible population, so that unexpected and/or abnormal changes can be detected and acted upon as rapidly as possible
 - Targeted surveillance collects information on a specific disease or condition so that its presence within a defined population can be measured, or its absence can be substantiated

What is disease zoning?

- Disease zoning is the process of delineating infected and uninfected populations in an area within a country or group of countries

Surveillance – skill/knowledge requirements

- Local conditions: industry/practices, species biology, ecosystems
- Biology of the disease/disease agent
- Statistical analysis: Probability/confidence, sensitivity/precision, sampling, experimental/survey design
- International standards – OIE/WTO-SPS

Infrastructure and supplies requirements

- Standard requirements for data collection and collation – e.g. computer hardware/software
- Sample collection/storage, shipment to labs – sample collection/kits/observation forms

Systems requirements

- Information management systems: communication and data collection, collation/analysis and storage – recordkeeping, data management, health information systems – repository of data on health status
- Communication systems for reporting – networks, industry liaison, communication lines: e-mail/telephone etc
- Assigned responsibilities for reporting – domestic/international
- Systems for intelligence gathering /pre-border intelligence/networking/monitoring scientific literature/news letters – (specially important in a large continent like Africa)
- Training/succession planning systems; systems for building farmer/fisher/extension staff awareness
- Financial resourcing – systems for covering costs of surveillance/diagnostics
- Supporting legislation/polices

What is diagnostics?

- Diagnostics is the process of identifying a disease by its signs, symptoms, and from the results of various diagnostic procedures
- In the context of surveillance programmes, diagnostics is the process of detecting the presence of a disease/disease agent in sampled animals – objective to avoid false negatives or false positives

Diagnostics

Some key considerations

- Case definitions
- Presumptive versus confirmatory diagnosis
- Sensitivity and specificity of diagnostic tests
- Clinical versus sub-clinical infection/disease

Diagnostic tools

- Diagnostics can be broadly categorised in terms of their complexity and difficulty into three levels
- Level I diagnosis can be made for certain diseases at the field site without laboratory confirmation. Level I information mostly used to reinforce Level II diagnosis that requires some laboratory support
- Level III diagnostic techniques require advanced laboratory infrastructure and training and are usually reserved for confirmation of diagnoses that remain presumptive at Levels I and II

Level I	Level II	Level III
<ul style="list-style-type: none">• Observation of animal/environment• Clinical examination• Gross pathology	<ul style="list-style-type: none">• Parasitology• Bacteriology• Mycology• Histopathology	<ul style="list-style-type: none">• Virology• EM• Molecular tests• Immuno-assay

Diagnostic tools

Diagnostics can also be categorised into (1) collection of field information, (2) laboratory techniques and (3) experimental techniques

Field information	Laboratory techniques	Experimental techniques
<ul style="list-style-type: none"> • history • production losses • animal behaviour • clinical signs • physical examination • epidemiology • response to therapy 	<ul style="list-style-type: none"> • microscopy • tissue smears • microbiology • histopathology • immunoassay • ultrastructural examinations • Molecular tests 	<ul style="list-style-type: none"> • physiology challenges • transmission tests

Diagnostic tools

These two ways of categorising diagnostics can be combined to provide an insight into the sorts of diagnostic technologies that are available and associated complexities and ease of adoption and application.

	LEVEL II	LEVEL III
Field information	<ul style="list-style-type: none"> • microscopy • tissue smears • microbiology • histopathology 	<ul style="list-style-type: none"> • physiology challenges • transmission tests
<ul style="list-style-type: none"> • history • production losses • animal behaviour • clinical signs • physical examination • epidemiology • response to therapy 	<ul style="list-style-type: none"> • immunoassay • ultrastructural examinations • Molecular tests 	
LEVEL I	LEVEL III	

ANNEX 7

Application of risk analysis and emergency response: tools for improving aquatic biosecurity (Dr Melba B. Reantaso)

Part 1: Risk analysis

Sector interests that are important to an integrated approach to biosecurity

- Competent authorities for agriculture, forestry, fisheries, food safety and public health
- Other government activities (e.g. trade, customs, tourism, marine conservation)
- Public opinion and representation
- Industry including importers and exporters
- Primary producers of food and agricultural commodities (e.g. farmers, aquafarmers, fishers)
- Scientific research institutes and universities
- Primary producers of food and agricultural commodities (e.g. farmers, aquafarmers, fishers)
- Scientific research institutes and universities
- NGOs, special interest groups, the media

Risk analysis and biosecurity

- Global climate of free trade
- At the heart of modern approaches to biosecurity – a unifying concept across different biosecurity sectors
- Essential tool to achieve the goals of protection of human, animal, and plant health and biodiversity
- National Competent Authorities (CA) are bound by international agreements to utilize risk analysis – new responsibilities and accountabilities on CA

What is risk?

- If you went to work this morning
- If you rode your bicycle, or drove a car or took a train
- If you put your money in bank, or in stocks or under a mattress
- If you bought a lottery ticket at a news stand or if you gambled at a casino
- If you engaged in activities that involve an element of CHANCE – something that is intimately connected with risk
- You were taking a RISK!

Origins: Risk and hazards

- Risk – originated from the French word *risqué* – means “danger, in which there is an element of chance”
- Hazard – comes from a game of chance (a type of dice game) invented in a castle named Hasart or Asart (in Palestine), while it was under siege.

Risks and hazards

- Risk – a combination of the likelihood (or possibility) of occurrence of undesired outcomes (loss or harm) and the severity (or magnitude) of consequences (impacts)
- Hazard – the presence of a material or condition that has the potential to cause loss or harm
- No matter how well managed a system is, there will always be associated risks and hazards

Risk analysis

- Process that allows to understand risk, measure it & weigh its consequences - risk-taking is one of the prime catalysts that drives modern society
- The notion of bringing risk under control is one of the central ideas that distinguish modern times from the distant past.
- Risk management is now an indispensable skill whose applications range from allocating wealth through planning a family to wearing a seatbelt

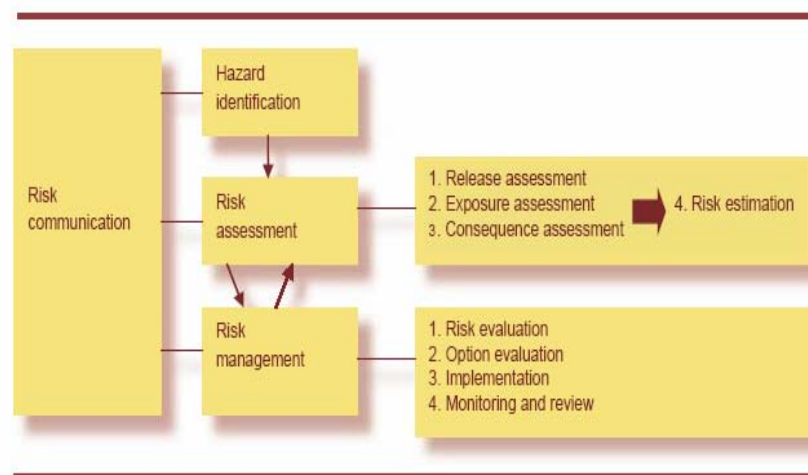
Applications of RA

- First professional risk assessors from ancient Babylonian (3200 BC) – offering advice on risky, uncertain or difficult decisions, e.g., marriage proposals or selecting building sites
- > than a century now, in industrialized economies - part of everyday activities of banking, insurance, and business operations
- Serious applications in human health and safety (early decades of this century)
- Research on natural hazard risks and disaster management

Recently: to evaluate and manage the potential of unwanted circumstances in a large array of areas:

- Industrial explosions
- Machine part and other mechanical and process failures
- Workplace injuries
- Injury or death from diseases, natural causes, lifestyles and voluntary pursued activities
- Impacts of economic development on ecosystems
- Financial market transactions

Principal components of risk analysis OIE



Risk analysis process

- What can go wrong?
- How likely it is to go wrong?
- What would be the consequence of it going wrong?
- What is the overall risk?
- Is the risk acceptable?
- What can be done to reduce the likelihood or the consequence of it going wrong?

Steps in the PRA/IRA

- Establish a RA Team
- Scoping a PRA
- Decide on the type of PRA – qualitative/quantitative
- Conduct a preliminary Hazard identification
- Inform stakeholders
- Conduct detailed hazard identification
- Conduct the risk assessment (4 steps)
- Conduct risk management (4 steps)
- Conduct internal and external scientific reviews and revisions
- Circulate the revised Risk analysis to stakeholders for final comment and revise as necessary
- Implement finalized Risk analysis via policy and legislation

Pathway analysis and scenario diagram

- important tools in the risk assessment process
- identify possible routes (pathways) and the individual events or steps
- logical process, critical steps (events) leading to an introduction are identified
- probability of each event can be estimated which could lead to an overall estimate
- gauge the effectiveness of a risk mitigation
- allows for sensitivity analysis – which pathway steps most influence the final risk estimation

Risk communication

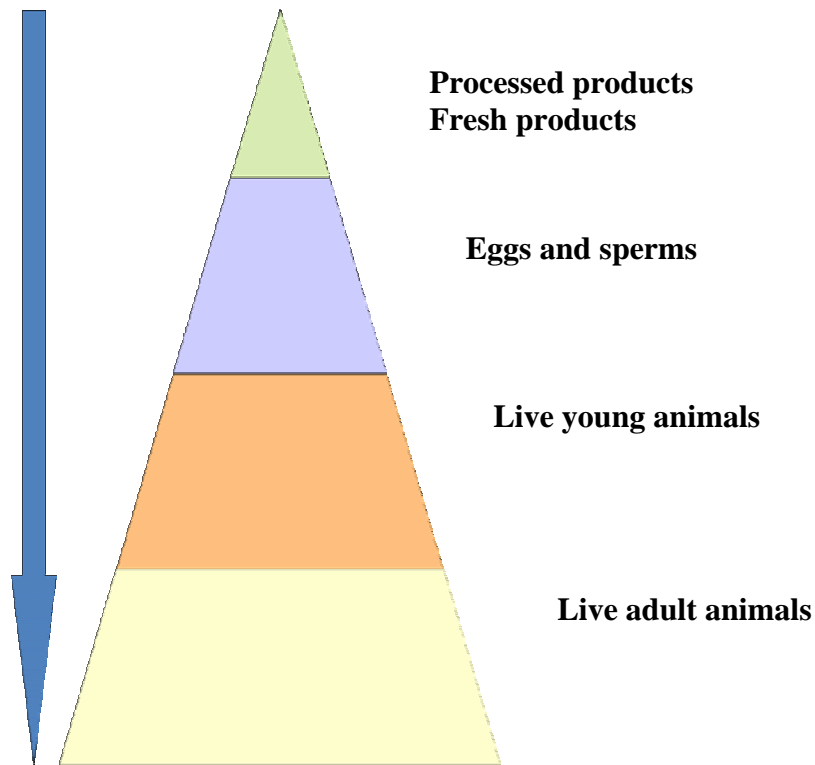
- Critical in the RA process and provides over-all system integrity
- Communication strategy (what message, to whom, how, how frequent, etc.)
- Key components: multidimensional, iterative, transparency, consensus building, stakeholder cooperation and consultation

Precautionary approach – PA

- widely used in fisheries management and elsewhere where governments must take action based on incomplete knowledge
- within RA for aquatic animals – a PA would be that both importing and exporting countries act responsibly and conservatively to avoid the spread of serious pathogens
- applications:
- throughout the RA process when “*cautious interim measures*” are considered necessary to ban or restrict trade until a sound RA can be completed;
- during the pathways scenario portion of the RA where key information gaps will be revealed and must be addressed by targeted research
- during risk management, when risk mitigation measures are identified to reduce the risk to an acceptable level

Future challenges

- Despite the best RA and risk mitigation measures, serious pathogens will be introduced and cause major disease problems
- Why?
 - limitations in diagnostic techniques
 - existence of cryptic (hidden/obscure) pathogens
 - ability of “benign organisms” (normally non-pathogenic) become pathogenic when introduced to new hosts and environments
- Good disease surveillance, reporting and well designed emergency plans



Demystifying risk analysis

- Risk analysis is a old concept and newly applied to aquaculture
- and a process...
- It is important to NOT be intimidated by the complexity of the process and to embrace the concept first

Good *cross-sectoral* and *interdisciplinary* approach to understand the risk analysis process and its application to sustainable aquaculture

Part 2: Emergency response

Objectives of an emergency response and contingency planning

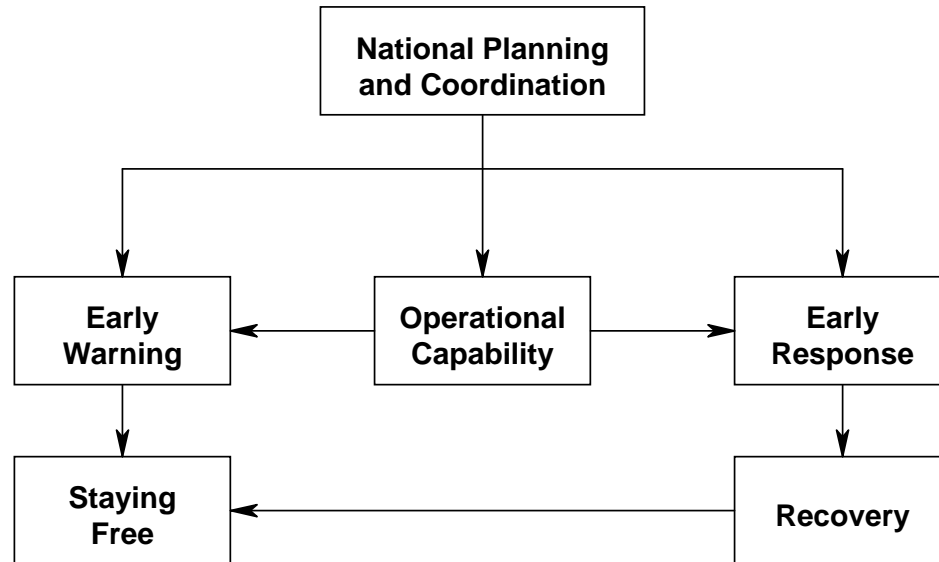
- prevent the incursion of exotic pathogens and pests
- rapid, well-organized and appropriate response to an emergency disease incident
- successful management of disease outbreaks
- Emergencies:
 - incursions of known exotic diseases
 - sudden change in the behaviour or distribution of endemic diseases
 - appearance of previously unrecognized disease

Emergency response and contingency planning

- National planning and coordination
- Operational capability
- Early warning
- Early detection
- Risk analysis
- Disease surveillance
- Early response

- Contingency plans
- Recovery from an emergency disease
- Staying free

Framework for emergency disease preparedness and response (Baldock, 2005)



National planning and coordination

- an important core function of government services; need to have adequate funding and allocation of other resources
- support of and involvement of relevant stakeholders
- in presenting a strong case for support for emergency preparedness planning – include disease risk, socio-economic consequences, as well as benefits that will result from rapid containment and eradication

Operational capability

- Responsibility for aquatic animal disease emergencies
 - National emergency disease planning committee
 - National emergency disease planning officer
 - specific tasks
- Contingency planning as a component of National Disaster Plan
 - national disaster plans dealing with fires, floods, hurricanes, earthquakes, volcanic eruptions, terrestrial and human infectious disease outbreaks
 - official recognition of aquatic animal disease emergencies as a disaster situation
- Legislation and enforcement
 - restrictions on movement and sale of infected stocks
 - testing and inspection of aquaculture premises and processing facilities
 - confiscation of stocks
 - mandatory treatment
 - destruction of aquatic animals
 - penalties for violation

Early warning

- having advance knowledge of high-risk diseases likely to threaten national biosecurity before pathogens enter territory
- depends on excellent awareness of current disease situation of trading partners and emerging aquatic diseases on global level
- good communication linkages
- access to disease databases

Early detection

- detection of an emerging disease situation within the shortest possible time frame
- broad awareness
- experienced veterinarians and/or aquatic animal health professionals trained in recognizing and reporting suspicious disease occurrence
- ability of the CA to undertake rapid and effective disease investigation
- access by CA to laboratories with expertise and facilities required for diagnosis

Risk analysis – in the context of contingency planning

- determine which aquatic resources are at a particular level of risk from aquatic animal imports for aquaculture, processing or live/fresh marketing and thus merit protection via investment in a prevention programme and contingency plan measures;
- determine which control options present the greatest chance of success vs risk of failure

Disease surveillance

- necessary for any effective government aquatic animal health protection programme
- maximizes the chances of early detection of diseases of concern
- provides the data required for science-based certification of export health status, international reporting and verification of freedom from disease
- provides a reliable picture of the health status of aquatic animal populations
- provides tracking traceability information for a rapid and effective response to a disease emergency.

Early response

- Definition: all actions targeted at rapid and effective containment of, and possibly elimination of, an emergency disease outbreak, with the objective of preventing it from spreading and becoming an epizootic.
- Eradication - highest level of response but not always possible.
- Containment - within specified zones with controls in place around infected zones to prevent further spread
- Mitigation – reduction of the impacts of the pathogen by implementing control measures at the farm or affected population levels.

Contingency plan

- a documented work plan designed to ensure that all needed actions, requirements and resources are provided in order to eradicate or bring under control disease outbreaks of significance to aquatic animal productivity and/or market access
- focus of high priority diseases, with generic plans of activities
- need stable resources and financial support
- need to be reviewed and agreed upon in advance
- refined on a regular basis through simulation exercise
- clear definition of roles and responsibilities
- summary document: an overview of the national approach for contingency planning

- technical plans – disease strategy manuals, enterprise manuals, general procedures manuals, destruction manuals, disposal manuals, job descriptions
- support plans – financial, resource, legislation, stakeholder involvement
- operational capability – management manual, diagnostic resources, field personnel, training resources, awareness and education, response exercises

Recovery from an emergency disease

- Verification and international acceptance of disease freedom
 - demonstration that the country has a capable aquatic animal health service and relevant disease surveillance programmes
 - targeted surveillance using scientifically proven laboratory tests for both clinical and subclinical infections
 - provision of surveillance data as evidence of an effective surveillance programme and diagnostic testing
- Rehabilitation of farming and fishing communities
 - repopulate with disease free animals; focus on alternative species; protecting survivors
 - providing full or partial compensation is a political decision (prescribed in legislation)
 - risk assessment consideration when stocking vulnerable species in waters where significant disease agents are known to occur

Staying free

- prevention is the key
- a thorough post-mortem review while the outbreak is still fresh in people's minds
 - analysing the origin, subsequent spread; how to improve disease surveillance; communication problems; gaps in legislation; training needs, etc.
- not to be complacent
- always be vigilant

Lessons from terrestrial disease emergencies (Scudamore, 2006)

- No amount of effort can eliminate the risk of danger from diseases. Four critical steps to ensure that an epidemic does not occur:
 - (a) prevent introduction of disease;
 - (b) ensure early detection;
 - (c) prevent spread of disease; and
 - (d) eliminate disease rapidly.
- Controlling a disease is often NOT a technical challenge but more of a
 - resource management challenge;
 - a public relations challenge;
 - an information management challenge;
 - an endurance challenge and most importantly
 - a challenge of having key decisions taken long before the entry of a pathogen into a country.
- Controlling a disease is often NOT a technical challenge but more of a
 - resource management challenge;
 - a public relations challenge;
 - an information management challenge;
 - an endurance challenge and most importantly;
 - a challenge of having key decisions taken long before the entry of a pathogen into a country.

Three important lessons from terrestrial disease emergencies (Scudamore, 2006)

- (1) Policy – developing and maintaining national strategies for disease prevention and control whose overall objective must be to minimise the risk of disease introduction; a strategy that is clear, policy decisions based on best available science, involving partners at all levels, and agreed control strategies clearly communicated to all stakeholders.
- (2) The Plan – developing and maintaining appropriate contingency plans to ensure emergency readiness and provide the ability to build up resources quickly and effectively. Needs clear strategy, clarity of roles and responsibilities, full consultation, cost-benefit analysis, capacity and process to scale up rapidly and exercising plans and procedures assuming worst-case scenarios.
- (3) The Plan – developing and maintaining appropriate contingency plans to ensure emergency readiness and provide the ability to build up resources quickly and effectively. Needs clear strategy, clarity of roles and responsibilities, full consultation, cost-benefit analysis, capacity and process to scale up rapidly and exercising plans and procedures assuming worst-case scenarios.

Major issues and challenges

- Aquaculture is an income generating activity
- Rapid sector growth has, in some instances, outstripped planning and regulatory activities
- There are regulatory rebounds, resource use conflicts, image problems
- The role of aquaculture in food security has been a major concern of the sector for many years
- Maintaining sustainability, achieving food safety and quality, promoting equity, and improving health and *Biosecurity* are major challenges

“An ounce of prevention is worth a pound of cure...”

ANNEX 8

Developments in aquatic animal health (Prof. Eli Katunguka-Rwakishaya)

Introduction

- Importance of aquatic animal health increasing
 - Steady worldwide expansion of aquaculture (farming of fish, molluscs and crustaceans)
 - Infectious diseases impact heavily on aquaculture
 - International trade in aquaculture animals causes spread of major infectious diseases of aquatic animals
- Veterinary services of some MC have
 - Not fully recognized and discharged their responsibilities for aquatic vs reporting
 - Not contributed to the setting of international aquatic animal health standards through the OIE.

Aquaculture production

- Continues to grow from the mid 1980s experiencing an annual growth of 8% per year
- Globally, consumer demand for farmed fish continues to rise
- Levels of wild fish capture have remained level since 1980s around 90-93 million tonnes per year
- FAO estimates an additional requirement of 40 million tonnes of aquatic food by 2030 (aquaculture)
- 1980 only 9 percent of fish consumed by the global human population came from aquaculture
- In 2004, this figure rose to 43 percent comprising 45.5 million tonnes of farmed fish
- Fresh water and marine capture fisheries currently produce 60 million tonnes for human consumption. Nearly half of all the fish products consumed are now from aquaculture

Importance of aquatic animal health

- Substantial world wide increases in the numbers and values of fish, molluscs and crustacean species (local food supply and international trade)
- Diseases cause significant losses in aquaculture production and have detrimental effect on international trade in aquatic animals and their products

Causes of diseases

- Local pathogens
- Inadequate farm management
- Environmental factors
- Poor water quality
- Pathogen transfer due to international trade especially in importing countries (major)

OIE standards for aquatic animals

- Developed by Aquatic Animal Health Standards Commission (Aquatic Animals Commission) with assistance of internationally renowned experts
- Views of delegates are sought through circulation of drafts and revised texts
- AAC collaborates closely with OIE Terrestrial Commission, Biological Standards Commission and Scientific Commission

Main standards

- Aquatic Animal Health Code commonly referred to as the Aquatic code
- Manual of Diagnostic tests for Aquatic Animals commonly referred to as the aquatic Manual (Epidemiological principles: risk analysis, surveillance protocols, etc.)

- New edition (ninth) of aquatic code and fifth edition of the Manual incorporate modifications approved by delegates during the general session in May 2007.

Response

- Most MC do not take the opportunity to influence the setting of these standards that apply to international trade
- Drafts sent to delegates have not reached aquatic animal health specialists in those countries in sufficient time for them to respond
- MC are encouraged to respond to drafts and revised texts sent to them in good time

OIE List of diseases

- Only one list combining previously notifiable and other significant diseases
- Information on diseases removed from the list has been maintained under separate category of previously listed diseases. This information will be useful to some member countries

Diseases of fish

- Epizootic haematopoietic necrosis
- Infectious haematopoietic necrosis
- Spring Viraemia of carp
- Viral haemorrhagic septicaemia
- Epizootic ulcerative syndrome
- Gyrodactylosis
- Red sea bream iridoviral diseases
- Koi herpesvirus disease

Diseases of molluscs

- Infection with *Bonamia ostreae*
- Infection with *Bonamia exitiosa*
- Infection with *Marteillia refringens*
- Infection with *Perkinus marinus*
- Infection with *Perkinus olseni*
- Infection with *Xenohalotis californiensis*

Diseases of crustaceans

- Taura syndrome, white spot disease
- Yellowhead disease
- Tetrahedral baculovirus
- Spherical baculovirus
- Infectious hypodermal and haematopoietic necrosis
- Crayfish plague, Infectious myonecrosis
- Necrotising hepatopancreatitis

Concept of safe commodities

- New in AAHSC
- Those commodities which can be traded in with negligible risk of disease transmission
- Scientific evidence to prove safety is required before a commodity is listed as safe
- MC with such scientific information are encouraged to make it available to the commission

Harmonization of aquatic and terrestrial codes

- Need has been identified to harmonise approaches of both commissions
- Ongoing: disease listing criteria, notification and epidemiological information data entry forms,
- To be started: zoning and compartmentalization, aquatic animal health surveillance, animal health certificates, disposal of carcasses and wastes of aquatic animals, aquatic feeds.

OIE standards for aquatic animal welfare

- International Committee decided that OIE gives priority to the welfare of animals used in agriculture and aquaculture
- Priority areas: transportation, humane slaughter and killing for disease control
- Other areas: housing and management, research animals, etc.

Cooperation between vet services and fisheries officers

- Recommendations by the seventy-second General session, May 2004
 - Reinforce to delegates their responsibility to the OIE for terrestrial as well as aquatic animals
 - Request MC to clarify the roles and responsibilities for aquatic animal health assigned to veterinary and other authorities in their countries
 - Provide opportunities to assist cooperation between veterinary and other authorities responsible for aquatic animal health in MC
 - MC to request their veterinary services to improve the communication and cooperation with fisheries authorities especially regarding disease reporting and disease emergency responses
 - 42 MC have nominated special official as the OIE Contact person for aquatic animal disease with responsibility for sending, under the authority of the delegate, comments on the commissions proposals.

Amphibian diseases

- MC have requested the AAHSC to include amphibian diseases in its scope
- A new ad hoc group on amphibian diseases has drafted chapters on two diseases proposed for listing
- Importance: trade for human consumption, laboratory animals, pet trade and zoo animals (multi-million dollar industry)

Conclusion

- Importance of Aquaculture as the fastest animal food producing industry in the world growing at about 8 percent
- The need to control and prevent spread of listed diseases (code and manual)
- The need for veterinary authorities to take a keener interest in aquatic animal diseases
- More cooperation between veterinary and fisheries authorities in the control and reporting of aquatic diseases

ANNEX 9

Requirements for a national biosecurity programme – the Australian experience (Dr Ramesh Perera)

Introduction

- a national biosecurity programme – **what might it look like?**
- a national **biosecurity programme/system** is made up of many risk management elements applied **consistently** in a **coordinated** way
- this presentation is based loosely on **Australia's biosecurity system** – combining Federal and State government responsibilities

Biosecurity in context

- biosecurity **scope**: pathogen, pest, genetic, food safety risks
- risk of pathogen introduction is a **component of aquatic animal health**
- biosecurity is also considered a **component of ESD**

National border controls

- **IRA/import controls** (SPS measures)
- **bilateral negotiation** as Competent Authority (CA)
- **CA evaluations**
- **equivalence** assessments
- **reporting**, international/regional **representation**
- **export attestation**: provision of health certification and facilitating other export requirements as CA; mediating equivalence requests

Incident response

- disease **surveillance**
- **reporting** obligations
- **emergency response plans**: disease control/eradication
- **MOUs with neighbours** for border control/emergency response

State/local biosecurity risk management

- controlling **high risk activities**: e.g. **bait** use, seafood **processing** plants
- **zoning**: locating aquaculture operations away from high risk areas
- regulating **farm-level** biosecurity
- aquaculture stock **escape prevention** strategies
- waste **water discharge control**, e.g. settlement/treatment
- controlling **domestic translocations**
- monitoring **aquaculture stock health**/reporting/audit
- building **awareness**/training
- **research**

General infrastructure requirements

- standards
- legislation
- compliance/audit
- recordkeeping
- extension services
- diagnostic capacity/capability
- technical know-how
- research capacity
- interagency coordination/agreements/MOUs

Summary

IRA/import controls CA assessment equivalence assessment representation reporting export attestation	standards legislation compliance/audit record keeping extension services diagnostics research capacity inter-agency coordination	surveillance programmes control high-risk activities incidence response farm biosecurity regulation research
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ANNEX 10

Southern African aquatic biosecurity: a presentation based on national surveys (Dr Ramesh Perera)

Participants

- Angola
- Botswana
- Kenya
- Malawi
- Mozambique
- Tanzania
- Uganda
- Zambia
- Zimbabwe



Questionnaire scope

- International affiliations
- Trade activity
- Border controls
- Surveillance/monitoring
- Incident/emergency response
- Diagnostic capacity
- Research/training
- Expertise (knowledgebase)
- Challenges

International affiliations

- All 9 countries have **OIE/WTO** membership
- National **vet service** is the OIE contact
- **Import/export controls** generally dealt with by vet service

Trade activity

- Exports: mainly marine/freshwater fish product, some shrimp, crocodile skins and **ornamentals**: to Europe, US, Middle-East and within Africa
- Health certification driven by importing country requirements
- Ornamental exported from Malawi, Kenya, Zambia; **fish/broodstock** from Uganda

Border control

- Imports: all countries are importers of aquatic commodities
- Live fish into Angola (freshwater fish larvae), Kenya and Uganda (ornamentals)
- Five countries ask for health certification; 3 had border inspection (option)
- Import risk analysis: 4 countries had expertise – generally in government sector
- All except 1 country had **WTO** expertise – generally in agriculture/vet agencies

Disease/pest surveillance

- Surveillance for aquatic pests/diseases is **minimal/nil** - Tanzania and Zambia (EUS) exceptions? Zimbabwe has special focus on freshwater aquatic pest species
- Several countries have veterinary surveillance programmes – many related to AI

Incidence response

- No countries has emergency disease response plans – although Zimbabwe reported response plans for water hyacinth and Kariba weed
- Several had response arrangements for terrestrial livestock diseases – including FMD, AI

Management of high-risk activities

- All indicated live fish movement controls –only 2 appear to be **domestic movement controls**
- 7 countries had **aquaculture controls** – mainly aimed at environmental management (3)
- 3 countries had controls on **waste disposal** from fish/shellfish **processing plants** – based on environmental management
- No countries had **ballast water** or **hull cleaning** controls

Extension services

- All indicated live fish movement controls –only 2 appear to be **domestic movement controls**
- 6 countries had **aquaculture controls** – mainly aimed at environmental management (3)
- 3 countries had controls on **waste disposal** from fish/shellfish **processing plants** – based on environmental management
- No countries had **ballast water** or **hull cleaning** controls

Extension services

- All except 1 country indicated having extension services – but most were not aquaculture specialised – staff numbers vary from 5-100
- Veterinary/agriculture extension services appear strong

Compliance/enforcement

- All except 1 country indicated having compliance activity – generally undertaken by fisheries agencies – Uganda appears to have a strong compliance focus
- Fisheries compliance for all except 1 country
- All countries had veterinary livestock compliance activity

Diagnostic capacity

- All countries had some access to diagnostic laboratories
- Combination of state vet labs, few universities and a few research institutes

Research/training

- Minimal training in aquatic biosecurity
- Some (like Uganda's National Aquaculture R&D Centre) had focus centres – many had had some (minor) incorporation into traditional veterinary coursework
- 5 countries had aquaculture training – mainly universities and state agencies as part of broad fisheries and aquaculture training of extension staff
- Most countries had high level of veterinary training

Expertise/knowledgebase

- Veterinary expertise is strong – ranging from post-grad , through veterinarian to para-vet staff
- Low to moderate aquaculture/fisheries expertise
- Minimal/nil aquatic biosecurity expertise
- Little or no pest identification expertise

Challenges

- Limited knowledge base (farmers and public sector)
- Poor record keeping
- Inadequate pest/disease surveillance
- Lack of enforcement

Conclusions

- There is a degree of variation between participating countries in aquatic biosecurity capacity
- Legislation in general appears to cover most biosecurity needs (?) – policies (?)
- In the context of identifying **capacity building** needs for **aquatic animal biosecurity** – all areas require augmentation to align with general international standards

Areas of focus should include:

- risk assessment
- translocation controls
- surveillance
- diagnostic capacity/capability
- emergency response
- enforcement
- technical expertise on biosecurity

ANNEX 11

National aquatic biosecurity capacity assessment – Tanzania (Mr Kitojo Wetengere)

International trade in aquatic animals and aquatic animal commodities and national border control

- Tanzania is a member of both World Animal Health Organisation (OIE) and World Trade Organization (WTO). The Department of Fisheries (DFs) under the Ministry of Livestock and Fisheries Department (MLDF) is the government Competent Authority agency recognized by the OIE.

There are legislation that controls imports and exports with respects to animal health.

- The regulations are clearly stipulated in the Fisheries Regulation of 2005 and Fisheries Act no. 22 of 2003. The section indicate that *“No person shall move or cause movement of eggs, fingerling, seed, exotic adult fish or genetically modified species from one water body to another without a written permit from the DFs”*.
- Tanzania exports shrimps to Japan and Australia. Fillets are exported to European countries and Tuna exported to Japan, Spain and China.
- Tanzania imports Scombridae family fish from South Africa and mackerel from Thailand and Japan, and Trout from the United Kingdom.
- All imports are required to have/show microbiological results, CA and health certification. The Tanzania Food and Drug Authority (TFDA Act No.1 of 2003 controls the quality, safety and effectiveness of food, drug, herbal drugs, cosmetics and medical services.

Surveillance/monitoring

- The National Aquaculture monitoring plan under the DFs is responsible for monitoring aquatic animal diseases, aquatic plants/algae diseases/pests or invasive pests’ species in the country.
- For instance section 15 (2) of the Fisheries Act No. 22 of 2003 indicates that *“where in the opinion of any local authority any fish or fish products in any water are infected with any epidemic disease, the DFs shall, if satisfied with the opinion of the local authority give notice in writing to the water therein requiring the destruction of all or fish products in the said waters or the taking of such other measures as the local authority may specify in the notice”*.

Incident/emergency response

- There is a programme going on under the DFs to remove invasive noxious aquatic plants especially the water hyacinth in Lake Victoria.

Regulation of high-risk activities

- Fisheries regulation of 2005 and Act No. 22 of 2003 stipulates the regulation of movements of live aquatic organisms. For instance clause 57 (h) of the Fisheries Act No. 22 of 2003 *“prohibits, restricts or regulate the importation into Mainland Tanzania any live fish, other than fish indigenous to Mainland Tanzania”*.
- Clause 57 (i) *“prohibit or regulate the exportation of fish, aquatic flora or any fish product or product of aquatic flora”*.

- Aquaculture activities whether commercial or subsistence has to be registered by the DFs and approved by the National Environment Management Council (NEMC). NEMC undertakes enforcement, compliance, review and monitoring of Environment Impact Assessment (EIA), research, facilitates public participation in environment decision-making, raises environment awareness and collects and disseminates information.
- Fisheries Act No. 22 of 2003 section 17 (t) requires all sport fishers to be licensed.
- The environment Act No. 20 of 2004 and fisheries Act No. 22 of 2003 prohibit disposal of waste that would pollute the environment. For instance Fisheries Act no. 22 of 2003 section 9 (2) (h) instruct the “*minimization of pollution, waste, discards, catch by lost or abandoned gear, catch of non target fish or specie and impacts on associated or dependent species through the development and use of selective environmentally safe and cost effective fishing gear and techniques*”.

Extension services

- The aquaculture section under the DFs is responsible for aquaculture management including extension. The section provides extension on aquaculture from site selection up to marketing of the produce. Recently emphasis has been placed on aqua-business and thus entrepreneurship information would be provided.
- There is also extension on capture fisheries. The extension is mainly on the use of gears which would foster sustainable use of fisheries resources, fishing area, regulating fishing to avoid conflict, fisheries monitoring, surveillance control and enforcement to ensure compliance with conservation and management and marketing of produce.
- The exact number of staffs for both aquaculture and capture fisheries were not known but there are staff at the headquarters and approximately each staff in 98 districts around the country. The staff are usually trained in either aquaculture or fisheries or both but provide extension for both fields.
- There is also extension provided for animal health. The department of veterinary under the Ministry of Livestock and Fisheries Development (MLFD) has the mandate of overall management and development of Livestock.
- The government, through the livestock extension field officers, is running extension services, at village level. But with the advent of economic liberalisation, the private sector will take over some of the government functions. The role of the government will be limited to the control of epidemics, infectious diseases, sanitary control, regulation and eradication of scheduled diseases. In vaccination programs, the government will retain the role of controlling the quality of vaccines. It will support and promote the private sector to import and distribute veterinary inputs and establish an effective regulatory and marketing system for products. It will, however, take a long time for private sector services to reach the village level, as most private practitioners are concentrated in cities and towns. Meanwhile, mechanisms should be set up to facilitate the participation of NGOs and community-based groups to fill the gap.

Institutional and human resource capacity

- The available data shows the number of personnel in the animal health delivery sector is as follows:
Registered veterinary surgeons – 414
Government Officers:
Veterinary surgeons – 173
Livestock officers – 67
Livestock field officers – 1 437

Compliance/enforcement

- Aquaculture section under the DFs is responsible for compliance services that monitor and regulate aquaculture and capture fisheries activities.
- The department of veterinary under the Ministry of Livestock and Fisheries Development (MLFD) for compliance services that monitor and regulate livestock activities

Diagnostic capacity

- Nyegezi National Laboratory in Mwanza under the DFs can undertake microbiology analysis of aquatic animals, aquaculturists and fisheries biologists can conduct water quality analysis.

Research and training

- The Sokoine University of Agriculture (SUA) offers first degree in aquaculture and the University of Dar es Salaam offers first degree on fisheries and aquaculture. In addition, SUA offers degree on veterinary. Further more Mbegani Fisheries Development Center offers fisheries courses at diploma and certificate level and Nyegezi Fisheries Institute offer fisheries courses at certificate level. Courses offered by the later institutes are biased on fisheries with lesser emphasis on aquaculture issues.
- Aquaculture experts
Doctorate 6
Masters 8
Bachelors 23

ANNEX 12

Republic of Uganda national aquatic animal biosecurity capacity (Mr Wilson Waiswa Mwanja)

Background

- Fisheries sector contributes > 12 percent of the national agricultural gross domestic product
- Second to coffee in export earnings
 - Bringing an estimated USD 200 million annually
- Nearly 92 percent comes from capture fisheries
- 8 percent comes from culture fisheries
 - Aquaculture and restocked communal water reservoirs
- Aquaculture production has been growing at a rate of over 300% annually
 - Most of it by emerging commercial fish farmers
- There has been rapid increase in movement of fish and fish and aquaculture products
 - Between watersheds and across the borders
 - Trade
 - Production
 - Research
 - Ornamental
- Urge to import and have better performing strains
 - With established and better paying markets
 - Easier to handle and commercially produce
 - That can fit the existing and known technologies for propagation and rearing

Management and development of fisheries sector

- Development and management of the fisheries sector is the public mandate of Ministry of Agriculture, Animal Industry and Fisheries
- The Department of Fisheries Resources falls under the Animal Resources Directorate
 - Heads of the Department
 - Commissioners
 - Commissioner for Fisheries (Chief Fisheries Officer)
- Ministry is under the administrative responsibility of the Permanent Secretary
 - Politically appointed
 - Not necessarily technical in agriculture, animal industry and fisheries

International trade in aquatic animals and aquatic animal commodities and national border controls

- Member to the World Animal Health Organisation (OIE)
- Member of the World Trade Organization
- The Directorate of Animal Resources (Director) is the competent authority of the OIE
- There are a number of legislations that regulate the import and export, and movement within of animals in the country
 - Fish Act, 1964 (CAP 197 of the Uganda Laws)
 - Animal Movement Act
 - Sanitary and Phytosanitary Act
 - Under which numerous regulations have been made to address import, export and movement of animals within and out of the country

Trade in Aquatic Products

- Major trade is in processed fisheries and aquaculture products
 - Fresh fish, head and gutted, smoked and sundried fish, salted fish

- International: EU, Asia, Japan, United States of America
 - Regional: the DRC, Kenya, Rwanda, CAR, Angola, the Sudan,
- Processed scales, bladder sacs, skin
 - China, Italy, South Africa
- Trade in live fish for bait, fingerlings and broodstock
 - Bait to Nile perch long line fishery in the 3 Lake Victoria riparian countries
 - Grow out fry and fingerlings to farmers in Uganda, Kenya, Tanzania, Rwanda, the DRC
 - Improved broodstock for hatchery operators to:
 - The DRC, Tanzania and Kenya

Required animal health certification for the trade

- Internally
 - Local Inspection certificate that certifies the fish is healthy and appropriate for either further processing or direct consumption at the point of first landing
 - Fish movement permit – that allows fish products to move from point of landing to the processing or consumer market points
- For external trade
 - Fish Health Certificate – which must accompany any exported fish consignment attesting to the quality, safety and original of the traded fish
 - Especially enforced for international markets and a few countries in the region such as South Africa and the Sudan (Khartoum)
 - Live Fish Import/Export Certificate
 - Attests to the veterinary clearance of the traded stock of key health conditions as may be demanded and specified by the importing country
- In both the Competent Authority for issuance and control of certification and movement permits is the
 - Commissioner for Fisheries

Imported Aquatic Organisms

- Processed fish for human consumption
 - Tinned/canned fish from Europe and Americas
 - Fresh fillets, frozen fillets, head and gutted, and packed fish fingers, balls, etc. from Europe, Americas and Asia
- Live fish for ornamental fish trade
 - From South Africa, Kenya, Malaysia, Israel, China and others
- Brood stock for hatchery production
 - From Egypt, Kenya, Thailand, China, Israel
- Post larvae for freshwater prawn production
 - India

Required Certification for imported aquatic items

- By law all imported aquatic organisms for human consumption must attest to the quality, safety and origin of fish before entry into the Uganda market
 - Rarely enforced
- All live fish imports must be accompanied by a Live fish import health certificate:
 - Attests to the veterinary clearance from source that the imported stock is free of disease and parasites specified by the Commissioner for Fisheries
 - This has been always enforced with good measure of success

Other official controls of imported aquatic organisms

- All major border control points have Ministry of Agriculture Officers manning the entry of agriculture products
- All live fish imported as broodstock for hatchery production

- Has to be quarantined and cleared at the National Aquaculture Research and Development Centre for certain period before release
- All importers and dealers in ornamental and bait fish
 - Must be registered and cleared with the Department of Fisheries Resources
 - Each imported live fish consignment must have import permit for the Department
 - There is mandatory inspection of all records and facilities handling imported live fish

Expertise in the country

- Import Risk Assessment
 - National Aquaculture Research and Development Centre technical personnel are legally responsible for such task
 - Can also be outsourced to Universities and private agencies
- Sanitary and Phytosanitary measures
 - Department of Crop Protection
 - Senior Agriculture Officer – coordinates the Ministry team on SPS

Surveillance and monitoring

- Department of Fisheries Resources Programme
 - Is required by law to conduct surveillance, monitor and keep a database on aquatic animal diseases occurrences and outbreaks
- The National Aquaculture Research and Development Agency
 - Is mandated to provide technical information on fish health and disease situation to the Department of Fisheries on a regular basis
- The Department of Fisheries Resources has also sanctioned private service providers in fish health management
 - Surveillance and monitoring of key emerging commercial aquaculture enterprises for fish diseases and parasites

Incident emergency response

- The Department of Fisheries Resources is currently in process of drafting and consulting on the fish health emergency plan
 - Under the responsibility of the Aquaculture Inspectorate Section
- For livestock
 - There is plan provided for legally under the remit of the Department of Livestock Health and Entomology
- For crop
 - There is plan provided for legally under the remit of the Department of Crop protection

Regulation of high-risk activities

- All movements of live or dead aquatic organisms within and/or from out into requires clearance of the Commissioner for Fisheries
 - Fish movement permit
 - Live fish import/export permits
 - Health clearance of such consignments
- There is a statutory instrument for regulation and control of all aquaculture activities in the country
 - Fish (Aquaculture) Rules, 2003
 - This gives the Commissioner powers to control and regulate all aquaculture practices
- There are several statutory instruments for capture fisheries that empower the Commissioner for Fisheries to regulate all kinds of activities including recreational fishing
 - In addition the Wild Life Act also regulates such activities

Waste disposal from seafood processing plants

- All plants for processing seafood require a certificate of clearance from National Environment Management Authority before being permitted to set up a plant
- Any body intending to establish a processing plant for seafood is required by law to submit a plan among others for treatment of effluents
- Annually the permit for operation of such a plant has to be renewed and requires compliance to the Fish (Quality) Assurance Rules, 1998
 - Key provision is adherence to treatment of the plant's effluents
- All the above is under the remit of the Department of Fisheries and National Environment Management Authority

Extension services

- According to the NAADS Act (2001), extension has to be farmer demanded and market driven
 - Therefore currently it's largely a remit of the private service providers
 - Government is meant to monitor the service providers on technical quality in the delivery of services
 - Government continues to provide for the poor farmers through contracted private service providers
- Government still has subject matter specialists in capture fisheries
 - Responsible for both regulation and guiding of fishermen in capture fisheries
- Government still retains Veterinary and Animal Husbandry Officers
 - Main responsibility is planning and regulation, but are also required to advise and support farmers especially in livestock disease control and management

Compliance and enforcement

- Aquaculture Inspectors under the Department of Fisheries Resources
 - compliance and enforcement of the regulations pertaining to aquaculture activities and practices
- Fisheries Regulation and Control
 - Remit of the Department of Fisheries Resources and cardinal role of the Commissioner for Fisheries
 - Regulation and Control officers
 - Authorized officers
- For livestock compliance and enforcements
 - Department of Production and Marketing
 - Department of Livestock Health and Entomology

Diagnostic capacity

- Parasitology
 - Department of Zoology, Faculty of Science, Makerere University
 - Department of Wild Aquatic Resources Management, Makerere University (WARM)
- Histopathology
 - Department of Zoology, Makerere University
 - WARM
- General bacteriology/mycology
 - Department of Zoology, Makerere University
 - WARM
- General virology
 - Uganda Virus Institute, Entebbe
- Histopathology
 - Department of Zoology, Makerere University, PO Box 7062, Kampala Uganda
 - WARM
- General bacteriology/mycology
 - Department of Zoology, Makerere University, PO Box 7062, Kampala Uganda

- WARM
- Electron microscopy
 - Not sure – but likely with Uganda virus institute and Mulago Medical School
- Tissue culture
 - Department of Zoology, Makerere University, PO Box 7062 Kampala Uganda
 - WARM
- Molecular diagnostics
 - Makerere University Institute of Natural Resources, PO Box 7062 Kampala
 - Virus Research Institute - Entebbe
- Immunoassay (e.g. ELISA)
 - Department of Biochemistry, Makerere University, PO Box 7062 Kampala, Uganda
- Water quality analysis
 - National Fisheries Research Institute, Nile Crescent, PO Box 343 Jinja Uganda
 - Ministry of Water and Environment laboratories at the Division of Water Resources Management , Entebbe, Uganda

Aquatic animal diseases

- Uganda's expertise is very limited
 - Many of young scientists lured into this line of work are only currently undergoing specialized training outside the country
 - There is going to be a Fish Pathology Laboratory at the National Aquaculture Research and Development Centre after completion of the rehabilitation
 - A number of students under going graduate studies through Makerere University will be available in a year
 - There is no specialised expert in diagnosis/identification of diseases/pests of aquatic plants/algae
- There is very limited capacity existing at the Universities in Aquatic Animal Disease diagnosis let alone health

Research and training

- National Aquaculture Research and Development Centre includes Aquatic Biosecurity in its programme
- There is but very limited training in aquatic biosecurity at local Universities and other tertiary institutions
- Makerere University offers :
 - a Bachelor of Science degree in Fisheries and Aquaculture
 - a Bachelor of Science degree in Zoology with options for hydrobiology
 - a Master of Science in Aquatic sciences which include a strong component of aquaculture science
- Busoga University offers a degree in Fisheries and Aquaculture
- There are a number of midlevel institutions offering hands-on diplomate study programmes in aquaculture and fisheries
- Core and strategic aquaculture research remains a remit of the National Aquaculture Research and Development Centre
 - Publically funded research in aquaculture is now competitive, open to competition from persons and agencies interested
- The National Fisheries Resources Research Institute based in Jinja is responsible for capture fisheries research
- Faculty of veterinary medicine is responsible for training and academic research in animal health (non-aquatic)
- Bukalasa and Arapai institutes are mid level institutes that training hands-on management as Animal Husbandry Officers

Uganda's aquatic animal knowledge base

Field of expertise	Level of qualification				
	Doctorate	Masters degree	Veterinary degree	Bachelors degree	Other (specify)
Aquatic biosecurity	0	04	0	20	
Veterinary science (non-aquatic)	40	12	1 200	200	
Aquaculture	06	60	0	120	
Fisheries science	40	15	0	200	

Main aquatic biosecurity challenges in Uganda

- pathogens/diseases of aquatic animals:
 - Inadequate knowledge of the practicing farmers in identifying and managing diseased fish
 - Lack of information and records on occurrence and impact of the disease/parasites/pests on cultured organisms
 - Limited personnel, technology and infrastructure to handle disease/parasites/pests in culture aquatic animals
- pathogens/diseases or pests of plants/algae:
 - Lack of experts in pathogens/diseases or pest of plants/algae
- invasive aquatic pest species:
 - Lack of expertise
- Inadequate capacity to manage aquatic biosecurity
 - Technological and physical infrastructure
 - Human resources
 - Logistics required

ANNEX 13

Working group themes, guidelines and members

Working group themes

- A Risk analysis and translocation controls (national/domestic)
- B Extension and enforcement (compliance)
- C Diagnostic capacity and technical expertise
- D Surveillance and emergency response

Guidelines for group activity

- Participants will be divided into 4 working groups
- Decide on a scribe and a presenter
- Identify projects or initiatives aimed at meeting capacity building needs for each topic of group activity

Considerations:

- Regional and national
- Can be small or big
- Should range from what is achievable now to more ambitious projects
- Who (drives/involved); how; timeframe (short-, medium-, long-term); resource needs
- Prioritize

Working group members

<p>Day 2 Group A Risk analysis and translocation controls (national/domestic) Mr Wilson Waiswa Mwanja – Uganda* Ms Esperanza Justiz Silva - Angola Mr Rafael Rafael – Mozambique Mr Shaft. M Nengu – Botswana Mr Gilson R. Njunga – Malawi Mr E. Katunguka-Rwakishaya – Uganda</p>	<p>Day 2 Group B Extension and enforcement (compliance) Ms Beatrice Nyandat – Kenya* Mr Kitojo Wetengere - Tanzania Mr Hang’ombe Bernard Mudenda – Zambia Mr Gilbert Hope Moyo – Zimbabwe Mr Geoffrey Kanyere – Malawi</p>
<p>Day 3 Group C Diagnostic capacity and technical expertise Mr Gilson R. Njunga – Malawi* Mr Gilbert Hope Moyo – Zimbabwe Mr Wilson Waiswa Mwanja – Uganda Mr Kitojo Wetengere - Tanzania Ms Beatrice Nyandat – Kenya Mr E. Katunguka-Rwakishaya – Uganda</p>	<p>Day 3 Group D Surveillance and emergency response Mr Hang’ombe Bernard Mudenda – Zambia* Mr Shaft M Nengu – Botswana Mr Rafael Rafael – Mozambique Ms Esperanza Justiz Silva – Angola Mr Geoffrey Kanyere – Malawi</p>

ANNEX 14

Recommendations, outputs and agreed follow-ups of the Lilongwe Workshop

In order to improve aquatic biosecurity in Southern Africa, the participants at the FAO Workshop on the Development of an Aquatic Biosecurity Framework for Southern Africa held at the Sunbird Hotel in Lilongwe, Malawi, from 22 to 24 April 2008 made the following recommendations:

1. Participants³ strongly recommended that the countries in the region should work closely in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the World Animal Health Organisation (OIE) during addressing matters pertaining to aquatic animal health and biosecurity.
2. FAO should write to participating governments participating in the regional Technical Cooperation Programme (TCP) project to highlight the importance of establishing formal focal points (akin to those established under an OIE initiative), asking for nominations. It was suggested that workshop attendees be the FAO focal point for aquatic biosecurity issues. It would be necessary to develop terms of reference for the focal points, including responsibilities and accountability, including raising awareness.
3. FAO should develop a follow-up project aimed at aquatic biosecurity capacity building in southern Africa. There is also an urgent need for a regional project for evaluating legal frameworks for aquatic biosecurity (with the need to link biodiversity, production and trade). Several countries advised of their intention to write a letter of support/request to the FAO for a regional project addressing both legal and capacity building issues.
4. The University of Zambia's School of Veterinary Medicine, through Dr Hang'ombe Bernard Mudenda, was identified as potential regional diagnostic centre and Uganda as a regional coordination centre.
5. FAO should develop a southern Africa regional model on import risk assessment for introductions and transfers of live aquatic animals.
6. Ministerial level meeting for southern African countries should be held to discuss aquatic animal biosecurity needs.
7. There is a need for a Web site on aquatic biosecurity to assist the southern African region on aquatic biosecurity issues. Participants recommended the establishment of a regional aquatic biosecurity information network including a dedicated Web site. As the first step, Mr Wilson Waiswa Mwanja of Uganda would coordinate establishment of an e-mail group for networking on aquatic biosecurity issues.
8. The participants identified the need for a joint FAO/OIE/Workshop statement as an outcome of the workshop.

³ See Annex 1 – List of participants

Follow-up activities

The following follow-up activities are being initiated/completed.

- The Aquatic Biosecurity Framework which will contain the broad development needs and recommendations for projects and activities with associated timelines aimed at enhancing southern African region's (as well as individual participating countries') capacity to effectively manage aquatic biosecurity risks and the workshop report are being finalized.
- Correspondence concerning establishing a communication platform on aquatic biosecurity among fisheries and focal points (FAO and OIE) in southern Africa had been initiated. The representative from Uganda volunteered to take a lead on this.
- At the recommendation of this regional workshop, a number of FAO focal points participated in the OIE seminar on "OIE international standards, a lever for growth in the fisheries and aquaculture sector in Southern Africa" organized by the OIE Subregional Representative, held in Maputo, Mozambique from 10 to 12 June 2008.
- Discussion are being made to include the southern Africa aquatic biosecurity framework in the broad FAO programme of work on SPADA (Special Programme for Aquaculture Development in Africa) and the aquatic biosecurity workshop participants to be included in the newly established Aquaculture Network for Africa (ANAF).

Workshop photographs



Opening ceremony guest speaker Mr Mazlan Jusoh, FAO Representative



Opening ceremony guest speaker Mr Alex Bulinari, Malawi Fisheries Department Director



Opening ceremony guest speaker Dr Rohana Subasinghe, FAO Fisheries and Aquaculture Department



Prof. Eli Katunguka-Rwakishaya (OIE) making a presentation



Dr Patrick Bastiensen (OIE), second from left, with regional participants from Zambia, Kenya, Uganda and Tanzania

Workshop group photograph



Eighteen officials (from fisheries and veterinary authorities) representing nine countries (Angola, Botswana, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe) and including those from OIE and FAO participated to the FAO Workshop on the Development of Aquatic Biosecurity Framework for Southern Africa, Lilongwe, Malawi, 22–24 April 2008.

The recent incursion of a serious finfish disease, epizootic ulcerative syndrome (EUS), in the Chobe-Zambezi River – and now confirmed in Botswana, Namibia and Zambia – revealed biosecurity weaknesses in the southern African region. The Workshop on the Development of an Aquatic Biosecurity Framework for Southern Africa was convened by FAO, as part of its continuing assistance to the region. The objectives were to understand the current situation, to prepare a regional framework and to identify capacity building needs to address aquatic biosecurity concerns which present potential risks to communities that depend on fisheries and aquaculture for food and livelihood.

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