EAST AFRICAN COMMUNITY

LAKE VICTORIA FISHERIES ORGANIZATION

SECRETARIAT

LAKE VICTORIA BASIN REGIONAL AQUATIC ORGANISMS' HEALTH STRATEGY (2024-2034)

This project is funded by the European Union

TRUEFISH ADVANCING AQUACULTURE

Landell Mills

Food and Agriculture Organization of the United Nations

WorldFish

LAKE VICTORIA BASIN REGIONAL AQUATIC ORGANISM HEALTH STRATEGY 2024-2034 (LVB RAOHS)

Table of Contents

Preparation of this document v
Acknowledgements vii
Abbreviations and Acronyms viii
Executive Summary x
1. INTRODUCTION 1
1.1 Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB) 1
Principles of PMP/AB 2
Implementations of PMP/AB 3
Opportunities/ Benefits for PMP/AB 3
1.2 Lake Victoria Fisheries Organisation (LVFO) 4
Mandate of LVFO 4
Achievements of LVFO in harmonizing regional frameworks in fisheries and aquaculture 4
Alignment of LVFO activities to the broader National, Regional and global context 5
Role of LVFO in LVB RAOHS 7
2. CURRENT STATUS OF AQUACULTURE DEVELOPMENT AND AQUATIC ANIMAL HEALTH MANAGEMENT 8
2.1 Aquaculture development in Lake Victoria Basin 8
2.2 Aquatic Animal Health – Self-assessment Surveys in PMP/AB context 10
Policy, legislation and enforcement 11
Human Resources and Institutional Capacity Development 11
Pathogen List 12
Disease Diagnostics 12
Risk Analysis 13
Farm-level Biosecurity and Health Management 13
Emergency Preparedness and Contingency Planning 13
Border Inspection, Health Certification and Quarantine 14
Surveillance, Monitoring and Reporting 14
Zoning and Compartmentalization 14
Communication and Information System 15
Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance 15
Research and Development 15
Regional and International Cooperation 15
Ecosystem Health 16
2.3 Gap analysis 16
2.4 Entry Points of LVB countries within the PMP/AB 17
3. LAKE VICTORIA BASIN REGIONAL AQUATIC ORGANISM HEALTH STRATEGY 19
3.1 Rationale 19
Impact of aquatic diseases/mortalities of fish 20
Streamline Trade in aquatic organisms among LVB countries 20
Alignment of LVB RAOHS to existing frameworks 21
3.2 The scope of the strategy 21

3.3 Development process of the strategy 22
3.4 Designing of the Strategy 23
3.5 Implementation framework 24
3.6 Financing framework 25
3.7 Purpose of the Strategy 25
3.8 Mission 26
3.9 Vision 26
3.10 Guiding principles for the implementation of the strategy 26
3.11 Monitoring, evaluation accountability, and learning 28
4. PROGRAMMES 29
4.1 Programme 1: Policy, legislation, and enforcement 29
Background 29
Current status 29
Objectives 29
Activities 30
4.2 Programme 2: Human Resources and Institutional Capacity Development 31
Background 31
Current Status 32
Objectives 32
Activities 32
4.3. Programme 3: Institutional Structure 33
Background 33
Current Status 33
Objectives 34
Activities 34
4.4. Programme 4: Pathogen List 34
Background 34
Current Status 35
Objectives 35
Activities 35
4.5. Programme 5: Disease Diagnostics 35
Background 35
Current Status 36
Objectives 36
Activities 36
4.6. Programme 6: Risk Analysis 37
Background 37
Current status 37
Objectives 38
Activities 38
4.7. Programme 7: Farm-level Biosecurity and Health Management 39
Background 39

Current Status 40
Objectives 40
Activities 40
4.8. Programme 8: Emergency Preparedness and Contingency Planning 41
Background 41
Current Status 41
Objectives 42
Activities 42
4.9. Programme 9: Border Inspection, Health Certification and Quarantine 44
Background 44
Current Status 44
Objectives 44
Activities 45
4.10. Programme 10 Surveillance, Monitoring and Reporting 46
Background 46
Current Status 47
Objectives 47
Activities 47
4.11. Programme 11: Zoning and Compartmentalization 47
Background 47
Current Status 48
Objectives 48
Activities 48
4.12. Programme 12: Communication and Information System 48
Background 48
Current Status 49
Objectives 49
Activities 49
4.13. Programme 13: Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance 49
Background 49
Current Status 50
Objectives 50
Activities 50
4.14. Programme 14: Research and Development 51
Background 51
Current Status 51
Objectives 51
Activities 51
4.15. Programme 15: Regional and International Cooperation 52
Background 52
Current Status 53
Objectives 53

Activities 53
4.16. Programme 16: Ecosystem Health 54
Background 54
Current Status 54
Objectives 54
Activities 54
5. REFERENCES 56
Annex I: LVB RAOHS Implementation Table 59
Annex 2: Detailed indicative budget required to implement the strategy 52

List of Figures

Figure 1: The four stages of the Progressive Management Pathway for Aquaculture Biosecurity. .. 2
Figure 2: The different scenarios for countries adapting the PMP/AB. 3
Figure 3: The map of Lake Victoria basin countries and the river network into the lake. 8
Figure 4: The 16 components of a Regional Aquatic Organism Health Strategy in relations to the PMP-AB. 24

List of Tables

Table 1: Population fish production levels and economic indicators in the LVB countries. 9
Table 2: The ten-year production trend of Nile Tilapia and African catfish in the LVB countries . 10
Table 3: The Summary of the results of SWOT Analysis..... 16
Table 4: Estimated level of aquatic biosecurity for LVB countries, scenario, and entry points along the PMP/AB..... 17

Preparation of this document

This document is the outcome of a systematic process initiated by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with Lake Victoria Fisheries Organisation (LVFO), with funding from the EU-EAC True Fish Farming project in Lake Victoria Basin (TRUEFISH) project (FRUG-GCP/RAF/519/EC). Under component 3, Result Area 3.1 "Aquatic Animal Health (AAH)", the project aimed to establish an effective AAH regulatory regime and guidance; AAH management systems; Aquatic Animal Diseases Surveillance and Controls and to enhance capacity and Awareness.

The process started with national self-assessment surveys on Aquatic Organism Health (AOH) capacity and performance in the five Lake Victoria Basin member countries: Burundi, Kenya, Rwanda, Tanzania and Uganda. The objectives of FAO Aquatic Organism Health Capacity and Performance Self-Assessment Survey Questionnaire were to a) obtain information on a country's national capacity and government agencies mandated to implement aquatic biosecurity programmes and support aquaculture through healthy production; b) determine which components and activities should be included in the aquatic organisms health strategy; and c) assist in guiding national strategic planning to improve aquatic organism health and ensure adequate support services. The respondents of Self-Assessment Survey Questionnaire included National Focal Points (NFPs), fisheries extension officers, representatives of academia involved in aquatic organisms training, with assistance from the national consultants in aquatic organisms' health and biosecurity where necessary. Concurrently, LVFO initiated the establishment of a 25-Member Aquatic Animal Health Technical Working Group within the Lake Victoria Fisheries Organization (LVFO - AAHTWG). Furthermore, LVFO TRUEFISH requested national governments to appoint national focal points for Aquatic Organism Health to provide technical oversight, offer high-level advice, and participate in formulating the regional strategy for aquatic organism health and aquaculture biosecurity.

The responses from the Self-Assessment Survey Questionnaires were summarized by national consultants and presented to LVFO AAHTWG and stakeholders, including representatives from government, academia, research organizations, private sector, and civil/ non-government organizations as well as FAO co-opted experts, during the FAO-TRUEFISH Stakeholder/Expert Regional Workshop and Training in Aquatic Animal Health and Aquaculture Biosecurity held in July from 12th to 15th 2022 in Dar es Salaam, Tanzania. The approved National summaries were further analysed and compiled into a series of survey summary tables by the International Consultant.

In February 2023, the FAO TRUEFISH Project organized another Regional Workshop and Training for the LVFO AAHTWG to finalize the analysis of the national assessments, discuss the drafting of the regional AOH strategy and develop the initial list of pathogens and diseases. The team also discussed the list of Strengths, Weaknesses, Opportunities and Threats developed International Consultant and adopted key Strengths, Weaknesses, Opportunities and Threats developed by the International Consultant and adopted key elements to produce a LVFO Regional SWOT Analysis. Taking into consideration all relevant information contained in the baseline summary tables, regional reports and SWOT analysis, a framework was prepared and used to develop draft Regional Strategy for Aquatic Organism Health for the Lake Victoria Basin (LVBRAOHS). Through iterations of exchanges, the draft LVB RAOHS was reviewed by LVFO AAHTWG and key stakeholders including representatives from research centres, academia,

intergovernmental organisations, and national governments. The Third draft was presented and adopted with comments at the 4th FAO-TRUEFISH meeting. After incorporating all the comments from the 4th FAO-TRUEFISH meeting, the final draft was presented to the LVFO Scientific committee and recommended for onward submission to the Fisheries and Aquaculture Council of Ministers for approval.

Acknowledgements

We extend our gratitude to the National Focal Points (NFPs), Academic officials and Fisheries Extension staff across respective countries and institutions for sparing their time to complete the FAO Aquatic Organism Health Capacity and Performance Self-Assessment Survey Questionnaire. Special recognition is due to the FAO international Consultant for compiling the regional report on Aquatic Organism Health Capacity and Performance and for spearheading the developing of the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis.

We also thank the national consultants in aquatic organisms' health and biosecurity for their assistance in reaching out to diverse stakeholders to gather relevant information on aquatic organism health. Our sincere admiration and appreciation go to the tireless efforts of the TRUEFISH Project Technical Adviser, Jose Parajua, the FAO Senior Officer Dr Melba Reantaso for their effective initiation and leadership in driving the action forward.

We acknowledge the technical support provided by International Consultant, Dr. Ramesh Perera, for analyzing the self-assessment survey questionnaire responses and drafting the SWOT and LVB RAOHS. Special thanks to the LVFO Secretariat, particularly Dr. Taabu Anthony Munyaho; Elysee Nzohabonayo and Edward Rukuunya, for their valuable contributions during various meetings. We also appreciate the support from the Team from FAO Regional Office for Africa (RAF), including Dr. Dismas Mbabazi, Mr. Koffi Honouga, as well as the FAO Food Safety, Nutrition and Health (NFIMF) Team and the Fisheries and Aquaculture Division (NFI) Senior Management Team, for their guidance and endorsement which greatly facilitated the development of this LVB RAOHS.

Importantly, we sincerely acknowledge the financial support from EU-EAC True Fish Farming Story in Lake Victoria Basin (TRUEFISH) project FRUG-GCP/RAF/519/EC), Component 3, Result Area 3.1 "Aquatic Animal Health," funded by the European Union.

Abbreviations and Acronyms

AIS	Aquatic invasive species
AAH	Aquatic Animal Health
AAHTWG	Aquatic Animal Health Technical Working Group
AHPND	Acute hepatopancreatic necrosis disease
ALOP	Appropriate level of protection
AMR	Antimicrobial resistance
AMU	Antimicrobial use
AOH	Aquatic Organism Health
AST	Antimicrobial susceptibility testing
ATLASS	Assessment Tool for Laboratory and AMR Surveillance Systems
AVC	Aquaculture value chain
BMPs	Better/Best management practices
CA	Competent Authority
CCRF	Code of Conduct for Responsible Fisheries and Aquaculture
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EAC	East African Community
EC	European Commission
EDRT	Emergency Disease Response Team
EKE	Expert knowledge elicitation
EPRS	Emergency preparedness and response system
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GAqP	Good aquaculture practices
GDP	Gross domestic product
HACCP	Hazard analysis and critical control points
HH	High health
ICES	International Council for the Exploration of the Sea
IMNV	Infectious myonecrosis virus
IRA	Import risk analysis
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
IUCN	International Union for the Conservation of Nature
LVB	Lake Victoria Basin
LVFO	Lake Victoria Fisheries Organization
LWG	Legal working group
MME	Mass mortality event
MOU	Memorandum of understanding
NACA	Network of Aquaculture Centres in Asia-Pacific
NADL	National aquatic disease list
NAOHS	National Aquatic Organism Health Strategy
NAP	National action plan
NAPL	National aquatic pathogen list
NFP	National focal point
NFIMF	FAO Food Safety, Nutrition and Health (Team)
NIF	FAO Fisheries and Aquaculture Division
PMP/AB	Progressive Management Pathway for Improving Aquaculture Biosecurity

PPP	Public-private partnerships
RABS	Regional Aquatic Biosecurity Strategy
RAOHS	Regional Aquatic Organism Health Strategy
SADC	Southern Africa Development Community
SIDA	Swedish International Development Agency
SOP	Standard operating procedure
SPF	Specific-pathogen-free
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAAD	Transboundary aquatic animal disease
TiLV	Tilapia lake virus
TOR	Terms of reference
TWG	Technical working group
VCA	Value chain analysis
WHO	World Health Organization
WOAH	World Organisation for Animal Health
WSD	White spot disease
WSSV	White spot syndrome virus
WTO	World Trade Organization

Executive Summary

The Regional Aquatic Organism Health Strategy for the Lake Victoria Basin (LVB RAOHS) is devised to enhance aquatic biosecurity, bolster aquatic organism health management capacity, conserve aquatic biodiversity, improve food security, nutrition, and safety, as well as promote sustainable management of aquatic resources in the LVB countries (Burundi, Kenya, Rwanda, Tanzania, and Uganda). This strategy aims to mitigate risks posed by regionally-identified and World Organisation for Animal Health (WOAH)-listed diseases. Implementation of this strategy is expected to achieve the following outcomes:

- Improved regional management of aquatic animal health and welfare by strengthening coordination among stakeholders and fostering collaboration among LVB countries to ensure effective management of aquatic animal health.
- Enhanced awareness and capacity building through training programmes organised for aquatic animal health experts, aquaculturists, and other stakeholders regarding responsible and scientifically justifiable practices for optimal aquatic animal health management.
- Enhanced technical capacity at various expertise levels within Competent Authorities and other relevant agencies responsible for aquatic animal health management.
- Collaborative efforts and confidence built among LVB countries to instil confidence in the aquaculture sector and other stakeholders in the efficacy of national Competent Authorities, state veterinary services, and relevant extension services.

The LVB member countries can enter PMP/AB under Scenario 1 – "Members with no national aquaculture biosecurity strategy in place, but an aquaculture sector exists or is in the early stage of development", and Scenario 4 – "Members whose aquaculture biosecurity is dependent on the biosecurity situation in neighbouring countries due to shared water bodies, watersheds or coastlines and where a regional or sub-regional aquaculture biosecurity strategy exists or is needed" at stage I of the PMP/AB. Therefore, LVB RAOHS comprises 16 major programmes, each addressing specific thematic areas, but interrelated to achieve the overarching goals of the strategy. The thematic areas, include policy formulation, institutional capacity development, disease diagnostics, biosecurity measures, emergency preparedness, surveillance, research, regional cooperation, and ecosystem health. The Programmes encompass a total of 42 activities, categorized based on the relevance to the PMP/AB country scenarios and the anticipated PMP-AB stage of implementation. The responsibilities for completion of each activity are designated to either the East African Community/Lake Victoria Fisheries Organization (EAC/LVFO), national governments within LVB countries, or both, with proposed timeframes ranging from short (three years to long-term (ten years). Commitment of all the five LVB countries to support and implement various national activities concurrently is paramount to release the benefits of the strategy and PMP/AB approach owing to the shared water systems. Financing of the activities in the strategy include contributions from national government, technical cooperation and bilateral agreements and LVFO resource mobilisation activities as well as support development partners interested in aquatic organism health management.

In conclusion, the LVB RAOHS serves as a comprehensive framework to address the challenges posed by aquatic organism health in the Lake Victoria Basin by fostering collaboration, enhancing capacity, and implementing strategic measures to ensure sustainable management of aquatic resources while safeguarding biodiversity, food security, and public health in the region.

1. INTRODUCTION

The draft Lake Victoria Basin Aquatic Organism Health Strategy (LVB RAOHS) is an output of a systematic process of collaboration spearheaded by LVFO and FAO with funding from EU-EAC True Fish Farming Story in Lake Victoria Basin (TRUE-FISH) project. The project was implemented under three components: i) business, ii) skills and iii) sustainability. Under component 3: sustainable and bio-secure regional aquaculture production systems; TRUEFISH aimed to achieve a strengthened aquatic organisms' health conditions' through enhancing the capacities of regional governments and the private sector to manage aquatic animal health and environmental impacts (Result 3.1). The goal of FAO-TRUEFISH project under component 3 was to assist Lake Victoria Basin (LVB) member countries in developing and harmonising national approaches to aquatic organism health and aquatic biosecurity through understanding and adopting the FAO's Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB).

The PMP/AB was conceived and promoted by Food and Agriculture Organization of the United Nations (FAO) in collaboration with the World Organisation for Animal Health (WOAH), and the Network of Aquaculture Centres in Asia-Pacific (NACA), industry and academic/research partners in fisheries and aquaculture. The goal of PMP/AB is to improve aquaculture biosecurity practices worldwide to support food security and nutrition, social and economic development and resilience, rural livelihoods, food safety and public health, and the environmental sustainability of the aquaculture sector. The approach aims to: i) reduce disease burden in aquatic systems; ii) improve aquatic health and welfare at farm, national and regional levels; iii) minimize global spread of diseases; iv) attract investment opportunities into aquaculture; v) optimize socioeconomic benefits from aquaculture as well as vi) achieve ONE Health goals. The PMP/AB provides a risk-based approach to aquaculture biosecurity based on value chain analysis (VCA) to assess, prevent, and manage risks to aquaculture. Adoption of the PMP/AB is expected to facilitate regional aquaculture development and sustainable aquatic organisms' production through improved aquatic biosecurity that reduces losses due to diseases. With improved aquaculture productivity and sustainability, the region will realise increased: a) employment, b) availability of inexpensive, protein-rich food, and c) foreign exchange earnings through elevated regional and international trade in live aquatic organisms and their products, which subsequently lead to improved well-being of the people of the LVB.

1.1 Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB)

PMP/AB was developed to support the designing of an elaborate and effective aquaculture biosecurity. The approach was adopted during the 10th session of the FAO Committee on Fisheries Sub-Committee on Aquaculture (COFI/SCA 10) (Trondheim, Norway, August 2019) with participation of representatives from Kenya, Tanzania and Uganda. Recommendation for continued promotion and implementation of the PMP/AB approach was made during the COFI/SCA 11th Session held in Rome, Italy in June 2022, with representation from Kenya, Tanzania, and Uganda. Further, during the COFI/SCA 12th Session held in May 2023, in Hermosillo, Mexico, with participants from Kenya, Tanzania and Uganda, FAO's activities on biosecurity and aquatic animal health through the PMP/AB and the activities of the Technical Working Group were commended, and the meeting encouraged FAO to continue the implementation through regionally approaches and working closely with other partners on aquatic animal health.

PMP/AB builds on existing frameworks, capacity and appropriate tools using risk-based approaches and strong stakeholder engagement to enhance aquaculture biosecurity capacity at the regional, national, local-sector and enterprise levels. PMP/AB focus on focuses on building resilience to aquaculture biosecurity vulnerabilities including threats to sustainable aquaculture due to pathogens and the associated diseases resulting from poor management practices, legal and uncontrolled trade, and lack of capacity in public and private institutions. Overall, the PMP/AB aims to achieve sustainable a) reduction in diseases burden; b) improvement of aquatic health and welfare, c) minimization of global spread of diseases; d) optimization of socioeconomic benefits from aquaculture; e) attraction of investment opportunities into aquaculture; and (f) achievement of One Health goals (FAO. 2023c).

The PMP/AB consists of four stages: 1) developing biosecurity strategy using a risk-based approach; 2) implementing biosecurity measures/systems; 3) enhancing biosecurity and preparedness and 4) sustaining biosecurity and health management systems established to support national aquaculture sector (Fig. 1).

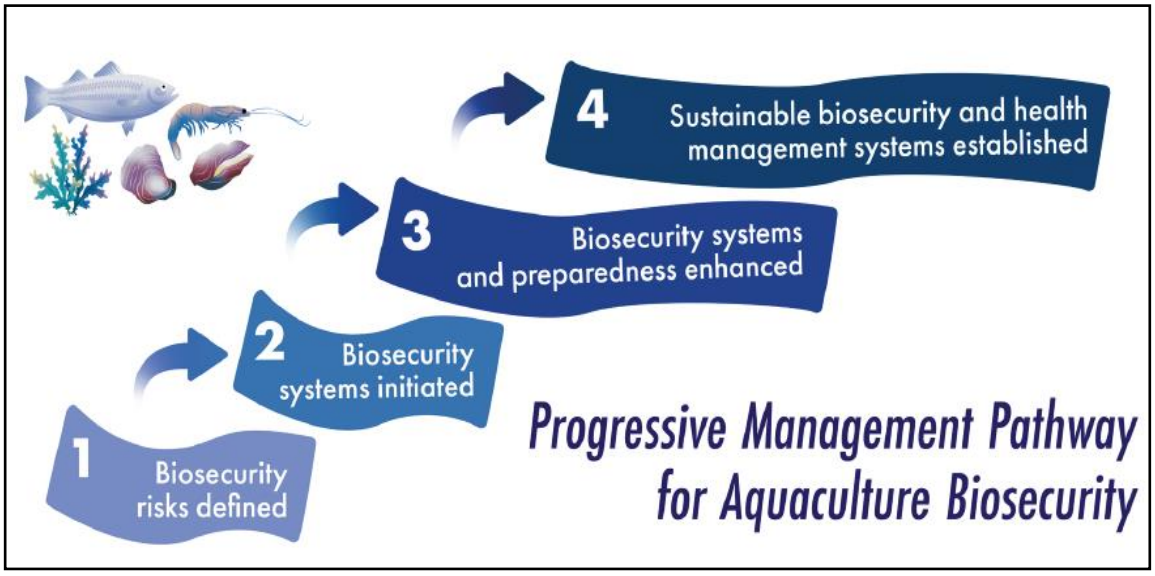

Figure 1: The four stages of the Progressive Management Pathway for Aquaculture Biosecurity. Source: FAO (2023c)

Principles of PMP/AB

The new initiative operates on the following principles:

a. *Risk-based approaches*: applies internationally accepted risk approaches along a value chain approach to identifying and managing risks to aquaculture production.
b. *Collaborative*: the strategic planning and implementation should be jointly developed by all actors along the value chain including industry stakeholders and governance authorities to ensure buy-in and best-fit for each country.
c. *Progressive*: the approach continuous auditing of the measures and improvement of enabling environment including legislative reviews and updates; zonation and compartmentalisation; as well as adjusting to emerging national, regional, and international conditions and requirements.

In addition, effectiveness of PMP/AB is enshrined in the following elements:

i. *Flexibility and inclusiveness*: the approach can be applied by a country to manage risks in any aquaculture sector, regardless of the species, environment, production system, and management strategy, size of operation and current aquatic biosecurity status as well as at individual farm level. Countries can start the pathway at any stage appropriate to the national situation, and progress at their own pace to the desired level of aquatic biosecurity.
ii. *Systematic planning and implementation*: PMP/AB is organised in four stages and requires each country to complete all activities in the stage, measured using set outcomes before proceeding to the next stage.

Implementations of PMP/AB

PMP/AB is a flexibility approach that can be initiated by any country irrespective of the status of national aquaculture biosecurity and stages of aquaculture development. The choice of entry is guided by four scenarios (Fig 2). Although actions in different stages can be initiate at the same time, countries must demonstrate achievement all the outcomes in that stage before moving to the next stage. The outcome must be described in a nationally endorsed strategic document called a Gateway Pass.

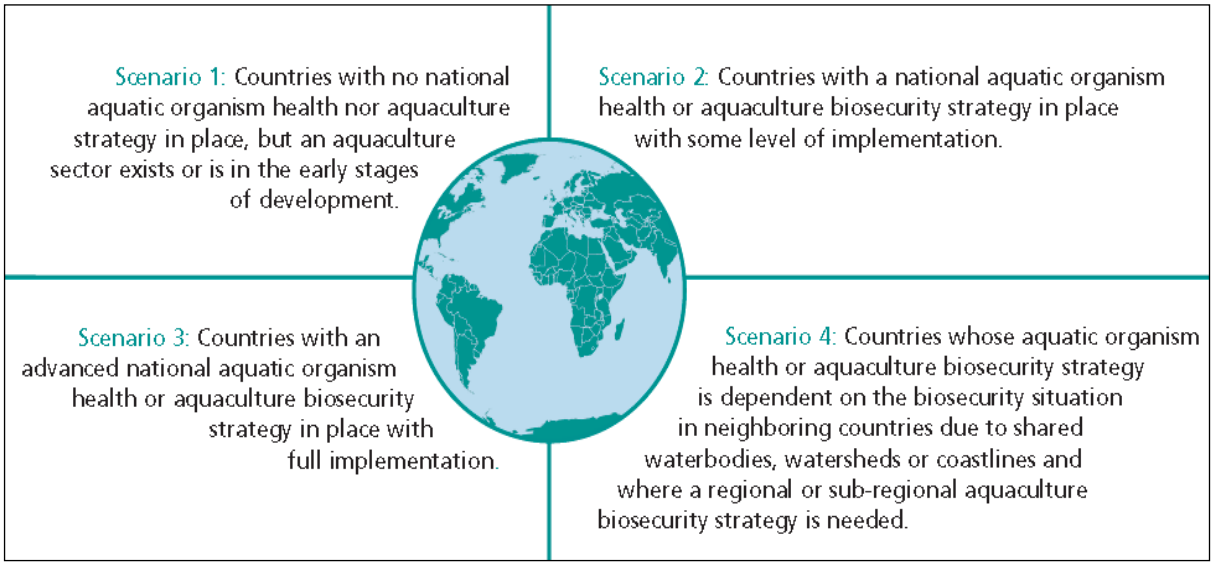

Figure 2: The different scenarios for countries adapting the PMP/AB.

Opportunities/ Benefits for PMP/AB

The PMP/AB offers LVFO member countries an opportunity to establish an enabling policy environment to harness aquaculture production in a sustainable manner that is responsive to environmental and human-induced challenges. PMP/AB promotes the awareness and adoption of appropriate biosecurity governance at the national, local-sector and enterprise levels, which can lead to a reduction in the incidence of pathogen introduction and impact of diseases as well as reduce reliance on veterinary medicines, whose misuse/ overuse can lead to the development of antimicrobial resistance (AMR). It provides a solid platform for joint formulation of strategic and implementation plans, as such, ensures buy-in and the best-fit for each member and promotes active engagement and long-term commitment to risk ownership and management by all actors. It can be applied to improve biosecurity for all forms of aquaculture production. Therefore, PMP/AB can be used to develop an aquaculture biosecurity strategy for existing aquaculture, new aquaculture sector or build or modify the existing regional or sub-regional aquaculture biosecurity

strategies. Importantly, each country can start the pathway at any stage appropriate to the national situation, and progress at their own pace to the desired level of aquatic biosecurity, hence PMP/AB does not create competition rather creates platform for collaborative learning.

1.2 Lake Victoria Fisheries Organisation (LVFO)

The Convention for the establishment of the Lake Victoria Fisheries Organization (LVFO) was signed in 1994 by Kenya, Tanzania, and Uganda, amended in 2016 to include other EAC Partner states: Rwanda and Burundi. The amended convention extended the focus of LVFO beyond Lake Victoria into covering all water bodies and aquaculture in the EAC region. LVFO is also recognized by Article 9.3 and Article 114, of the EAC Treaty, provides for the establishment of common fisheries management systems for inland and marine waters.

Mandate of LVFO

LVFO is the regional specialised institution mandated to coordinate the harmonization of the national and regional policies, law, regulations, standards, and guidelines to ensure sustainable management and development of fisheries and aquaculture resources within EAC region. The institution focus the operations on shared resources including Lake Victoria shared between Kenya, Tanzania, and Uganda and the Lake Victoria drainage networks in Burundi and Rwanda.

Achievements of LVFO in harmonizing regional frameworks in fisheries and aquaculture

The establishment of LVFO has been a cornerstone of the East African Community's efforts to address the challenges facing the Lake Victoria Basin and its water resources. The institute has already guided the harmonization and adoption several regional frameworks to ensure sustainable management and development of fisheries and aquaculture resources. Some of the frameworks include:

a) Harmonized East African Community guidelines for traders in Fish, Fishery, and Aquaculture Products and Inputs in Regional and International Trade to facilitate cross border trade by ensuring compliance with regulatory requirements and making sure that fisheries and aquaculture inputs and products that cross borders are of required standard, quality, and safety. The guidelines provided information on key requirements to trade, clearance procedures, different institutions and offices which handle imports and exports of fish, fishery and aquaculture products and inputs, documentations, and procedures at all border posts in the EAC and contribute to the implementation of the common market protocol.

b) Harmonized guidelines for establishment and management of fish breeding and nursery areas in Lake Victoria, which a) provided guidance regarding establishment and management of fish breeding and nursery areas and aid in restoration of degraded fish habitats and species; b) harmonized procedures for development of national guidelines, awareness creation, identification, mapping, validation, gazetting, marking, monitoring and evaluation of fish breeding and nursery areas c) specified roles and responsibilities of various stakeholders and d) provided a framework for collaboration and participation of key stakeholders in the management of the fish breeding and nursery areas.

c) Guidelines for Establishment and Operation of Cage Fish Farming in the East African Community to streamline and guide the establishment and operation of cage fish farming in line with international codes of practice for aquaculture to ensure environmental sustainability and harmony among the resource users.

d) Data, Information, and Knowledge Sharing Policy developed by LVFO with a goal of enhancing data, information, and knowledge sharing between the LVFO and its stakeholders. The policy has harmonised procedures for information and data acquisition, sharing and utilisation, to inform sustainable management and development of fisheries and aquaculture in the region.
e) Regional guidelines for fisheries co-management on Lake Victoria that guides the harmonized approaches to formation, functions, information flow and reporting and financing of co-management committees.

Alignment of LVFO activities to the broader National, Regional and global context

The contribution of LVFO to achieving various national, regional, continental, and international agreements and policies underscores the importance of LVB ROAHS, spearheaded by FAO-LVFO, to realising sustainable aquaculture development in the regional and beyond.

a) EAC Fisheries and Aquaculture Policy

Evidently, LVFO contributed to realization of the specific objectives of the EAC Fisheries and Aquaculture Policy. Notably, LVFO has contributed to: i) increased fish production to optimal levels and reduced fish post-harvest losses; ii) increased fish per capita consumption in the EAC; iii) increased annual fish exports; iv) increased public financing and private sector investments; v) enhanced capacity of centres of excellence on management, development, research and sharing of fisheries and Aquaculture data and information and vi) strengthen data and information collection and dissemination in fisheries and aquaculture for effective management and development at all levels.

b) FAO - Code of Conduct for Responsible Fisheries and Aquaculture (CCRF)

LVFO mission and vision, aligns to the Code of Conduct for Responsible Fisheries and Aquaculture and contributes to: i) promoting the contribution of fisheries to food security and food quality, prioritising nutritional needs of local communities; ii) promoting the trade of fish and fishery products in conformity with relevant international rules and avoid the use of measures that constitute hidden barriers to such trade and iii) serving as an instrument of reference to supporting member countries establish or improve the legal and institutional framework required for the exercise of responsible fisheries and aquaculture in the formulation and implementation of appropriate measures.

c) EAC Regional Strategy for Sustainable Aquaculture Development (2013)

LVFO aligns with objective III, “to provide a sustainable and enabling aquaculture environment to promote fish health, sanitation, and disease control”, of the EAC Regional Strategy for Sustainable Aquaculture Development. In this regards, LVFO supports the realisation of this objective by guiding member countries to develop and implement a Regional Aquatic Organism Health Strategy to safeguard aquatic organism health.

d) Regional Aquatic Biosecurity Strategy for the Southern African Development Community 2016.

The Southern African Development Community (SADC) is a regional economic community comprising 16 countries, including the United Republic of Tanzania. Established in 1992, SADC is committed to regional integration and poverty eradication within Southern Africa through economic development and ensuring peace and security. The SADC Aquatic Animal Health Strategy (2016- 2026) was approved and launched at the SADC Council of Ministers meeting on 14th August 2017, aims to support the growth of aquaculture industry through a long-term, enabling policy environment and a framework for a cooperative programme on aquatic animal health management and biosecurity governance at the regional and national levels. In this regard, LVFO extends the initiative to EAC to eliminate potential trade barriers of aquatic organism resources between the blocks.

e) World Organization for Animal Health

LVFO contributes to achieving the WOAH Aquatic Animal Health Strategy 2021–2025 goal, of improving aquatic animal health and welfare worldwide. Notably, LVFO through the LVB ROAHS, contributes to support EAC member countries to strengthen and harmonise Aquatic Animal Health Services; increase their capacity to respond to emerging aquatic animal health issues, foster regional collaborations to provide global aquatic animal health and welfare leadership as well as facilitate safe trade and improve aquatic animal health and welfare.

f) The African Union (AU) Policy Framework and Reform Strategy on Fisheries and Aquaculture

The African Union (AU) Policy Framework and Reform Strategy on Fisheries and Aquaculture adopted in Malabo, Equatorial Guinea in 2014 recognized the importance of intra-regional trade of fish and fishery products. The EAC member countries committed to "accelerate trade by developing fish value chains, promoting responsible and equitable fish trade and marketing in order to significantly harness the benefits of Africa's fisheries and aquaculture endowments". In order to accelerate trade and ensure safe trade of fish, issues of aquatic animal health and biosecurity are mandatory for the member states, to which LVFO has committed to realise.

g) National Legislation

According to the Countries Self-Assessment Survey conducted by FAO in 2021, none of the countries in the region that participated in the survey have a stand-alone legislation guiding aquatic animal health (AAH) issues. The AAH issues were embedded in different legislations managed by various Competent Authorities, thus creating a coordination nightmare and weakening enforcement, hence the need for harmonization of Competent Authorities for AAH. As a way forward, LVFO is obliged to support harmonization of policies and strategies among LVB countries and with the relevant international legislation.

Role of LVFO in LVB RAOHS

LVFO remain central in coordinating and promoting efforts towards sustainable management and development of aquatic resources in EAC for improved livelihood, food and nutrition security as well as wealth creation. To uphold sustainability of aquatic resources, LVFO collaborated with FAO in introducing the concept of PMP/AB to LVFO members and to support adoption and implement of measures to solve weakness/ gaps identified under Self-Assessment Surveys to enhance national Aquatic Organism Health Capacity and Performance. Subsequently, LVFO supported the drafting of the *Lake Victoria Basin Regional Strategy for Aquatic Organism Health*. The strategic framework aims to guide the adoption and promotion of PMP/AB approach to develop and implement harmonised aquatic animal health and biosecurity measures among member's countries. The initiative aims to reduce the risks of aquatic organism's diseases impacting a) fisheries and aquaculture productivity and sustainability, b) livelihoods of farmers, c) national economies, trade, environment, and d) human health in EAC through:

1. Improving regional cooperation in aquatic biosecurity and welfare.
2. Developing and implementing national strategies on aquatic animal health.
3. Improving surveillance, reporting and response to disease emergencies.
4. Promoting harmonization of diagnostic procedures and risk assessment.
5. Strongly promoting better aquatic animal health management practices at the farm level.

2. CURRENT STATUS OF AQUACULTURE DEVELOPMENT AND AQUATIC ANIMAL HEALTH MANAGEMENT

2.1 Aquaculture development in Lake Victoria Basin

The Lake Victoria Basin region comprises of five countries, namely: Burundi, Kenya, Rwanda Tanzania and Uganda (Fig. 1). The countries lying between 5°30"N 12°S and 28°45"E 41°50"E covering an area of 1,817,700 km^2 with 101,700 Km^2 (5.6% of the total area) covered with water.

Figure 3: The map of Lake Victoria basin countries and the river network into the lake.

The region has had human population growth of 23.2%, increasing from 126.6 million in 2009 to approximately 164.8 million in 2019 to 187.9 in 2021 (table 1). The regional Gross Domestic Product (GDP) has more than doubled from an estimated US$73 billion in 2009 to US$193.7 billion in 2019. The national economies of the five countries depend on agricultural sector, which contributes up to 60% of the GDP and employs over 70% of the total population in the region (EAC 2019). Fisheries sector is important non-traditional agricultural export commodity across the regional governments. However, the quantities of fish produced from aquaculture systems, and fisheries sector in general, vary tremendously across the LVB countries. Correspondingly, the contribution of fish to the national economies and fish consumption per capita vary significantly among countries (Table 1).

Table 1: Population fish production levels and economic indicators in the LVB countries.

	Burundi[%]	Kenya[@]	Rwanda*	Tanzania [X]	Uganda[#]
Total population (millions in 2021)	12.6	53	13.4	63.7[xx]	45.2
Gross Domestic Product (USD billions, 2019)	3.2	110.3	11.1	68.2	43.4
Per capita GDP (USD)	292	2,081	854	1.099	1,052
Contribution of Agriculture to GDP in 2021 (%)	28.7	22.4	24.0	26.1	24.1
Total fish production (tonnes 2021)	22,133	157,296	42,405	439,385	760,545
Total aquaculture production (tonnes 2021)	1,737	20,970	10,311	25,280	138,558
Contribution of aquaculture to total fish production (%)	7.8	13.3	24.3	5.8	18.2
Percent of fisheries to GDP (2021)	~0.1	0.7	0.4	1.8	2.2
Fish consumption in 2020 (kg/capita/yr)	2.5	2.9	4.5	8.5	14.8
Employment in agriculture sector including fisheries and aquaculture (%)	86.0	14.9	64.0	65.7[+]	61.4

Source: # = UBOS (2022); * = NISR (2022); x = TNBS (2022a); xx = TNBS (2022b); + = TNBS 2021), & = FAOSTAT 2023a; % = INSBU (2023); @ = KNBS (2022)

Historically, fish farming in East Africa was introduced between 1910s and 1950s by colonialists with aim of providing additional protein supplements and income to communities as well as for leisure through sport fishing (Egna 1998; Achieng 1994; Kabagambe 1994; Dadzie 1992; Corsi *et al*., 1986; Balarin, 1985). As such, the practice commenced with the culture of imported species, notably *Onchorynchus mykiss*; *Salmo trutta*, *Micropterus salmoides* and *Cyprinus carpio* in earthen ponds at extensive levels. The first domestication of native species including Redbelly tilapia (*Coptodon zillii*, previously known as *Tilapia Zillii*). In late 1950s, local species including Nile Tilapia (*Oreochromis niloticus*) and African catfish (*Clarias gariepinus*) were adopted for aquaculture.

Since introduction, the tilapia has been cultured, predominately in earthen-pond ranging in size from less than 500m² to 1500m^2, and receive low or no input with little or no need for routine management (Dadzie, 1992; Kabagambe 1994; Mugunti *et al*., 2021). Although appreciable quantities of Nile Tilapia produced were recorded in 1970s in LVB countries, almost three decades after the adoption of fish farming (El-Sayed 2020). Nonetheless, production from ponds has generally remained very low. Significant increase in tilapia production occurred following the introduction of cage culture (Table 2). Although cage fish farming was first demonstrated in 1970s in Tanzania (Ibrahim *et al*., 1975) and 1988 in Kenya (Aura *et al*., 2018), the technology only picked pace in 2000s following successful commercial trials in Kenya (LAT-FAO 2022; Njiru *et al*., 2019; Orina *et al*., 2021), Uganda (LAT-FAO 2022; Mbowa et al. 2017; Jonas et al., 2012; DFRU, 2008;), Rwanda (Kampayana et al., 2016) and Tanzania (LAT-FAO 2022). Since 2003, the number and size of cages on Lake Victoria rapidly increased from less than 2 units of 3m^3 in early 2000s to over 3000 units with an average diameter of 20m in 2022 (LAT-FAO 2022; Nyakeya *et al*., 2022; Orina *et al*., 2021; Musinguzi *et al*., 2019; Njiru *et al*., 2018). In Burundi, the first cage culture system was installed in Lake Dogodogo, Cibitoke province in 2012 (Fish Consulting Group 2012). Correspondingly, the tilapia production also increased tremendously after 2010 across all the LVB counties except Uganda, which started around 2005 (Table 2).

Meanwhile, the culture of African catfish (*Clarias gariepnus*) started as a polyculture with tilapia, to harness the predatorial habits, to control over-breeding in mixed-sex tilapia culture in earthen ponds. Commercial farming of African catfish gained momentum after optimizing seed production in 1970s (Hogendoorn 1979; Hogendoorn and Vismans 1980). The reproduction technologies were

adopted in Kenya around 1990s (Campbell *et al*., 1995) and in 2000s Uganda (Matsiko and Mwanja 2008) to supply fingerlings for Nile perch fishery. Within LVB, Uganda is the leading producer of African catfish and prior to introduction of commercial tilapia cage culture, this species contributed over 50% of total aquaculture production annually. Conversely, the contribution of African catfish to annual total aquaculture production in the other LVB countries has remained consistently lower than tilapia (Table. 2).

Generally, aquaculture establishments are concentrated within catchment of Lake Victoria, a shared water body between Kenya, Tanzania and Uganda but receives substantial water from Burundi and Rwanda. In addition to aquaculture, Lake Victoria accounts for about 98 per cent of all fish landings in the region. Therefore, the high concentration of aquaculture and extensive hydrological patterns directly linking water systems of the neighbouring countries, poses a very high risk of introduction pathogens into the system and across the entire region.

Table 2: The ten-year production trend of Nile Tilapia and African catfish in the LVB countries

	Burundi		Rwanda		Tanzania		Kenya		Uganda	
Year	Tilapia	Catfish	Tilapia	Catfish	Tilapia	Catfish	Tilapia	Catfish	Tilapia	Catfish
2001	48	2	381	14	300	-	412	304	1,350	540
2002	48	2	542	20	630	-	421	202	1,797	2,728
2003	48	2	1,000	2	2	-	600	319	2,000	3,000
2004	48	2	340	16	4	-	614	320	1,660	3,827
2005	48	2	18	16	4	-	622	318	4,221	6,528
2006	48	2	-	30	4	-	609	302	11,365	20,941
2007	48	2	58	2	4	-	2,965	890	16,763	34,096
2008	48	2	58	2	5	-	3,113	935	17,000	35,000
2009	48	2	58	2	75	-	3,424	1,047	21,445	54,956
2010	15	2	98	2	200	1	9,115	2,188	31,500	63,000
2011	60	2	165	100	221	-	16,602	3,984	28,101	57,300
2012	158	2	494	1	2,913	-	16,115	3,869	52,303	43,586
2013	380	5	1,153	1	2,980	5	17,626	4,230	47,841	49,491
2014	800	5	1,453	40	3,000	7	18,072	4,337	53,093	57,626
2015	1,260	66	1,533	74	3,500	10	13,991	3,358	57,329	59,914
2016	1,320	70	1,453	126	3,800	500	11,962	1,944	74,654	43,187
2017	1,380	75	3,200	156	9,000	2,000	9,885	1,606	74,924	37,195
2018	1,455	80	3,200	156	11,000	3,800	12,175	2,160	70,095	33,454
2019	1,460	80	3,450	182	15,417	788	14,850	2,650	71,287	31,401
2020	1,360	75	6,500	220	16,371	862	15,557	3,270	86,011	37,488
2021	1,400	75	9,700	260	24,016	1,264	16,350	3,450	98,471	39,605

Data source: FAOSTAT 2023b

2.2 Aquatic Animal Health – Self-assessment Surveys in PMP/AB context

Corresponding to the relatively low quantities of fish produced compared to Asia and low awareness about aquatic organisms' diseases among actors, reports regarding diseases outbreaks

are scarce. However, the observed rapid increases in fish production trends suggest expansion and growth of aquaculture sector characterised with intensification of production systems. In intensive systems, there are multitude of fish stressors, which, undoubtedly trigger and exacerbate episodes of disease outbreak. Besides, fish is widely traded organism, both alive and as products, hence pose a great threat of transferring the associated pathogens within and across national and regional boundaries. To better understand the prevailing national capacities and performances among LVB countries to prevent and control aquatic organisms" conditions/ pathogens, national self-assessment surveys were conducted, in the context of with Progressive Management Pathway for Improving Aquaculture Biosecurity within the five countries using the revised FAO self-assessment questionnaire on aquatic animal health capacity and performance. The assessment surveys are essential in estimating the national and regional entry points into the PMP/AB. The surveys a) generated information on the essential requirements needed to develop and support an efficient aquatic-health sector; and b) seek opinions on the biosecurity components and activities to strengthen national and regional Aquatic Animal Health Strategy. The outcome from different sections is summarized below, to highlight the current situation that necessitated the development of ROAHS.

Policy, legislation and enforcement

All five countries are members of the World Trade Organisation (WTO) and the World Organisation for Animal Health (WOAH) with national representative, the Chief Veterinary Officer (CVO). As members of the WTO, each country, is subject to requirements of the WTO-SPS Agreement. The SPS Agreements recognises the WOAH aquatic animal code and manual as representing the international standard for mitigating biosecurity risks associated with trade in live and non-viable aquatic animal commodities. The proposed RAOHS highlights the commitment of national governments to international principles of handling trade barriers. In addition, all countries use the FAO's Code of Conduct for Responsible Fisheries (CCRF) to guide the development of policies and/or standards related to ensure effective conservation, management, and development of living aquatic resources, with due respect for the ecosystem and biodiversity. Therefore, it is imperative for LVB national and regional to harmonise frameworks in tandem with international laws and regulations. Regarding legislation, all countries do not have a stand-alone legislation on AOH. Therefore, issues of AOH are addressed in more than one legislative document causing institutional complexity in coordination and collaboration. Although all five countries have compliance services are geared to enforcing import and export controls, the level of implementation and compliance is to a lesser extent enforced for international trade in live animals.

Human Resources and Institutional Capacity Development

Aquatic Organisms health requires expertise in, but not limited to, Pathology, Experimental Parasitology, Taxonomy/systematics, Virology, Bacteriology, Mycology, Epidemiology, Aquatic Toxicology, Molecular Diagnostics, Electron Microscopy, Aquatic Biosecurity (including risk analysis), Aquatic Medicine and Pharmacology and Aquatic Animal Health Information Systems. The survey revealed that both the regional and national levels had inadequate (in several cases, lack of) appropriate biosecurity expertise, thus, the ability to diagnose diseases and pathogens of aquatic organisms had remained low. Concerning capacity building, institutions have established or being established to undertake human resource building in aquatic organism health. However, the Veterinary institutions have their curricula containing very small portions that focus on training

on aquatic organisms' and hence aquatic animal disease remains a challenge to veterinarians. Therefore, the existing and ongoing training approaches in aquatic organism health can be enhanced and institutions supported to address the curricula limitations to produce appropriate human resources capable of assisting respective countries develop Aquatic Organism Health Strategies and addressing the requirements of PMP-AB implementation.

Pathogen List

Knowledge about the diversity and distribution of aquatic organisms' pathogens is critical in designing control measures and developing initiatives to prevent introductions and spread of pathogens. National pathogen lists underpin surveillance and monitoring programs, disease notification/reporting obligations, aquatic animal health certification, and emergency disease preparedness and response plans. Although, Burundi and Tanzania have listed yersiniosis, herpesvirosis, corynebacteriosis and pseudomoniasis among other broad categories of viral, fungal diseases and nutritional deficiencies. However, the information is too broad or not sufficiently inclusive of known significant aquatic animal pathogens to be useful for purposes of reporting, surveillance and monitoring, disease control/eradication or health certification. Meanwhile, Kenya, Rwanda and Uganda do not have a National Aquatic Pathogen List (NAPL) or National Aquatic Disease List (NADL). Furthermore, neither disease surveillance efforts nor aquatic organism health information systems (AOHIS) are present in the five countries. Yet, AOHIS is supposed to record, collate and analyse data and to report findings, which is an essential tool in effective management of AOH especially in surveillance and monitoring, health certification, zoning and international reporting. Given the shared risks associated with the location within the LVB countries, it is logical for the five countries to work together to identify selection criteria for listing and jointly develop a list of significant pathogens for national listing, which forms part of the Aquatic Organism Health Strategy.

Disease Diagnostics

Diagnostic capacity is essential for effective governance of aquatic organism health and support surveillance and monitoring, disease reporting, zoning and compartmentalization, health certification and emergency disease preparedness and response especially in detection of emerging pathogens. Diagnostics range from gross filed observations (Level I) to technologically advanced laboratory analyses (Levels II and III). All levels of testing and the ability to meeting high demand of testing during surge period associated with serious disease outbreaks are critical in satisfying country's diagnostic needs and WOAH aquatic animal health standards. Self-assessment survey results revealed that most countries of the LVB have some infrastructure at universities and research institutions dedicated to performing basic aquatic organism health assessment (Levels I and II) and were accessible for implementation of the PMP-AB. However, diagnostic capacities especially requiring level III diagnosis following WOAH methodologies were inadequate for WOAH-listed diseases. There is also a lack of national diagnostic standards and accreditation of laboratories for aquatic organism diseases within the region. The region has no international or national reference centres for aquatic organism disease diagnostics, hence a clear need to increase the disease diagnostics capability of the LVB countries. A detailed analysis of laboratory services in the LVB countries is a first logical step towards improving diagnostic capacity in the region.

Risk Analysis

PMP/AB utilised risk-based approaches to enhance aquaculture biosecurity capacity at all levels: enterprise, national, and regional levels. Risk analysis is a structured process that provides a flexible framework within which the risks of adverse consequences resulting from a course of the action can be determined and management options evaluated systematic in a scientific manner. Therefore, risk analysis is an essential component of AOHS. Aquaculture enterprises are operated by complex network of actors, beginning with production and ending with the consumer, each posing a risk of entry and establishment of a pathogen. Therefore, value chain analysis and risk analysis are combined to provide a risk-based and people-centred approach to planning disease control measures for aquaculture systems, hence demand for well-seasoned capacity to undertake the process. Although some countries appear to be undertaking pathogen/disease risk assessments as part of the broader aquatic organism health management activities, all the LVB member countries lack personnel with expertise to undertake risk analysis. It is worth noting that "Harmonized fisheries and aquaculture border inspection manual for East African Community", was developed to enhance fish and fish products' trade, the systems, documentation, and procedures at border posts, are primarily concerned with food safety risk with no mention of pathogen risks associated with cross border trade in live aquatic organisms.

Farm-level Biosecurity and Health Management

The farm activities including internal and external measures take to minimize risk are central in preventing entry and spread of aquatic organism pathogens. Apparently, national governments have laws and regulations requiring farmers to have farm biosecurity plans, undertake disease reporting and record keeping obligations, adhere to movement control of organisms into or out of farms, appropriately manage farm wastewater and use farm chemicals including antimicrobials, most farmers have limited knowledge on pathogens. Meanwhile, the responsibility and level of awareness among other actors are not streamlines. In addition, there is lack of personnel with expertise in the diverse sets of skills needed in the various aspects of AOH programmes, budgetary constraints; inadequate diagnostic capacity; weak enforcement; overlapping agency mandates and poor communication between agencies participating in AOH; the infancy of aquaculture as an industry in the region constraints to implementing effective aquatic animal health programmes. Besides, compliance services in all five countries appear to have greater emphasis on managing imports and exports especially with respect to food safety and to a lesser extent, international trade in live aquatic animals.

Emergency Preparedness and Contingency Planning

Emergency preparedness is the ability to respond rapidly and effectively to disease emergencies supported by effective surveillance and monitoring as well as reporting systems. A good emergency preparedness plan requires a detailed contingency planning outlining the early notification pathways, coordination between agencies and industry, and plans to readily access skilled personnel as well as essential equipment and materials. Disease containment or eradication of disease outbreaks is often difficult, costly and time consuming but impacts can be mitigated by emergency preparedness and contingency planning with dedicated pre-agreed resourcing and early action. Importantly, sharing the LVB means that given time, diseases are likely to spread to all counties in the region. The LVB countries however, the contingency plans for disease outbreaks in aquatic organisms are poorly developed and there is limited consideration for emergency response

to exotic disease, large scale outbreak of endemic aquatic disease, transboundary Aquatic Animal Diseases as well as serious emerging diseases. A collective regional approach to establish and align emergency preparedness for AOH to the existing national emergency strategies would be prudent and worth considering as part of a LVB aquatic biosecurity strategy.

Border Inspection, Health Certification and Quarantine

Border controls represent the first line of defence especially in preventing the entry of exotic pathogens, All LVB countries having compliance systems, especially at points of entry/exit to enforce aquatic animal health and food safety related import requirements for international trade in aquatic organisms/products. Within the East Africa Community (EAC), imports and exports of fisheries occur under the Lake Victoria Fisheries Organization's Harmonized Fisheries and Aquaculture Border Inspection Manual for East African Community, which promotes trade, but a weak point for smuggling fish with the associated pathogens species into the region. For trade beyond EAC, countries either require certification of health either as importers or issue the certification as exporters by the competent authority. Despite the elaborate system, the lack of diagnostic capacity, lack of qualified personnel, inadequate knowledge of regional disease status including emerging diseases, inadequate budgets, lack of risk analysis expertise suggest the need to strengthen the entire process. Domestic movements of aquatic organisms and products are well monitored and enforce domestic movements of fish and their products.

Surveillance, Monitoring and Reporting

With rapid aquaculture development aquaculture in the regions reflected in the steady increase in fish quantities produced, surveillance and monitoring programs are key components especially in a) AOH management system, b) underpinning emergency disease response and c) establishing health status in health certificate attestations. Although two countries: Uganda and Kenya recently participated in an active surveillance and training exercise for TiLV under FAO project GCP/RAF/510/MUL: *Enhancing capacity/risk reduction of emerging Tilapia Lake Virus (TiLV) to African tilapia aquaculture*, none of the five LVB countries have any government support active surveillance systems for monitoring presence of serious aquatic pathogens targeting either WOAH-listed or non-listed diseases of national importance. Therefore, establishing national and regional surveillance and associated reporting frameworks, would go a long way toward safeguarding LVB biosecurity.

Zoning and Compartmentalization

Zoning and compartmentalisation are disease management strategies aim at establishing animal populations with a distinct health status based on effective separation of populations and application of biosecurity measures to prevent the reintroduction of the infection. Zoning relies on geographic factors such as natural or man-made barriers under the direct responsibility of the competent authority. Compartmentalisation focuses on isolating compartment with specific management and biosecurity measures in establishments to ensure the maintenance of the health status. In LVB countries, zoning and compartmentalisation are inexistence and lack of information on pathogen distribution within the country or across the borders, it is difficult to implement zoning and compartmentalization.

Communication and Information System

Timely communication of an outbreak either endemic or exotic or emerging through efficient channels underpins timely response and management of aquatic organisms' pathogens. With respect to Aquatic Organism Health Information Systems (AOHIS), there is a severe lack of AOHIS in LVB countries. Poorly organised reporting systems hampers information transfer among actors, negatively affecting the emergence response.

Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance

All countries of the LVB stated having regulations controlling treatments, drugs or veterinary biologics applied in aquaculture. This is aimed at combating antimicrobial resistance (AMR) due to the inappropriate and over-use of antibiotics important to the treatment of diseases in human, livestock, poultry, and fish. Despite the presence of regulations, there is limited capacity, both human resource and finance to support implementation. Notwithstanding, the limited diagnostic capacities may also compromise the accuracy of laboratory outcomes to support correct treatment.

Research and Development

Research is essential in generating and optimising innovations and technologies AOH management as well as pathway for maintaining pace changes in the environment, pathogen and host. Within LVB region, countries have universities and research institutions conducting research in aquatic ecosystems include AOH-related activities, albeit on a very small-scale and scattered. This is not unexpected given research focus is typically demand-driven, funder-oriented and aquaculture, along with associated AOH research needs, is relatively new to the region. The expected future growth of the sector is however expected to result in a commensurate increased demand for AOH research. Therefore, both government, developmental partners and private sector need commit resources and infrastructural support for research.

Regional and International Cooperation

Developing international, regional and domestic linkages and cooperation offers great potential to increase AOH capacity. There are a range of international collaborations in the field of aquaculture and fisheries in the region. Although, it is not always clear the extent to which AOH activities are featured of the projects implemented within the basin. The common goals arise from the sharing of Lake Victoria offer great potential for regional cooperation and networking in almost all areas of AOH. Indeed, all LVB countries are members of LVFO which coordinates harmonization of activities on Lake Victoria and in the catchment. In addition, LVB country governments have established national research organizations, namely: National Center for Fisheries and Aquaculture Development (Burundi); Kenya Marine and Fisheries Research Institute (Kenya); Rwanda Agriculture and Animal Resources Board (Rwanda); Tanzania Fisheries Research Institute (Tanzania) and National Fisheries Resources Research Institute (Uganda) which focus on aquatic resources research and have strong regional collaboration. These organizations offer potential opportunities to share information systems, diagnostic capability, disease surveillance, emergency disease preparedness and response systems, cooperative research, and expertise. Domestic linkages between agencies, particularly government, universities and the private sector responsible for fisheries and aquaculture should be explored and promoted to develop standardized procedures.

Ecosystem Health

It is clear that aquaculture development has often had a negative impact on the health of aquatic ecosystems, through such impacts as mangrove destruction, salination of farmlands, introduction of aquatic invasive species (AIS), the introduction and spread of exotic pathogens, the amplification of endemic diseases, the irresponsible discharge of waste materials, and the negative impacts of the misuse of antibiotics and other veterinary drugs. It is therefore essential that future aquaculture development in the LVB Region should be done with minimal environmental impacts and with due attention to all laws and regulations and good aquaculture practices (GAqPs) in the countries of the LVB.

2.3 Gap analysis

The efforts to manage aquatic animal health and welfare, usually lag the rapid growth of aquatic organism production and the increased risk of disease. As such, there is a compelling need for coordinated and collaborative action among the countries sharing the resources of the LVB. The efforts to improve aquatic animal health extends beyond the LVB, thus increasing the potential to improve livelihoods, feed a growing population, provide opportunities for job and food security, and contribute to a sustainable future. Therefore, identify strengths, weaknesses, opportunities, and threats (SWOT) related to national and regional aquatic biosecurity needs is a critical step towards gap analysis. In this regard, TRUEFISH organised a workshop for the 2nd LVFO AAHTWG meeting on 20 – 23rd February 2023 in Kisumu – Kenya, during which members re-analysed and scored the nationally-ranks strengths, weaknesses, opportunities and threats to generate a regional SWOT in aquatic organisms' health (Table 3). The team further evaluated the current national and regional strategic positions in context of PMP/AB, aquatic biosecurity and identified the internal and external factors that are favourable and unfavourable to achieving its objectives for aquatic AAH/biosecurity. These analyses clarified on the relative important "priorities", "challenges" and "constraints" that should be considered developing the RAOHS activities.

Table 3: The Summary of the results of SWOT Analysis

Strengthen	**Weaknesses**
1. Political will prioritising fish for development across LVB countries. 2. Existing national policies that are supportive of aquaculture growth in the region. 3. Abundance of fresh water throughout LVB favouring aquaculture. 4. Existing collaboration among different stakeholders especially between government aquaculture and fisheries officers with compliance officers for effective legislation enforcement. 5. Training institutions with specialized courses in area aquatic organisms' health exist or are being established in the region. 6. Existing regional frameworks for cooperation and harmonization. 7. Existing fisheries and livestock extension services.	1. Frequent changes in governments with new priorities. 2. There are no comprehensive national aquatic organisms' health policy/plans. 3. Inadequate disease surveillance and monitoring. 4. Limited access to qualified aquatic organisms' health expertise in all aspects of AAH management. 5. Weak aquatic organisms' disease diagnostic capability (expertise) and capacity (infrastructure). 6. Inadequate dedicated funding for AOH governance from government and developmental partners. 7. Limited knowledge of current national aquatic organism health status, including emerging diseases. 8. Inadequate awareness and knowledge among

	actors of aquatic biosecurity risks or good aquatic biosecurity practices.
Opportunities	**Threats**
1. Potential for establishing hatcheries for production of certified good quality fingerings in LVB region. 2. Regional cohesion that allows for collective detailed gap-analysis of existing legislation, diagnostic services, national pathogen/disease lists, diagnostic standards, and information systems with a view to harmonization and resource sharing across the LVB. 3. Opportunity to reap long-term social and economic benefits from funding comprehensive ecologically sustainable aquaculture governance framework (licensing and permitting) to manage the controlled and safe (biosecure) growth of the sector. 4. Availability of tilapia and catfish adapted to local LVB conditions which can be used for selective breeding to improve performance. 5. Opportunity to grow sector biosecurity/AOH management adopting/adapting lessons learnt in Asia – potential for existing farm biosecurity protocols and procedures for pond and cage culture developed in Asia for adaptation to LVB.	1. Priority shifts for new governments elected to power. 2. A shared water basin exacerbates the mechanisms for aquatic animal disease spread between LVB countries. 3. A regional aquatic biosecurity strategy does not exist. 4. Exotic diseases in aquaculture pose a threat to wild populations of aquatic organisms. 5. Uncontrolled development of aquaculture in the region poses increased AAH/biosecurity risks to aquaculture, capture fisheries and the environment more widely. 6. Illegal use/misuse of antibiotics and other drugs pose risks of anti-microbial resistance (AMR) with potential threats to human populations. 7. Aquaculture intensification in previously undeveloped areas presents an increased risk of new pathogen emergence, which if not detected and contained quickly, can spread readily to wild and other aquaculture populations. 8. Climate change can accelerate emergence of diseases.

2.4 Entry Points of LVB countries within the PMP/AB

The Gap analysis performed at the 2nd LVFO AAHTWG meeting on 20th – 23rd February 2023 in Kisumu – Kenya identified the current situation with regard to requirements for the desired stage of PMP/AB. The team was guided by the results of the self-assessment surveys, national levels of aquaculture development and the list SWOT to determine the scenario and estimate the stage for each country to entry into PMP/AB (Table 4).

Table 4: Estimated level of aquatic biosecurity for LVB countries, scenario, and entry points along the PMP/AB.

LVB Country	**Aquatic Biosecurity Situation**		
	Strategy in place	Current Level of Aquaculture Biosecurity	Estimated PMP/AB entry Stage
Scenario 1. Members with no national aquaculture biosecurity strategy in place, but an aquaculture sector exists or is in the early stage of development			
Burundi	No	Low	Stage 1
Kenya	No	Medium	Stage 1
Rwanda	No	Low	Stage 1
Tanzania	No	Low	Stage 1
Uganda	No	Medium	Stage 1
Scenario 4 – Members whose aquaculture biosecurity is dependent on the biosecurity situation in neighbouring countries due to shared waterbodies, watersheds or coastlines and where a regional or			

subregional aquaculture biosecurity strategy exists or is needed	
Burundi	River Kagera – flowing through Rwanda to Lake Victoria
Kenya	Several rivers flow into Victoria and shares the lake with Tanzania and Uganda
Rwanda	River Kagera – flowing through Uganda to Lake Victoria
Tanzania	Several rivers flow into Victoria and shares the lake with Kenya and Uganda
Uganda	Several rivers flow into Victoria and shares the lake with Kenya and Tanzania

3. LAKE VICTORIA BASIN REGIONAL AQUATIC ORGANISM HEALTH STRATEGY

3.1 Rationale

Human consumption of aquatic organisms especially fish is steadily increasing owing to high nutrient benefits. In particular, fish has high amount micro-nutrients including calcium, phosphorus, iodine, zinc, iron, and selenium, hence playing a significant role in securing and sustaining food and nutrition security. Aquatic organisms are the most traded commodities globally and the demand for aquatic animal products is estimated to reach 32% by 2030. Through trade, all actors at different nodes and stages earn incomes that eventually sustains their livelihoods, thus fisheries and aquaculture play a critical role in poverty alleviation. Notwithstanding, fisheries and aquaculture is a source of employment to millions as fishers, processors, traders, farmers, suppliers of various inputs and transporters, from many earn additional incomes. Overall, fisheries and aquaculture contribute to achieving sustainable development goals, notably, SDG 1: No poverty, SDG 2: No hunger, SDG 3: good health and well-being, SDG 8: decent work and economic development and SDG 14: life below water. In addition, sustainable development and utilization of fisheries and aquaculture resources contributes to realizing the African Union Agenda 2063 Aspiration 1: a prosperous Africa, based on inclusive growth and sustainable development, Aspiration 6) Africa whose development is people driven, relying on the potential offered by African people, especially its women and youth, and caring for children, and Aspiration 7) Africa as a strong, united, resilient and influential global player and partner.

Following the stagnated catches from wild fisheries, aquaculture has potential for continued growth to meet the rapidly growing demand for aquatic products. Indeed, in LVB countries fish production from aquaculture facilities between 2001 and 2021, grew at an average of 15% annually compared to a mere 2.4% from capture fisheries. With increasing importance of fish and the need to feed the growing population, LVB countries have prioritized aquaculture development reflected in the National Aquaculture Development Strategies to promote fish consumption through increase fish supply. For instance, Kenya targets at least 500,000MT of fish to achieve 8kg per capita consumption and Tanzania aim at increasing fish consumption from 8.5% to nearer the global consumption levels of 20.5 kg. However, disease outbreaks can greatly hamper the potential of aquaculture to contribute to food security and poverty alleviation. Disease outbreaks are linked to inadequate on-farm, national and regional biosecurity measures resulting in the introduction of new pathogens through trade of aquatic organisms, poor or lack of adequate aquatic health management practices, or emergence and re-emergence of exotic and endemic pathogens due to ecosystem changes associated with increased pollution and climate change. The lack of effective national and regional plans and strategies, and lack of awareness of the important role of biosecurity, weak adoption of appropriate biosecurity at governance and sector levels and poor public–private sector partnership (PPP) significantly hamper the ability to reduce the incidence and impact of disease incursions. Therefore, the need for LVB RAOHS to direct regional and national efforts toward building collaborative and sustainable systems for management aquatic organism diseases in the region.

Impact of aquatic diseases/mortalities of fish

Disease outbreaks remain a crucial economic and societal challenge in fisheries and aquaculture. An outbreak results in a range of severe socio-economic impacts including losses in production due to fish mortalities. During disease outbreak, farmers incur direct loss of income due to fish deaths or indirectly as expenses on treatment. In serious cases, farms may close down leading to loss employment and livelihood among the community. Infected fish may present ugly lesions leading to market rejection, but some pathogens may affect humans as well, hence raise public health concerns subsequently lead to loss of market access and market share. Increase in frequency of fish mortalities leads to loss of investment and consumer confidence. Loss in fish production may consequently result in food shortages as well as failure or closure of the fish business and industry. Evidently, Kenyan cage farmers in 2022 and 2023 experience mass mortalities of tilapia and caused an estimated 1.4 billion Kenyan shillings ($11.4 million)[1] to the country. Besides, nearly one third of the cage farmers suspended restocking activities, implying the purchases of fingerlings, feeds and other related inputs were suspended. This highlights the cascading effects of fish mortalities along the value chain. In Uganda, well established farm sought liquidation after experiencing prolong outbreak of fish mortalities causing to significant reduction in fish production and subsequently profitability. In this case, over 200 employees have lost their jobs, income, and general livelihood. Although not quantifies, disease outbreak may cause substantial financial losses to government through loss of taxes and increased medical costs to manage nutritional deficiencies due to reduction in consumption of micronutrients-rich aquatic organisms. Beyond Africa, economic losses due to disease outbreaks are estimated at millions of dollars. In Asia, the outbreak of a fungal infection called Epizootic Ulcerative Syndrome (EUS) in fish-ponds and cages caused an estimated farm production losses of USD 1.36 million. Meanwhile, outbreak of viral infection, infectious salmon anaemia, in Scottish salmon farming industry resulted in approximately GPB 20 million loss in 1998/1999. Likewise disease-related outbreaks in China in 2017, resulted in an estimated loss of approximately USD 5.3 billion, with tilapia diseases caused by several pathogens ranked first, with an estimated loss of USD 450 million.

Streamline Trade in aquatic organisms among LVB countries

The East African Community countries are dedicated to enhancing economic efficiency and fostering regional integration through strategic investments and the utilization of established industries. As such, the regions aspiration is to operate as a single investment area with harmonized trade policies, investment incentives, and product standards. By recognizing the importance of standardization and quality assurance, the LVB countries have emphasized the role of standards, metrology, and testing in promoting trade, investment, and consumer protection. To contribute to achieving smooth and elevated trade in aquatic organisms, the LVB RAOHS offers opportunity to national governments to adopt and implement harmonized approaches to managing aquatic organisms' health issues that may hamper trade. Importantly, LVB RAOHS will ensure simplifies, standardized, and harmonized trade information and documentation to facilitate the seamless flow of aquatic organisms.

[1] https://thefishsite.com/articles/mass-tilapia-mortalities-reported-in-lake-victoria#:~:text=The%20past%20few%20months%20have,hundreds%20of%20millions%20of%20fish.&text=The%20mortality%20incidents%20started%20in,November%2C%20particularly%20in%20Kisumu%20County.

Alignment of LVB RAOHS to existing frameworks

It is noteworthy that all the five LVB countries: Burundi, Kenya, Rwanda, Tanzania and Uganda are contracting parties of EAC. Therefore, the activities of LVFO as specialized institution of EAC are guided by the needs and desired developmental direction of contracting parties enshrined in the national fisheries and aquaculture development, policies, plans and strategies. In Burundi, LVB ROAHS contributes to achieving "*environmentally friendly (ecological sustainability) aquaculture practice, governed by good legislation and adequate legislation to attract investment*" in addition to "*establishing a quality control system for the movement of aquatic organisms, environmental protection, as well as the use of exotic species and genetically modified organisms*" of the national development strategy of aquaculture in Burundi, 2010. For Kenya, LVB RAOHS aligns with strategy 6: "*increase fish production in aquaculture system*" to 100,000mt by 2027 under the strategic objective 2: "*develop, manage, and optimize utilization of fisheries and aquaculture resources*" of the Kenya Fisheries Services Strategic Plan 2023–2027. Specifically, the LVB RAOHS collates with following notable activities: 1) *develop disease surveillance and control mechanisms*; 2) *authenticate and certify hatcheries and aquaculture establishment*; 3) *revise aquaculture potential zones and productivity base*, 4) *capacity building efforts* and 5) *promotion of public-private partnerships and investments in aquaculture*. With regards to Tanzania, LVB RAOHS contributes to accelerating the achievement of various thematic areas in aquaculture and capture fisheries including but not limited to a) *aquatic environmental health and spatial planning*, b) *ornamental fish culture and trade*, c) *maintenance of the environment, ecological systems and biodiversity*, d) *improved research, monitoring and reporting system* and e) *compliance and enforcement of management measures* enshrined in Fisheries Sector Master Plan 2021/22–2036/37. In Rwanda, the Master Plan for Development of Fisheries and Aquaculture in Rwanda 2011 – 2020 fronts "*Maintenance of aquatic environmental health*" as one of the key mechanisms to achieve sustainable aquaculture development. Although the new aquaculture development strategy in near finalization, the LVB RAOHS is aligns with Uganda National Fisheries and Aquaculture Policy 2018, which guides the developmental strategy. The policy statement under the thematic area *Fish Biosafety and Disease Control* focuses on establishing and implementing fish health and biosecurity protocols to protect biological diversity of fisheries and the life support system and emphasizes *the need to support fish biosafety initiatives and disease control mechanisms; build the requisite infrastructure and capacity to detect and deter water contamination as well as build capacity of the stakeholders*. Regarding the alignment and contribution of LVB RAOHS to regional, continental and International frameworks, the importance of LVB RAOHS in realizing sustainable aquaculture development in the regional and beyond has been highlighted in section 1.2.

3.2 The scope of the strategy

Geographically, the strategy targets the five LVB countries, namely, Burundi, Kenya, Rwanda, Tanzania and Uganda that share and/or have drainage systems into Lake Victoria with the goal of protecting lake's biodiversity and maintaining good environmental quality and integrity while sustainably developing aquaculture sector. The goal will be achieved through adopting the systematic risk-based, progressive and aquaculture biosecurity pathway. However, the other water systems within the target countries will benefit through state specific activities that aim at strengthening national biosecurity measures supported under this strategy. The strategy considers all the aquatic organisms' including, but not limited to, fish, crustaceans, aquatic plants such as seaweeds, algae within the LVB aquatic systems. Given the flexibility and systematic process for

implementing PMP/AB and the reliance on risk assessment, potential threats all aquatic organisms of national interest can be evaluated and same principles applied to safeguard the organisms at farm, industry, national and the regional levels.

3.3 Development process of the strategy

In pursuit of fostering the enduring sustainability of aquaculture within the East Africa region, particularly in light of emerging disease risks that can be exacerbated by many different factors as climate change, FAO TRUEFISH dedicated support to enhance the capacity of East African Community (EAC) member states and the private sector in managing aquatic organisms' health and mitigating environmental impacts. The initiative was accomplished through systematic pathway supported by strong involvement of stakeholders: national governments, academia, researchers, farmers and farmer organizations to ensure buy-in and ownership of the strategy.

Foremost was the establishment of a Regional Technical Working Group on Aquatic Animal Health within the Lake Victoria Fisheries Organization (LVFO), the LVFO Aquatic Animal Health Technical Working Group (AAHTWG); the appointment of national focal points for Aquatic Animal Health (AAH), and the development of a structured work program. This served to facilitate effective engagement and participation from countries, as well as pertinent institutions and stakeholders. In 2021, FAO in collaboration with LVFO, inaugurated the (AAHTWG) after establishment of LVFO protocols. The membership of AAHTWG comprises of 25 technical member, consisting of five persons from each of the five LVB countries: Burundi, Kenya, Rwanda, Tanzania, and Uganda representing relevant institutions and stakeholders. As delineated in the Terms of Reference of the LVFO AAHTWG, the group holds primary responsibility for providing technical oversight and offering high-level advice and guidance to bolster AAH conditions and biosecurity standards across the EAC region. Of particular importance is the support provided to FAO TRUEFISH in formulating the LVFO Regional Strategy on Aquatic Organism Health, culminating in its definitive version for submission to LVFO's official approval channels.

Parallel, to facilitate the work of the AAHTWG, FAO conducted five national self-assessments between 2021 and 2022 in each participating country. These assessments, led by national AOH experts in collaboration with competent authorities, provided crucial insights into the current status of AOH performance and capacity within respective territories. Key areas evaluated included institutional frameworks, legislation and policy, disease surveillance, diagnostics, emergency preparedness, extension services, trade, compliance, research, existing infrastructure, challenges, and constraints.

Building upon the findings of the self-assessments, FAO TRUEFISH drafted an initial draft of the Lake Victoria Basin Regional Aquatic Organism Health Strategy (LVB RAOHS) – draft 1, for review and discussion. Draft 1 underwent rigorous scrutiny during the 2nd LVFO AAHTWG meeting and FAO TRUEFISH Stakeholder/Experts Regional Workshop and Training on Health Management and Aquaculture Biosecurity in February 2023 at Kisumu, Kenya. Subsequent to incorporating feedback from this meeting, a revised second draft of the LVB RAOHS was shared with LVFO AAHTWG members for further input in June/July 2023. In September 2023, FAO TRUEFISH consolidated the suggestions and comments gathered from the AAHTWG and stakeholders to finalize the third draft of the strategy. In February 2024, the third draft was discussed and adopted by LVFO AAHTWG members and forwarded the document to the LVFO

Senior Officials. In March 2024, the draft strategy was presented to LVFO Senior Officials consisting of directors of research institutions and management from the five LVB countries. The recommendations from the LVFO Scientific and management Committees are incorporated into the strategy for presentation to the Executive Committee, comprising Permanent Secretaries of Fisheries and Aquaculture, for further consideration and approval. Subsequently, the LVFO Council of Ministers will deliberate on the adoption of the LVB RAOHS as a formal policy document.

3.4 Designing of the Strategy

The LVB RAOHS is designed to cover the 16 main elements of regional biosecurity in the context of PMP/AB. Therefore, the strategy comprises of 16 interrelated major programmes (thematic areas) containing a total of 42 activities. Each element consist of the following sections: a) Background – a brief overview of the programme; b) Current Status – a summary of the current status of activities related to the programme, based on findings of the FAO Aquatic Animal Heath Capacity and Performance Self-Assessment Survey Questionnaire conducted during the second half of 2022; c) Objectives – a brief statement on the anticipated achievements from implementing the programme and d) Activities – brief summaries of the key activities (projects) that shall be accomplished within each programme.[2]

For each activity indicates, the country scenario in the PMP/AB that shall be supported and the PMP-AB stage in which the thematic area first appears. Further, the strategy provides information on the designated responsibility for completion either EAC/LVFO or National government of countries of the LVB (the countries alone are responsible) or both EAC/LVFO and national government of countries of the LVB (both will participate in completion of the Activity). In addition, the strategy presents the proposed timeframe (short term, medium term, long term)[3] and the short description of the activity.

The 16 programmes (Fig. 4) address the following broad thematic areas grouped under specific stage of PMP/AB include a) Stage 1: 1. Policy, Legislation and Enforcement[4], 2. Human Resources and Institutional Capacity Development; 3. Institutional Structure, 4. Pathogen List, 5. Disease Diagnostics, 6. Risk Analysis and management, 7. Farm-level Biosecurity and Health Management and 8. Emergency Preparedness and Contingency Planning. Under stage 2, include 9. Border Inspection, Health Certification and Quarantine, 10. Surveillance, Monitoring and Reporting, 11. Communication and Information System and 12. Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance. In stage 3, the following elements are addressed: 13. Zoning and Compartmentalization, 14. Research and Development, 15. Regional and International Cooperation and 16. Ecosystem Health.

[2] While the priority of each Activity is usually designated, in the case of PMP/AB, each Member will have different priorities depending on their starting point (Stage) for implementation. The priority of all Activities is thus considered the same, and the sequence of their implementation should be determined by the countries of the LVB.
[3] Short term = 1-2 years, Medium term =, 2-5 years, Long term = 5-10 years.
[4] Numbers in parentheses indicate the PMP-AB stage in which the thematic area first appears.

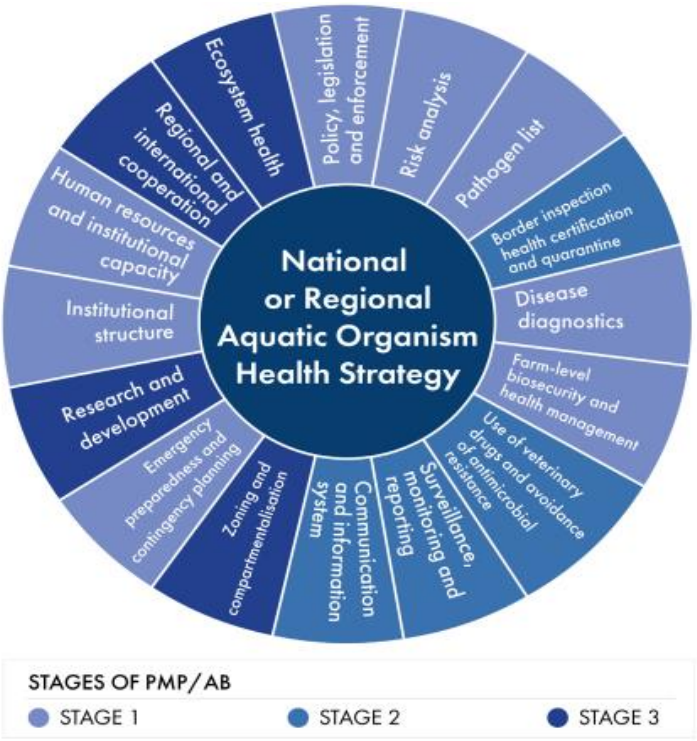

Figure 4: The 16 components of a Regional Aquatic Organism Health Strategy in relations to the PMP-AB. (Courtesy Paulo Padre, FAO)

3.5 Implementation framework

The commitment of national governments is paramount during the implementation of this strategy and realizing the benefits of PMP/AB because of the high connectedness of water systems in the region. It is therefore, the responsibility of respective countries to safeguard the entry points from outside the LVB. To accelerate trade while maintaining the sovereignty of LVB countries, harmonizing the implementation activities will be paramount. Therefore, all countries should therefore, endeavor to implement the assigned tasks. Once the LVB RAOHS is accepted by participating national governments, the strategy will be coordinated and implemented by LVFO, supported by its AAHTWG.

Overall, LVFO will be responsible for overseeing the implementation of the strategy with guidance from the AAHTWG while adhering the international standards and where necessary seek technical guidance from key international and regional agencies. The activities will be executed at both national and regional levels, with shared responsibilities as deemed necessary. National governments will oversee activities identified at the national level within the framework of National Aquatic Organism Health Strategies (NAOHS), while regional-level activities will be jointly managed by LVB countries and other pertinent regional and international organizations, subject to funding availability. Given potential overlaps with other regional strategies, such as the Regional Aquatic Biosecurity Strategy for the Southern African Development Community (SADC RABS), efforts are made to harmonize strategies and leverage existing frameworks to avoid duplication, particularly in cases where countries are members of multiple regional bodies.

3.6 Financing framework

A three pronged-approach has been suggested to financing the activities of the strategy. First, financial backing will be sourced from member states to support activities that will be executed at the national level. In this regard, the national governments are expected to provide funding through either national budget framework or source support from development partners under Bilateral Agreements, Technical Cooperation Programmes among others. Secondly, regional activities, could be supported both technically and financially by the efforts of LVFO. It is envisaged that LVFO will conduct financial drive to secure support from interested development partners. Thirdly, the interested development partners including FAO, may continue to offer technical and financial support for prioritized program activities through existing project such as TRUEFISH contingent upon funding availability and alignment with its work plan and developing new project.

3.7 Purpose of the Strategy

The purpose of the *Regional Aquatic Organism Health Strategy for the Lake Victoria basin* is:

"To support the improvement and harmonisation of regional aquatic organism health and biosecurity by encouraging and assisting LVB members to implement a value chain risk-based, progressive and collaborative Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB) to protect aquatic organism health in aquaculture production sectors and the natural environment."

More specifically, implementation of this LVB RAOHS promotes the following outcomes:

- Increased standardization and harmonization of programmes for aquatic biosecurity of countries of the LVB (policies, legislation, diagnostics, health certificates, etc.).
- Adoption of risk-based and value chain assessments to aquaculture biosecurity within the Progressive Management Pathway for Aquaculture Biosecurity (PMP/AB) that will lead to a better knowledge of the health status of cultured aquatic organisms, reduced losses due to pathogens, and increased traceability of live aquatic organisms and their products;
- Recognition of aquatic plants in the socio-economic well-being of the riparian communities and economies of countries of the LVB, and their integration into programmes for aquaculture biosecurity;
- Improved awareness among aquatic animal and plant health experts, aquaculturists and other stakeholders of the responsible and scientifically justifiable practices necessary to optimize aquatic organism health management;
- Improved awareness of, and risk mitigation for nationally listed diseases (National Aquatic Pathogen List) as well as those listed by the World Organization for Animal Health (WOAH) transmitted by live aquatic organisms and their products and enhanced coordination among countries of the LVB towards improved and harmonized programmes in support of national and regional aquatic organism health;
- Improved protection of aquatic biodiversity against exotic diseases and potentially invasive aquatic species (AIS) that may carry pathogens;
- Improved technical capacity at different levels of expertise among Competent Authorities and other agencies responsible for the management of aquatic organism health and biosecurity;
- Improved collaborative efforts among countries of the LVB, resulting in increased confidence of the aquaculture sectors of the countries, trading partners and other stakeholders in national

Competent Authorities, fisheries and aquaculture authorities, state veterinary services and relevant extension services.

3.8 Mission

The mission of the *Lake Victoria Basin Regional Aquatic Organism Health Strategy* (LVB RAOHS) is:

"*To harmonize regional aquatic biosecurity in the LVB for the protection of aquatic organism health in aquaculture sectors and the natural environment."*

3.9 Vision

The Vision is a statement of where the strategy will lead the region. The long-term vision of the Strategy is:

"*Aquatic organism health capacity in the LVB that protects sustainable development of aquaculture and regional aquatic ecosystems from the impacts of serious infectious disease*".

3.10 Guiding principles for the implementation of the strategy

The following set of 13 Guiding Principles[5] provides guidance to the LVBAOHS in all circumstances, irrespective of changes in goals, work plan, structure, or management. The principles accept and incorporate relevant international aquatic animal health standards to ensure harmonization, transparency, and equivalence and to ensure that the aquatic organism health status in LVB region is internationally recognized.

1. Aquatic biosecurity should adopt internationally accepted risk assessment methodologies and, where feasible, employ a value chain approach to effectively address risks associated with aquaculture production at the sectoral level, focusing on specific species or commodities. By prioritizing prevention, this approach integrates various risk identification and management measures such as value chain analysis (VCA), hazard analysis and critical control points (HACCP), import risk analysis (IRA), better management practices (BMPs), good aquaculture practices (GAqP), standard operating procedures (SOPs), health certification, quarantine, specific pathogen free (SPF) and high health (HH) stocks, and vaccination protocols.
2. The LVBAOHS is based on the Progressive Management Pathway for Aquaculture Biosecurity (PMP-AB)[6] (see Figure 1) and is designed to provide benefits to all countries sharing the LVB, no matter the current aquatic biosecurity status, aquaculture production systems, or whether, or not decide to adopt the PMP-AB as formal policy.

[5] The Guiding Principles in this document were based on a similar document, i.e. the Network of Aquaculture Centres in Asia Pacific (NACA) Regional Aquatic Organism Health Strategy that was prepared by FAO Consultant, Dr James Richard Arthur (Bariere, Canada).

[6] FAO. 2020. Report of the Progressive Management Pathway for Improving Aquaculture Biosecurity (PMP/AB): First Technical Working Group Meeting, Rome, 20–22 March 2019. FAO Fisheries and Aquaculture Report No. 1322. Rome. https://doi.org/10.4060/cb0582en

3. All countries sharing the LVB are encouraged to adopt the PMP-AB. Countries can begin the pathway at the stage appropriate to their national situation, and progress at their own pace to the desired level of aquatic biosecurity[7].
4. Biosecurity programmes for aquatic organisms should increase the contribution of aquaculture to the economies of countries of the LVB through increased access to and competitiveness in international and domestic markets.
5. Biosecurity programmes for aquatic organisms and other health management measures should be effective, practical, and cost-effective and utilize readily available resources.
6. Ensuring access to essential infrastructure and specialized expertise is crucial to improving aquatic biosecurity in the countries of the LVB. It is crucial to keep senior policy-makers informed about the significant contributions of aquaculture to the economies of countries of the LVB and the well-being of their citizens, the considerable losses caused by disease outbreaks. Proactive and sufficient policy measures, along with adequate financial support, are necessary to promote effective aquatic biosecurity and safeguard the health of aquatic organisms.
7. Improved aquatic health management measures should facilitate aquaculture to develop in harmony with nature, managing and minimizing transient environmental impacts and avoiding significant, cumulative, long-term, or irreversible changes to ecosystems, to cultural remains or to valued landscape and scenery.
8. Improved aquatic biosecurity and other aquatic organism health measures should foster strong links amongst aquaculturists, recognizing and supporting the needs of private-sector aquaculturists and working with community initiatives to manage local environments for mutual benefit.
9. Improved aquatic biosecurity and the aquatic organism health programmes of countries of the LVB should contribute to social, economic, and environmental sustainability. These should embrace the precepts of transparency, integration, coordinated government and fit-for-purpose regulation, partnership and stakeholder participation, accountability, ethics, and regard for animal welfare, through a culture of best practice and continuous improvement.
10. While adhering to internationally recognized standards, guidelines, or recommendations such as the WOAH Aquatic Animal Health Code (WOAH 2022), countries of the LVB have the discretion to implement or uphold sanitary measures that offer a higher level of protection. However, such measures must be scientifically justified through risk analysis and align with the countries' appropriate level of protection (ALOP). Control measures applied to movements of aquatic organisms within each country's territory must also be consistent with this ALOP.
11. Aquatic biosecurity is important for economic, social, developmental, and public resource purposes. Collaboration among all stakeholders including governments, public institutions, the private sector and existing aquaculture and fishing industries is important to achieve effective biosecurity.

[7] The PMP/AB is defined as a pathway that builds on existing frameworks, supported by appropriate tools (via the "PMP/AB toolkit") that focus on aquaculture biosecurity, including health management and reduction of antimicrobial resistance (AMR). This follows risk-based, progressive and collaborative principles that provide the cost-effective management of risks posed by infectious agents to aquaculture through a strategic approach at enterprise, national and international levels with shared public-private responsibilities. The PMP/AB is applied through four stages: PMP/AB Stage 1: Biosecurity risks defined; PMP/AB Stage 2: Biosecurity systems implemented; PMP/AB Stage 3: Enhanced biosecurity and preparedness and PMP/AB Stage 4: Sustainable biosecurity & health management systems established

12. The National Aquatic Organisms Health Strategies (NAOHS) of countries of the LVB and related procedures will adhere to international and regional guidelines to the greatest extent feasible, to ensure harmonization across a broad spectrum, consistency, and cooperation in the implementation of these strategies.
13. Foster collaboration with international organizations and with other regional organizations, wherever possible, to further increase the capacities of the countries of the LVB in areas related to aquatic organism health and aquatic biosecurity.'

3.11 Monitoring, evaluation accountability, and learning

The implementation of the RAOHS will follow systematic steps consisting of planning, monitoring evaluate the impact, learn from experience and always ensuring accountability. Planning is a continuous process and in this case, after rolling out the strategy for implementation by respective countries, regular planning activities will be organized by LVFO for members to reflect on lessons learnt, align activities to the prevailing context and evaluate the achievement of desired outcomes of the interventions and efforts. The activities and implementation plans will be adjusted based on the data gathered and lessons learned from previous evaluations. Monitoring and evaluation are key steps towards ensuring effectiveness and continual improvement of the LVB RAOHS in achieving its goals. An elaborate work plan or implementation framework outlining the clear set of indicator of the baseline and targets as well as indicators of activity, output, outcome and impact level will be prepared to ensure transparent reporting of results achieved by the LVB RAOHS implementation. Regular meetings, quarterly, biannually and annually, will be organized to analyze progress and challenges experienced during implementation and adopt respective corrective measures. Various channels and platforms will be utilized to share information, experiences and lessons learnt. Information will be packaged inform of newsletters, briefs, website, brochures, bulletins and any other appropriate form to disseminate information about good practices, case studies, successes as well as failures. In addition face to face meeting will be organized for CAs to share national progress in implementing the national activities. Implementation of the strategy will enable learning and transforming knowledge into actions through peer-to-peer learning exchanges among LVB countries; fostering champions to accelerate adoption of outputs from the strategy and use of technical assistance among others. At all stages, LVFO and national governments will ensure financial accountability and provide evidence of value for money.

4. PROGRAMMES[8]

The following interrelated elements of biosecurity have been considered in this strategy ensure improved and strengthened aquaculture biosecurity in LVB countries to achieve sustainability in a) reducing in diseases burden; b) improving aquatic organisms health and welfare, c) minimizing global spread of diseases; d) optimizing socioeconomic benefits from aquaculture; e) attracting investment opportunities into aquaculture; and (f) attaining One Health goals.

4.1 Programme 1: Policy, legislation, and enforcement

Background

Policy is the national programme that outlines the anticipated achievement in broad terms including the government's goals and objectives for the sector and recommendations for its sustainable development. In contrast, a strategy is a plan that outlines how the national policy is to be achieved. It contains specific objectives and outputs, a timeframe, indicators of performance, and provision for monitoring and review. Legislation is the sum total of laws, regulations, and other legally binding documents issued by the government to enforce its policies. Enforcement, set out as rules, is the state's actions to ensure compliance with its legislation and regulations. To address aquatic biosecurity and to support national aquatic organism health policy, the relevant legislation of all the countries of the LVB should be reviewed and where necessary, updated and/or revised. Where required, new legislation should be drafted to support AOH, welfare of aquatic organisms, and aquatic biosecurity. Likewise, the ability of countries of the LVB to enforce aquatic biosecurity laws and regulations should be evaluated and improved, if found lacking.

Current status

Aquatic Organism health (AOH) in LVB countries are addressed in multiple pieces of legislation, reflecting the number of ministries involved in aquaculture/AOH governance and the historical evolution of ministerial arrangements. Compliance services enforcing import and export controls in all five countries, supported by the *Harmonized Fisheries and Aquaculture Border Inspection Manual for East African Community*, appear well geared to, food safety and to a lesser extent, international trade in live animals. Although government agencies responsible for leading AOH policy and planning are defined but, the lack of effective AOH management on the ground and absence of detailed documented plans for achieving effective AOH management in the region represents a serious risk to the aquaculture and fisheries sectors and associated livelihoods.

Objectives

The Objectives of Programme 1 are:

i. to assist countries of LVB, to either prepare, or review and revise the National Aquatic Organism Health Strategy (NAOHS) and determine appropriate scenario and stage to initiate participation in the PMP-AB;

[8] Programme descriptions are based on FAO (2023).

ii. to harmonize legislation related to AOH and aquatic biosecurity among LVB countries with relevant international legislation and standards e.g. EU Directive 2006/88/EC and the WOAH standards;
iii. to establish and legally define the responsibilities for aquatic organism health management among agencies;
iv. to ensure that countries of the LVB have adequate capability and capacity to effectively enforce aquatic organism health and associated biosecurity laws and regulations (see Programme 2: Human Resources and Institutional Capacity Development);
v. to promote communication, consultation, and shared policy among countries of the LVB regarding the introduction and transfer of aquatic animals and plants (Scenario 4) (see also Programme 12: Communication and Information Systems).

Activities

Programme 1 has four activities to be implemented:
Activity 1: *Assist countries of the LVB to either draft or review and revise their NAOHS, and determine the appropriate PMP-AB scenario and starting Stage and alignment to the LVB RAOHS.*

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: This activity will be initiated during the Third LVFO AAHTWG foreseen for the last quarter of 2023, right after the official approval of the LVB RAOHS by the LVFO Ministers Council. FAO TRUEFISH will provide guidance to the National Focal Point (NFP) and national delegates/experts for each country attending the 3rd AAHTWG meeting on steps to be taken based on this RAOHS. Work on the NAOHS will be continued by concerned national authorities in consultation with national experts and senior policy-makers to further develop the strategy and generate support for its adoption as an official policy document.

Activity 2: *Conduct in-depth reviews of aquatic organisms' health-related legislations and biosecurity and harmonize with the international legislations (e.g., EU Directive 2006/88/EC) and the WOAH standards).*

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to long term (2030 – 2034)
- *Responsibility:* EAC/LVFO and national government of countries of the LVB.
- *Description*: A LVFO AAHTWG with support from international experts will review the status of aquatic organism health and biosecurity-related legislation of the 5 countries of the LVB and prepare a regional status report and associated recommendations. The group will examine the relevant legislation and requirements of major trading partners such as the European Union, and if necessary, to the United States, Japan, and others (Emirates, Israel, etc.) and draft model legislation that fully conforms to these laws and requirements.

Activity 3: *Assess the capacity and effectiveness of enforcement of aquatic organisms' health and biosecurity measures.*

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility:* National government of countries of the LVB
- *Description*: Under Activity 4, individual countries will evaluate the existing capacity to enforce current and proposed laws and regulations related to aquatic organism health and biosecurity, including activities related to border inspection, health certification and quarantine, farm-level inspection and biosecurity, and control of domestic movements of live aquatic organisms. This activity may lead to recommendations for improved laws and regulations and will identify weaknesses in manpower and capacity that can be addressed by government.

Activity 4: *Establish and operationalize LVB Technical Working Group for Biosecurity of Shared River Systems and Lake Shoreline*

- Scenario supported: 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO, with participation of LVB national governments
- *Description*: Activity 5 addresses Scenario 4 of the PMP-AB, which applies to all the five LVB countries. The LVFO AAHTWG will develop guidelines for the responsible use of shared river systems and lake shorelines with regard to aquaculture development as well as the introduction and transfer of live aquatic organisms into such systems. The activity may lead to Memoranda of Understanding (MOU) between countries sharing a specific river system or shoreline in order to reduce the risk of introducing aquatic invasive species (AIS) or the introduction and spread of serious Transboundary Aquatic Animal Diseases (TAADs).

4.2 Programme 2: Human Resources and Institutional Capacity Development

Background

A sound knowledge of aquatic diseases is a prerequisite to making informed decisions about aquatic disease management and implementation of the PMP-AB at all levels. At the same time, there is a need for fisheries/aquatic scientists, veterinarians, and fisheries officers to provide support to a growing high-value aquaculture industry. With the expected continued growth of aquaculture in the LVB Region, it is important that sufficient training opportunities are made available. Training opportunities should provide the academic foundation for government officials to make informed decisions when dealing with the trade in aquatic organisms and to assist farmers in setting up individual health management plans for their culture facilities within a commodity-based value chain approach. This will support international market acceptance of aquatic products being exported by countries of the LVB and protect indigenous stocks from disease threats associated with the importation of live aquatic organisms, thus maintaining aquatic biodiversity.

Current Status

Although tertiary institutions and universities exist offering academic programmes in aquatic organisms' health, number of appropriate biosecurity expertise is limited and the capability to diagnose diseases and pathogens of aquatic organisms is very low. Besides, many aspects of aquatic organism disease differ substantially from those of terrestrial plants and animals, yet the curricula provide a very small part in aquatic organisms' health. Consequently, the field of aquatic organisms' disease remains a challenge to fisheries/aquatic scientists, veterinarians and other officials dealing with aquatic organisms. Therefore, the much-needed competencies must be developed and strengthened to manage the health of aquatic species; assist LVB countries finalize respective NAOHS and addressing the requirements of PMP-AB implementation.

Objectives

The objectives of Programme 2 are:

i. to ensure that countries of the LVB are familiar with all aspects of the PMP-AB, the associated value chain approach and are able to guide its implementation;
ii. to transfer understanding and requirements of the PMP-AB to key stakeholders and participants in selected aquaculture value chains (AVCs) of individual countries of the LVB;
iii. to increase the knowledge and expertise of national aquatic organism health workers, biosecurity officers and aquaculturists through targeted short-term training and curriculum development; and
iv. to mobilize funding to support the development of human resources and institutional capacity to support implementation of NAOHS and PMP-AB by countries of the LVB.

Activities

Programme 2 has four activities to be accomplished:
Activity 5: *Provide short-term training through regional workshops and pilot projects to ensure that LVB countries are familiarized with the PMP-AB and the value chain approach to risk management.*

- Scenario supported: 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO
- *Description*: Under Activity 6, EAC/LVFO, in cooperation with FAO and other interested donors, will organize regional workshops for NFPs, aquatic organism health and biosecurity experts and key policy-makers to enhance their understanding of the requirements and benefits of implementing the PMP-AB.

Activity 6: Transfer of the understanding and requirements of PMP-AB to stakeholders in selected aquaculture value chains within LVB countries

- Scenario supported: 1, 4
- Scenario: 1,2,3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: National government of LVB countries, with participation of EAC/LVFO
- *Description*: Under Activity 7, NFPs and experts of individual LVB countries trained under Activity 6, will organize workshops for stakeholders involved in implementation of the PMP/AB

for the selected aquaculture value chain(s). This activity will support organization and planning of National Working Groups for specific value chains selected for PMP-AB implementation.

Activity 7: *Increase the knowledge and expertise of national aquatic organism health workers, biosecurity officers and aquaculturists, border-post officers etc. through targeted short-term training.*

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to medium term (2027 – 2030)
- *Responsibility*: EAC/LVFO and national governments of the countries of the LVB
- *Description*: Under Activity 8, EAC/LVFO and LVB countries will organize a series of technical workshops for aquatic organism health workers, biosecurity officers and aquaculturists. EAC/LVFO will consult individual countries to determine the topics of highest interest, which, based on the Self-Assessment Survey Questionnaire returns and SWOT analysis, will include such areas as disease diagnosis, risk assessment, quarantine and border inspection, etc. EAC/LVFO will also seek to assist individual countries with requests for short-term trainings through placement with laboratories and agencies within the LVB Region. For some topics, such as on-farm biosecurity, participants in regional trainings will be expected to organize national workshops to transfer knowledge gained.

Activity 8: Mobilize funding to support development of human resources and institutional capacities.

- Scenario supported: 1,4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to long term (2030 – 2034)
- *Responsibility*: EAC/LVFO and national governments of LVB countries
- *Description*: Based on the results of the various activities defined in this LVB RAOHS, EAC/LVFO will approach national governments, regional bodies, and international donor agencies to solicit funding to support building regional human and institutional capacities in aquatic organism health and biosecurity.

4.3. Programme 3: Institutional Structure

Background

Institutional structure (infrastructure) for aquatic organism health and aquatic biosecurity encompasses the essential facilities and systems serving a country. The facilities include dedicated physical structures such as buildings for office space, diagnostic and other laboratories, quarantine facilities, tank rooms, experimental ponds, etc. Adequate and appropriate infrastructure is essential to the success of any country's NAOHS and aquatic biosecurity programme, including implementation of the PMP-AB.

Current Status

Although several LVB countries have very basic infrastructure (offices, diagnostic laboratories and research facilities) located at some universities and research institutions, dedicated to aquatic organism health and accessible for implementation of the PMP-AB, some countries have little or no

infrastructure. Even those with basic structure, the facilities are not accredited to perform diagnoses of aquatic pathogens to international standards. Further, most facilities lack advanced infrastructure to support all levels of diagnosis.

Objectives

The objective of Programme 3 is to "ensure that countries of the LVB have sufficient and appropriate infrastructure to meet their national aquatic organism health and biosecurity objectives as well as supporting implementation of NAOHS in the context of the PMP-AB".

Activities

There are two activities to be accomplished under Programme 3:
Activity 9: Assess the existing infrastructure against the minimum standard required to support the implementation of the NAOHS and the PMP-AB.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: : Short (2024 – 2027)
- *Responsibility*: National government of LVB countries, with assistance of EAC/LVFO
- *Description*: Under Activity 10, each country of the LVB should undertake a review and analysis of the infrastructure needed and currently dedicated or available to support the implementation of its NAOHS, and the PMP-AB through the value chain analysis of selected commodity/commodities. The review should draw upon each country's responses to the Self-Assessment Survey questionnaire and the SWOT analysis carried out by each country. Together these will form the basis for a gap analysis where countries can investigate infrastructure requirements in greater detail to identify gaps in essential infrastructure needed to implement the NAOHS and PMP-AB.

Activity 10: Develop appropriate infrastructure including field and laboratory consumables to support the NAOHS and PMP-AB in diagnostics, research, surveillance etc.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: National governments of LVB countries, with assistance from EAC/LVFO
- *Description*: This Activity will follow up on Activity 10 by making recommendations for the upgrading or establishment of essential infrastructure to support aquatic organism health and biosecurity and will seek funding sources to support its development.

4.4. Programme 4: Pathogen List

Background

National aquatic pathogen (or disease) lists (NAPL/NADL) are essential for health certification, disease surveillance and monitoring, emergency response planning, prevention, and control of diseases in aquaculture facilities, etc. NAPL/NADL are developed following a clearly established criteria for listing/delisting of pathogens/diseases based on internationally accepted methods. WOAH-listed diseases are relevant all countries and form a good starting point. However, the

WOAH-listed diseases are those of internationally traded commodities, while NAPLs must also consider other serious pathogens/diseases of national concern which have zoonotic, economic and/or ecological impacts. NAPLs need to be constituted based on a thorough knowledge of a country's disease status, which can only be obtained through passive and active disease surveillance programmes, generalized disease/pathogen surveys, adequate disease record keeping and reporting, and a national disease database.

Current Status

Given the shared risks associated with the location within the LVB, it is logical for the five LVB countries to work together to design selection criteria for listing and jointly develop a list of significant pathogens for national/ regional listing. Reporting systems, surveillance and monitoring, as well as AOHIS are relatively underdeveloped in the LVB region, representing a significant drawback as they underpin so many aspects of effective AOH management.

Objectives

The objectives of Programme 4 are to:

i. guide countries of the LVB, where necessary, to draft NAPL for eventual approval by government, and to harmonize and update national and regional pathogen lists based on uniform criteria for listing and delisting of pathogens/diseases of importance (based on international standards) at the national and regional levels and to ensure uniform pathogen/disease nomenclature.
ii. adopt legally obliging and clearly defined NAPLs including WOAH notifiable diseases.

Activities

There is one activity to be accomplished under Programme 4:
Activity 11: Assist LVB countries to draft or update national and regional pathogen lists based uniform criteria for listing and delisting pathogens for uniformity and up-to-date pathogen/ disease nomenclature for approval by the respective government.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: : Short (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: A technical working group will, in full consultation with LVB countries develop criteria for the listing and delisting of pathogens in the regional, based on the criteria outlined in the WOAH Code and other international agencies. Once approved, individual countries will formally adopt these criteria for listing and delisting pathogens on their National Pathogen Lists.

4.5. Programme 5: Disease Diagnostics

Background

Disease diagnostic capability is an essential component of any NAOHS or aquatic biosecurity programme. Disease diagnostics play two significant roles in animal health and disease management. Firstly, to ensure that stocks of aquatic organisms intended to be moved from one area or country to another are not carrying infection by specific pathogens at subclinical levels.

This is accomplished through screening of apparently healthy plants and animals. Secondly, to determine the cause of unfavourable health or other abnormalities to recommend measures appropriate to a particular situation. The accurate and rapid diagnosis of an outbreak of disease is essential in preventing further losses through correct treatment, disease containment and, where possible, eradication. Diagnostics is also a key element of quarantine and health certification, surveillance and monitoring, zoning, and compartmentalization as well as demonstration of freedom from a disease, etc. Diagnostics include use of simple, on-farm methods (level I) and more advanced laboratory-based techniques requiring a high level of expertise and infrastructure (levels II and III) to confirm pathogens including WOAH-listed diseases. Level I diagnostics are based on-farm, field observation of mortalities and gross clinical symptoms. Level II diagnosis is based on histopathology and culture and isolation of pathogens while level III diagnosis involves molecular and ultrastructural diagnostic methods. Industry access to diagnostics is important for farm biosecurity, especially in semi-intensive and intensive commercial farming systems. Collection and collation of field epidemiological data and histopathology are especially important in routine health monitoring and detection of emerging diseases. Diagnostic capacity is also about the ability to undertake testing at volume, i.e., the capacity to meet routine testing demand as well as high demand during periods of serious disease outbreaks.

Current Status

There is inadequate diagnostic capacity for diseases of aquatic organisms in the countries of the LVB, including diagnostic capacity for WOAH-listed diseases, requiring level III diagnosis using WOAH methodologies. There is also a lack of national diagnostic standards and accreditation of laboratories for aquatic organism diseases within the region. The region has no international or national reference centres for aquatic organism disease diagnostics.

Objectives

The objectives of Programme 5 are, to:

i. improve the capacity of countries of the LVB to diagnose important diseases of aquatic organisms to international standards; and
ii. improve the capability of extension workers and aquaculturists in countries of the LVB in on-farm diagnostics, disease reporting, and sample preparation

Activities

There are three activities to be accomplished under Programme 5:
Activity 12: *Develop diagnostic infrastructure and support accreditation process of national diagnostic laboratories in LVB countries*

- Scenario supported: 1
- Stages facilitated: 1
- *Timeframe*: Medium term (2027 – 2030)
- *Responsibility*: National government of countries of the LVB, with guidance from EAC/LVFO
- *Description*: Based on countries' assessments of diagnostic needs and existing capacity (gap analysis), individual countries will, as appropriate, designate a National Aquatic Organism Disease Diagnostic Laboratory and develop the required specialist expertise and infrastructure, including adequate annual operating budget.

Activity 13: Provide targeted training for technicians in aquatic disease diagnostics to LVB countries.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to medium (2027 – 2030)
- *Responsibility*: EAC/LVFO
- *Description*: Based on individual country's assessments of diagnostic needs and capacity, EAC/LVFO will assist in improving regional diagnostic expertise by arranging advanced training to address specific gaps through regional training workshops and assisting individual countries with placement of their experts in advanced research and diagnostic laboratories for short-term work experience. Support for this Activity will be sought from FAO and other interested international donors.

Activity 14: Provide targeted training for extension workers and aqua-farm personnel in on-farm diagnostics, disease reporting and sample preparation

- Scenario supported: 1,4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to medium (2027 – 2030)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: EAC/LVFO will organize a regional "training of trainers" workshop and provide guidance to diagnosticians on basic and advanced on-farm diagnostic methods, development of a disease identification guide for mobile devices, disease investigation and reporting, and the proper preparation of samples for shipment to diagnostic laboratories. Upon completion of training, trainers will organize training sessions for individual countries to pass this knowledge on to extension workers and aquaculturists.

4.6. Programme 6: Risk Analysis

Background

Risk analysis provides a flexible framework within which risks of adverse consequences resulting from a course of action can be evaluated systematically and based on science. The PMP-AB, through a value chain approach, uses various risk assessment methods to identify, assess and manage risks to aquaculture production throughout an individual aquaculture value chain. Risk assessment tools may include gap analysis, SWOT analysis, import risk analysis (IRA), hazard analysis and critical control point (HACCP), and expert knowledge elicitation (EKE). IRA is an internationally accepted method for deciding whether trade in a particular commodity either a live aquatic organism or its product poses a significant risk to human, animal or plant health and, if so, what measures, if any, can be applied to reduce that risk to an acceptable level.

Current status

Currently all LVB countries lack risk analysis expertise. PMP-AB which uses integrated approaches to identify and assess risks along the value chain to aquaculture production is new to countries of the LVB. Training programmes and appropriate regional or EAC/LVFO structures for conducting risk assessments within the PMP-AB value chain-based framework for key aquatic

commodities (species) are essential for successful implementation. The capacity for countries of the LVB to conduct IRAs, both within the PMP-AB framework i.e., for an aquatic species being introduced by a country for initiation of a value chain production system or for other purposes is needed. IRAs should be coordinated with ecological and genetic risk analyses where proposals to introduce new species for aquaculture development are received.

Objectives

The objectives of Programme 6 are, to:

i. achieve the necessary level of capacity and expertise to conduct the various types of risk assessment essential to implementation of the PMP-AB by countries of the LVB;
ii. incorporate a science-based, consultative and transparent pathogen risk analysis process in the development and implementation of the national and regional policies, mechanisms and procedures for dealing with import and export of live aquatic organisms and their products; and
iii. review and improve policy, mechanisms and procedures with regard to domestic, regional and international movement of live aquatic organisms and their products so as to prevent the spread of important aquatic pathogens.

Activities

Four activities to be accomplished under Programme 6:

Activity 15: Organise training activities to increase the capacity and expertise in risk assessment methodologies for LVB countries to effectively implement PMP-AB

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to medium (2027 – 2030)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Building on activities of the FAO's PMP-AB programme, such as the PMP-AB risk assessment video training course, the PMP-AB *Guidance Application ToolKit 4: Risk Assessment*, and the various risk analysis workshops will be organised FAO Members, EAC/LVFO, with the assistance and support of FAO and other interested donors. The activity will involve offering a series of training workshops on risk assessment within the context of the PMP-AB. The activity intents to progressively increase expertise and experience though review and conducting of actual risk assessments as needed by countries of the LVB (see also Activity 5, Programme 2: Human Resources and Institutional Capacity Development).

Activity 16: Develop a regional commodity-based risk assessment framework

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Within the AAHTWG of the EAC/LVFO, a regional Pathogen Risk Analysis Working Group consisting of regional experts in pathogen risk analysis and aquatic animal biosecurity will be established. The Working Group will be comprised of experts from countries participating, as trainers or trainees, in activity 16. When requested, the Working Group will provide guidance and recommendations to LVB countries through thorough

review of draft value chain-based risk assessments and will undertake to develop and publish a recommended risk analysis framework and associated guidance that will facilitate the conduct of IRAs by individual countries of the LVB.

Activity 17: Develop EAC/LVFO -harmonized standards and guidelines for risk management requirements for importing live aquatic organisms.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium term (2027 – 2030)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: An expert will conduct review of published risk analyses i.e. IRA and ecological/pest risk analyses; international and regional standards and guidelines related to importations of live aquatic organisms, including ornamental aquatic organisms. Thereafter, the expert will develop a set of standards and guidelines to assist LVB countries in regulating international trade (importations) of live aquatic animals and plants destined for aquaculture and the aquarium trade within the LVB Region. This activity will be collaborated with activities 28, 29 and 30 under Programme 9 on border inspection, health certification and quarantine. Following the approval of the standards and guidelines by EAC/LVFO secretariat and/or its governing Council, individual countries are expected to adopt them as minimum national standards and guidelines. With uniform approach, the national adopted standards form minimum standards applied throughout the LVB Region.

Activity 18: Promote cooperation among Competent Authorities to manage aquatic organisms' health (pathogen, genetic and ecological risks) associated with importations.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: Under this Activity, LVFO will organise regular workshop for Competent Authorities to discuss guidelines and procedures for IRA, genetic risk analysis and pest/ecological risk analysis and develop an integrated approach and framework for evaluating the risks associated with a proposed importation of live aquatic organism or its product for use by LVB countries.

4.7. Programme 7: Farm-level Biosecurity and Health Management

Background

Good farm-level biosecurity and aquatic health management are essential for sustainable aquaculture production. This includes always knowing the health status of the cultured stock, from stocking to harvest or on-selling and, importantly, the health status of any introduced or imported stock. Among others, biosecurity includes ensuring pathogens do not gain entry or exit through water intake and outflow, (or other entry points), proper stocking density, correct feeding, daily health monitoring, good biosecurity practices, early recognition of disease and its proper identification and treatment, etc. All critical processes should be covered by Good Aquaculture Practices (GAqP) and Standard Operating Procedures (SOPs). Aquaculture production facilities are the key components of an aquaculture value chain (AVC), and if they fail due to poor

management or biosecurity that allows pathogen entry and spread, then the entire AVC may collapse.

Current Status

There is poor awareness of aquatic organism health among actors along the aquaculture value chain particularly especially small-scale and extensive farmers in the LVB region leading to constraints in implementing effective aquatic organism health programmes. The farm management practices of small-scale farmers including acquisition of seed from wild, poor feeding, inadequate water quality monitoring and poor biosecurity measures create conducive conditions for proliferation of pathogens that are spread into the environment through release of untreated wastewater, sharing of equipment and uncertified seeds.

Objectives

The objectives of Programme 7 are:

i. to increase the capacity and knowledge of extension officers and other personnel to educate aquaculturists on good aquaculture practices (GAqPs) and importance of aquaculture biosecurity;
ii. to draft GAqPs and standard operating procedures (SOPs) for aquaculture value chains (AVCs) in LVB countries for which the PMP-AB process will be implemented.

Activities

There are three activities to be accomplished under Programme 7:

Activity 19: Identify training needs among stakeholders on Good Aquaculture Practices (GAqPs) and aquaculture biosecurity

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027)
- *Responsibility*: National government of countries of the LVB, with assistance of EAC/LVFO
- *Description:* Under this Activity, LVB countries will conduct a national survey to establish the capacity building needs of stakeholders along the selected aquaculture value chains. This activity will guide the development of (GAqPs) and standard operating procedures (SOPs).

Activity 20: Develop good aquaculture practices (GAqPs) and standard Operating Procedures (SOPs) for LVB countries in the process of implementing PMP-AB

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027) to medium (2027 – 2030)
- *Responsibility*: National government of LVB countries, with assistance of EAC/LVFO
- *Description*: Under this Activity, in each LVB countries, an AVC will be selected for implementation of the PMP-AB and relevant guidelines, GAqPs and SOPs for the AVC commodity in question reviewed. In addition, standardized SOPs and GAqPs for all production facilities within the AVC will be prepared. EAC/LVFO may assist by reviewing SOPs and GAqPs for various commodities (e.g., finfish, crustaceans, molluscs) and

preparing generic GAqPs and SOPs for each subsector that can be modified to suit specific country AVCs.

Activity 21: Provide training of extension officers, other first-line personnel and aquaculturists on GAqPs and the importance of good aquaculture biosecurity.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027)
- *Responsibility*: National government of LVB countries, with assistance of EAC/LVFO
- *Description*: Under this Activity, countries of the LVB should review the capacity and capability of their extension services (gap analysis). Short-term national trainings should be organized on GAqPs and aquatic biosecurity, including on-farm disease diagnosis, reporting, and preparation of samples for shipment to diagnostics laboratories. Once key personnel are trained, coordinated extension and training should be conducted at the local level to improve the knowledge of small-scale aquaculturists. This activity builds on Programme 2: Human Resources and Institutional Capacity Development

4.8. Programme 8: Emergency Preparedness and Contingency Planning

Background

Emergency preparedness is the ability to respond effectively and timely to disease emergencies e.g., disease outbreaks, mass mortalities. The capability to deal with emergency disease situations requires a great deal of planning and coordination, including establishing operational, financial and legislative mechanisms and making required resources available on short notice including skilled personnel and essential equipment. If there is importation of live aquatic organisms, the possibility of serious disease outbreaks due to exotic pathogens exist. Even under the best of circumstances, pathogens will occasionally escape border detection, breach national barriers, become established, spread and cause major losses. The extent to which losses occur often depends on the speed of detection, which depends on the effectiveness of disease surveillance, diagnostics and reporting programmes and the rapidity and effectiveness with which countries recognize and react to the first reports of serious disease. The rate and effectiveness of the reaction including containment and/or eradication, are largely dependent upon contingency planning. Therefore, countries of the LVB need to develop such plans for key cultured species and diseases.

Current Status

Contingency planning or emergency preparedness for outbreaks of aquatic organism disease amongst LVB countries are not streamlined in the existing plans and strategies. At the regional level, EAC/LVFO lack a permanent emergency response team to deal with outbreaks of aquatic animal disease. The national governments and regional bodies lack clear procedures for dealing with requests from LVB countries to provide emergency assistance in instances of serious disease outbreaks in aquatic organisms. Importantly, there are no clear mechanisms streamlined among LVB countries for rapid resource mobilisations to support emergence responses in aquatic environments.

Objectives

The objectives of Programme 8 are:

i. to assist countries of the LVB in developing or improving contingency plans for key diseases, commodities and value chains and harmonizing the contingency plans at regional level;
ii. to develop generic disease manuals for specific diseases of high priority to the LVB Region;
iii. to review EAC/LVFO's protocol for dealing with requests from countries of the LVB to provide emergency assistance in events of serious disease outbreaks including the possible, of establishing a permanent emergency response team, with membership and terms of reference,
iv. to establish a regional emergency response fund and a rapid mobilization team.

Activities

There are six activities to be accomplished under Programme 8:

Activity 22: Organize a regional workshop on contingency planning and emergency preparedness for LVB countries.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: EAC/LVFO will organize regional workshops on contingency planning and emergency preparedness, with the assistance of LVB countries and interested development agencies, to assist countries in developing, where plans are lacking or improving, as necessary, contingency and emergency response plans. Countries will discuss experiences and the requirements of broader emergency response planning and will identify specific diseases of concern to the LVB Region for further guidance.

Activity 23: Develop generic disease manuals for diseases of high priority to the LVB Region

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium (2027 – 2030) to long term (2030 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: EAC/LVFO, with the assistance of regional experts and LVFO AAHTWG will prepare generic disease manuals for specific high-priority diseases affecting commodities selected by countries of the LVB for value chain analysis and implementation of the PMP-AB. Manuals similar to the AQUAPLAN Disease Manuals[9] and FAO Disease Strategy Manuals for infectious myonecrosis virus (IMNV)[10] (Tang et al., 2019), AHPND (Tang et al., 2020) and TilV (Tang et al., 2021), could be developed and modified, as necessary, to fit individual country situations. Further, FAO is developing a Toolkit for dealing with aquatic organism mass mortality events (MMEs) to support PMP-AB implementation that can be adopted by LVB countries. This activity builds on activity 15 under Programme 5: Disease Diagnostics.

[9]https://oar.marine.ie/bitstream/handle/10793/1133/AquaPlan%20Final%20Report.pdf?sequence=1&isAllowed=y
[10] https://www.fao.org/documents/card/en/c/ca6052en

Activity 24: Mainstream aquatic organisms' health issues in national emergency preparedness & contingency planning strategies.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium (2027 – 2030) to long term (2030 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Under this Activity, experts appointed by EAC/LVFO in consultation with national CAs, will undertake a review of the national emergency preparedness & contingency planning strategies in aquatic organisms health emergences. Based on the results of this review and on best international practice, the experts will either develop or suggest revise national emergency preparedness & contingency planning strategies to consider strong inclusion of aquatic organisms' health emergences.

Activity 25: Design EAC/LVFO's protocol for dealing with requests from LVB countries to provide emergency assistance in case of disease outbreaks.

- Scenario supported: 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short (2024 – 2027)
- *Responsibility*: EAC/LVFO
- *Description*: Under this Activity, EAC/LVFO's will develop protocol for dealing with requests from LVB countries to provide emergency assistance for serious disease outbreaks.

Activity 26: Establish and operationalize permanent emergency response team including the membership and terms of reference.

- Scenario supported: 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO
- *Description:* Under this Activity, EAC/LVFO's will establish a permanent emergency response team, possible part of the AAHTWG, including its membership, terms of reference (TOR).

Activity 27: Establish a regional emergency response fund and mechanisms from rapid fund mobilization.

- Scenario supported: 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO
- *Description:* EAC/LVFO's will spearhead the mobilisation of resources and maintain resource envelop aimed to support rapid deployment of the regional emergence team during serious disease outbreaks.

4.9. Programme 9: Border Inspection, Health Certification and Quarantine

Background

Border inspection includes all activities regulating the importation and exportation of live aquatic organisms and their products enforced by the national Competent Authority (CA) and national customs officers at international airports, land border posts and seaports of entry. Quarantine involves holding of aquatic organisms under conditions that prevent their escape, escape of any pathogens or "fellow travellers" they may be carrying, into the surrounding environment. Quarantine may be conducted pre-border – in the exporting country, border – at the entry point of the importing country or post-border – at a quarantine facility operated directly by the CA or by the private sector, under the standards and supervision of the CA inside the importing country. Quarantine is one of the risk mitigation measures that may be applied to shipments of live aquatic organisms to reduce the risk of introducing serious pathogens and pests.

Aquatic organism health certification is a core component of most import controls. These certificates usually take the form of attestations by the CA of the exporting country providing guarantees concerning the disease status of the export commodity and that the consignment meet the conditions required by the importing country's CA as reflected in the import permit. These attestations can be for example about the source of the animals/product, the health status of the animals or any processing to which they have been subject.

It is important therefore that the CAs of exporting countries have the AOH management systems to support claims made in health certificates, and that receiving CAs have the resources and systems to check the authenticity of these certificates. This includes the veracity of any pre-export testing, the qualifications of the exporting country officials attesting to health status of the aquatic organisms, and record keeping that allows for audit and traceability of certification systems. These import/export control systems are equally important for trade within the EAC and beyond. The demand for AOH certification services is expected to grow in the region with the anticipated growth of the aquaculture industry, as will the scrutiny of these services by receiving CAs.

Current Status

All LVB countries have compliance systems to enforce aquatic animal health and food safety related import requirements for international trade in aquatic organisms/products and the monitoring and enforcing of domestic movements of aquatic organisms and their products. However, compliance systems that monitor and enforce international exportations and those related to disease prevention, management and control in aquaculture facilities are less well developed.

Objectives

The Objectives of Programme 9 are:

i. to assist LVB countries in reducing the risk of spreading serious diseases of aquatic organisms through improved importation and exportation procedures, including border inspection of live aquatic organisms and their products and use of other risk management measures such as health certification and quarantine;

ii. to harmonize standards for handling importations of live aquatic organisms and their products at the regional level, including associated health certifications;
iii. to prevent the introduction into the region of harmful aquatic invasive and pest species by establishing a regional list of species prohibited for importation by all countries in the LVB.

Activities

There are four activities to be accomplished under Programme 9:
Activity 28: Evaluate current import practices and existing standards for quarantine facilities in LVB countries

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium term (2027 – 2030)
- *Responsibility*: National government of countries of the LVB
- *Description*: Individual LVB countries will review and, where necessary, revise their current import practices and existing standards for the construction and operation of quarantine facilities

Activity 29: Harmonize standards for handling importations of live aquatic organisms and their products at regional level, including associated health certification.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: Under this Activity, experts appointed by EAC/LVFO in consultation with national CAs, will undertake a review of the standards and procedures applied by countries of the LVB in handling the importation of live aquatic organisms focusing border control, health certification, inspection and diagnostics, quarantine. Based on the results of this review and on best international practice, the experts will either develop or revise e.g., Fisheries and Aquaculture Border Inspection Manual for EAC), a set of recommended regional guidelines for standardized procedures for importation of live aquatic organisms and their products including standards for health certificates to accompany imported shipments as well as the recommended standards for the construction and operation of quarantine facilities.

Activity 30: Build capacity at national and regional levels for the safe importation of live aquatic organisms

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: A regional programme for improving the capacity of countries of the LVB, in particular, the appropriate personnel from the Competent Authority, to implement the recommended standards and procedures for the safe importation of live aquatic organisms will be developed by EAC/LVFO based on the assessment of country and regional needs conducted under activities 28 and 28, and taking into account activities under Programme 2: Human Resources and Institutional Capacity Development.

Activity 31: Develop/ review a list of aquatic species that should prohibited in the region

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: EAC/LVFO experts, in consultation with country CAs, will review regional and international experiences with exotic aquatic species to identify those species that, due to their invasiveness or other negative characteristics, have caused serious harmful economic, environmental and/or human health impacts to importing countries, both within the LVB Region and elsewhere in the world. Based on this review, LVB countries will draw up a list of aquatic plant and animal species that, if absent, should not be imported into the region or, if already introduced, should be prevented from further spread and, if possible, eradicated. Following approval of the list by LVB countries, countries will be supported to take necessary regulatory actions to prohibit the importation of these listed species into their territories following activities outlined under Programme 1: Policy, Legislation and Enforcement. EAC/LVFO will also establish the criteria for listing of an aquatic species as "prohibited" and a mechanism for regular review and updating of the species listing.

4.10. Programme 10 Surveillance, Monitoring and Reporting

Background

Disease surveillance is a fundamental component of any official aquatic organism health protection programme. Surveillance and monitoring programmes are essential for the detection and rapid emergency response to significant disease outbreaks and form the basis for early warning of exotic incursions or newly emerging diseases. Surveillance and monitoring are also increasingly demanded by trading partners to support statements of national disease status and form a basis for zoning and compartmentalization (Programme 11). Surveillance also provides the building blocks of information necessary to have an accurate picture of the distribution and occurrence of pathogens relevant to disease control and international movement of aquatic organisms and their products. Surveillance can be passive – reactive and general in nature or active – proactive and targeted. In both cases, there must be adequate reporting mechanisms so that suspected cases of serious disease outbreaks are quickly communicated to the CA. Surveillance and monitoring efforts must be supported by adequate diagnostic capability. These include appropriately trained expertise, suitably equipped laboratory and rapid-response field diagnostics, and standardized field and laboratory methods; information system management of recording, collating, and analysing data and reporting findings; legal support structures, transport and communication networks and linked to national and international – WOAH and regional – disease reporting systems e.g. NAPL/NADL, disease notification and reporting procedures. Surveillance to demonstrate freedom from a specific disease requires a well-designed active surveillance programme that meets the standards outlined in the WOAH Aquatic Animal Health Code (WOAH, 2022). Guidance in the design and implementation of an active surveillance for aquatic diseases for a multidisciplinary team in developing countries is available and can be used as reference (Bondad-Reantaso *et al.* 2021).

Current Status

None of the five LVB countries have any apparent active surveillance systems for monitoring presence of serious aquatic pathogens targeting either WOAH-listed or non-listed diseases of national importance. However, two countries recently participated in a surveillance and training exercise for TiLV under FAO project GCP/RAF/510/MUL: *Enhancing capacity/risk reduction of emerging Tilapia Lake Virus (TiLV) to African tilapia aquaculture*. Overall National Pathogen Lists, reporting systems, surveillance and monitoring, and aquatic animal health information systems are relatively underdeveloped in the LVB region, representing a significant drawback in many aspects of effective aquatic organism health (AOH) management.

Objectives

The objective of Programme 10 is to assist LVB countries that lack disease surveillance programmes to establish passive or active (as appropriate) programmes, and to assist countries surveillance programmes improve them through their review and analysis.

Activities

There is one activity to be accomplished under Programme 10:

Activity 32: Assist LVB countries lacking aquatic disease surveillance programmes to establish passive or active (as appropriate) programmes, and review and improve such programmes in countries undertaking aquatic disease surveillance

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium term (2027 – 2030)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: EAC/LVFO will organize a series of workshops to assist in the development and improvement of countries' disease surveillance and monitoring programmes. The workshops will consider the most effective and cost-efficient ways to implement passive surveillance programmes. The activity will also involve the review in detail the active surveillance programmes established by countries to help improve their effectiveness, statistical basis, reporting, data storage and other aspects. This activity builds on Programme 2: Human Resources and Institutional Capacity Development.

4.11. Programme 11: Zoning and Compartmentalization

Background

Zoning and compartmentalization are procedures implemented by a country under the provisions of Chapter 4.2 of the Aquatic Animal Health Code (WOAH, 2022) to define subpopulations aquatic organisms with a distinct health status for the purpose of disease control or international trade. Compartmentalization applies to a subpopulation when management practices related to biosecurity are the defining factors. A "compartment" being defined as "one or more aquaculture establishments under a common biosecurity management system containing an aquatic animal population with a distinct health status with respect to a specific disease or diseases, for which the required surveillance and control measures are applied, and basic biosecurity conditions are met

for the purpose of international trade". Zoning is applied when a subpopulation is defined on a geographical basis. A "zone" being "an area in one or more countries containing an aquatic animal population with a specific aquatic animal health status with respect to a disease, in which surveillance and control measures and basic biosecurity conditions are applied". The purpose of zoning and compartmentalization is to allow a country where a WOAH-listed disease is present, to clearly demonstrate to trading partners that certain geographical areas (zones) or aquaculture facilities (compartments) are free of the disease(s) in question and thus aquatic animals originating from these zones or compartments may be traded internationally. To establish a disease-free zone or compartment, a country must meet a series of rigorous requirements as outlined in the Aquatic Animal Health Code (WOAH, 2022).

Current Status

Zoning and compartmentalization are inexistence in the aquaculture sectors of the LVB. TRUEFISH is conducting an overall spatial planning activity for the entire lake, where feasibility maps for development of aquaculture are being drafted. By the end of 2023 three pilot areas will be selected for calculating carrying capacity and applying zoning as defined here (within the pilot area). Therefore, this activity will be partially supported by the project.

Objectives

The objective of Programme 11 is to assess the status of zoning and compartmentalization in countries of the LVB, improve the understanding by CAs of countries of the requirements for zoning and compartmentalization, and where desirable and feasible, to help countries identify aquaculture facilities or value chains where zones or compartments could be established.

Activities

There is one activity to be accomplished under Programme 16:
Activity 33: Review the status of zoning and compartmentalization in LVB countries and assess the feasibility of implementing of zones and compartments for aquaculture value chains in countries implementing the PMP-AB

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: Under activity 31, EAC/LVFO will, through its NFPs, collect, analyse and summarize information on the zoning and compartmentalization accomplished by LVB countries. A workshop will hold to review the findings, assist CAs in understanding WOAH requirements, and assess the feasibility of implementing such programmes for aquaculture value chains of LVB countries for which the PMP-AB is being implemented.

4.12. Programme 12: Communication and Information System

Background

Communication includes activities that increase the flow of information between and among policy-makers, researchers, Competent Authorities, regional bodies and international agencies and

experts. Communication activities assist with problem-solving and keep relatively isolated national experts, up-to-date regarding regional and global aquatic organisms' health situation. Establishing and promoting good communication and linkages between all actors including national aquatic organisms' health services providers and national fisheries authorities is especially important for an effective aquatic organism biosecurity programme.

Current Status

Currently there are no regional mechanisms and platforms that promotes communication on aquatic organism health and biosecurity matters between experts, policy-makers, quarantine officers, diagnosticians, etc in LVB countries. On a global basis, communication and information on aquatic organism health and biosecurity matters are provided and accessed through WOAH (https://www.woah.org/en/home/) and the national WOAH representatives in LVB as well as the FAO's aquatic organism health programmes. However, these platforms have limited information on aquatic organism health from LVB.

Objectives

The Objective of Programme 12 is to continue to support and strengthen EAC/LVFO's role as the lead agency for aquatic organism health in the LVB Region.

Activities

There is one activity to be accomplished under Programme 12:
Activity 34: Develop and maintain a regional Aquatic Organism Health module in the LVFO Information System.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Through this activity, EAC/LVFO will initiate development and implementation of effective communication mechanisms including use of a digital communication platform including digital application and dedicated regularly updated AOH web portal. This will allow the rapid sharing of information amongst stakeholders along the aquaculture value chain and promote active participation of actors in the implementation of this RAOHS and the PMP-AB.

4.13. Programme 13: Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance

Background

Antimicrobial resistance (AMR) due to the inappropriate and over-use of antimicrobials impacts treatment outcomes of diseases in humans, livestock, poultry, and aquaculture. AMR is recognized as a major global threat to livelihood that requires immediate action. To address AMR in aquaculture, it is important to establish the status of antimicrobial usage and levels of AMR in the region, examine national initiatives and regulatory instruments. The results will guide the development of a regional framework for AMR surveillance that harmonizes national AMR surveillance and monitoring programs for aquatic animals to WOAH Aquatic Animal Health Code.

The guideline for monitoring and surveillance of AMR should include regional protocols for sampling, laboratory testing and data management.

Current Status

A broad range of legislation and national action plans for AMR governs the use of antimicrobials in the countries of the LVB. However, most countries lack aquaculture specific legislation and plans to address inappropriate use of antibiotics and other veterinary drugs in aquatic organism production establishments. The baseline data on AMR from aquaculture is also lacking, hence, it is difficult to monitor the progress towards reducing antimicrobial overuse or misuse. Besides, there appears to be little enforcement of relevant legislation and regulations and inspections or monitoring team for controlling the use of drug use in aquaculture.

Objectives

The Objectives of Programme 13 are:

i. to assist countries of the LVB that lack national action plans (NAPs) for AMR to develop such plans, and to review the status of NAPs and their effectiveness in those countries who have developed and implemented such plans;
ii. to review and update information on the use of veterinary drugs by countries of the LVB and the status of relevant legislation and enforcement.

Activities

There are two activities to be accomplished under Programme 12:
Activity 35: Review and update provisions in national legislation of LVB countries that regulate the use of veterinary drugs in aquaculture and the status of enforcement

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: EAC/LVFO will coordinate the collection and analysis of information on the use of veterinary drugs by LVB countries and on relevant legislation and its enforcement. This may lead to regional recommendations on drug usage and harmonized legislation.

Activity 36: Assist LVB countries lacking national action plans (NAPs) for Antimicrobial resistance (AMR) to develop such plans, and review the status and effectiveness of NAPs in countries with AMR-NAPs

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Medium term (2027 – 2030)
- *Responsibility*: EAC/LVFO and national government of LVB countries
- *Description*: EAC/LVFO will organize a workshop for the development and review of national action plans on AMR for LVB countries. Prior to the workshop, EAC/LVFO, with assistance from regional experts, will conduct a review of NAPs for AMR and develop a guidance document to assist with harmonized NAPs.

4.14. Programme 14: Research and Development

Background

Research capacity in aquatic plant and animal health is necessary to the successful expansion of aquaculture development. Targeted and basic research can lead to better disease management, better understanding of national aquatic organism health status, support to risk analysis, improved diagnostic methods, etc. Where specific research capacity is low, countries rely largely on research conducted by scientists in other nations. Often, such "borrowed" research may not be directly applicable to local situations and experimental testing must be undertaken to adapt these findings. In other cases, little or no relevant information on the specific problem may be available. Mechanisms to improve access to research capacity include development of national aquatic organisms' health research laboratories, supporting linkages and research programmes within universities and the private sector, contracting of targeted research with foreign institutions, and development of a regional aquatic organisms' health centre. Ongoing research needs to be supported to allow a better understanding of a few aquatic diseases that have recently been introduced into the LVB. The impacts and spread of introduced diseases among indigenous species and to widely divergent catchments are poorly studied. A better knowledge of such TAADs under local conditions is vital for the sustainable development of aquaculture production and the maintenance of aquatic biodiversity.

Current Status

The LVB region has many universities and research institutions, with some AAH-related research activities. The existence of the dedicated African Centre for Aquatic Animal Health at Sokoine University of Agriculture is notable. However, regional AOH research activity in general is limited due to inadequate or lack of funding, low-level extensive production systems and aquaculture, along with associated AOH research needs, is relatively new to the region. The expected future growth of the sector and intensification of production establishment, is however expected to result in a commensurate increased demand for AOH research, driven both by government and private sector information needs.

Objectives

The Objective of Programme 14 is to increase research activity in areas that have greatest potential to contribute to the improvement of regional aquatic organism health and biosecurity. (Also see Activity 40 under Programme 15: International and Regional Cooperation).

Activities

There are three activities to be accomplished under Programme 14:
Activity 37: Develop a research agenda to prioritize aquatic organisms' health research and development programmes for the region and nationally

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Short term (2024 – 2027)

- *Responsibility*: EAC/LFVO and national government of countries of the LVB
- *Description*: Under Activity 35, EAC/LVFO will identify and prioritize current and potential aquatic organism health research and development programmes, including development of new diagnostic tests/ farm based diagnostic mechanisms, which can contribute to the advancement of aquatic organism health management and biosecurity in the region. NFPs and Competent Authorities will assist by identifying and prioritizing activities and needs on both a national and regional basis.

Activity 38: Profile research establishments and align their research activities to priority research and development programmes in aquatic organism health within the LVB countries and region

- Scenario supported: 1,4
- Stages facilitated: 1, 2, 3
- *Timeframe*: short term (2024 – 2027)
- *Responsibility*: EAC/LFVO and national government of countries of the LVB
- *Description*: EAC/LVFO, through the NFPs, will conduct a regional survey of government, university, and private research facilities to identify the expertise and infrastructure available in the region and current research programmes. This will lead to the establishment of a regional database of facilities, scientists, expertise, and mandates/interests. This database can then be used to identify potential participants in projects targeting specific research needs for the advancement of regional aquatic biosecurity.

Activity 39: Mobilize resources for aquatic organism health research for the LVB Region

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: long term (2024 – 2034)
- *Responsibility*: EAC/LFVO and national government of countries of the LVB
- *Description*: Based on the findings of Activities 37 and 38, this Activity will develop preproposals for priority aquatic organism research projects in the LVB Region and will identify potential international, regional, and national funding sources for individual projects based on the interests of potential funding agencies and the priorities of countries of the LVB. Once potential funding sources for an individual project have been identified, EAC/LVFO will lead or assist countries, as required, in the preparation of a proposal to funding-agency requirements.

4.15. Programme 15: Regional and International Cooperation

Background

Cooperation refers to the sharing of effort and resources including staff, infrastructure, technology, knowledge, funding between and/or among countries of the LVB, government agencies, universities, the private sector and other stakeholders to achieve common objectives or goals. Cooperation in research and training is possible via international agencies such as the FAO, Norwegian Veterinary Institute, Centre for Environment, Fisheries and Aquaculture Science (CEFAS, United Kingdom) SIDA, and with foreign universities and experts.

Current Status

Although there are a range of international collaborations in the field of aquaculture and fisheries in the region, it is not always clear the degree to which AOH is considered in the projects. The common goals that arise from countries sharing aquatic resources is the great potential for regional cooperation and networking in almost all areas of AOH. Evidently, regional collaboration guided the LVFO's harmonized border inspection procedures and cage culture guidelines. Other potential opportunities identified for the region include shared information systems, diagnostic capability, disease surveillance, emergency disease preparedness and response systems, collaborative research, and shared expertise. Further international cooperation with LVB countries e.g., FAO, WOAH, World Health Organization, and World Trade Organisation has the potential to lead to development of regional strategy and policy for disease reporting, emergency response actions, the development of standardized procedures for import and export of live aquatic organisms, harmonization of legislation, shared communication structures including website, newsletter, regional disease cards and notifications, coordinated trainings, and workshops, etc.

Objectives

The objective of Programme 15 is to improve regional aquatic organism health and biosecurity by identifying mechanisms for increasing appropriate regional and international cooperation among Competent Authorities, experts and other relevant stakeholders.

Activities

There are two activities to be accomplished under Programme 15:
Activity 40: Promote cooperation among LVB countries in the control of the serious aquatic organism diseases existing in the region

- Scenario supported: 1,4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Under Activity 40, EAC/LVFO will identify and facilitate mechanisms to increase cooperation among countries of the LVB that will assist in controlling serious aquatic organism diseases that are present in the region.

Activity 41: Promote collaborations in research and technology transfer among the value chain actors, local, regional and international aquatic organism health experts

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: Long term (2024 – 2034)
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Under activity 41, EAC/LVFO will identify and facilitate mechanisms to increase cooperation between countries of the LVB, aquatic organism health experts in government, academia and the private sector, and their local, regional and international counterparts. This activity also links to activities under Programme 14: Research and Development.

4.16. Programme 16: Ecosystem Health

Background

The “One Health” is holistic and trans-disciplinary concept, incorporating the important linkages between human, animal and ecosystem health. Ecosystem health describe the state of an ecosystem relative to a desired management target. One health examines the: 1) effect of the environment in which aquatic animals are farmed on their health, 2) the negative impacts, such as the escape of invasive species and release of pathogens into the natural environment and transfer of AMR determinants to environmental bacteria, and 3) pollution and loss of species diversity associated with farmed aquatic organism. Anthropogenic stressors linked to population growth in addition to climate change, have accelerated environmental pollution, damage to biodiversity, deterioration of ecosystems, and habitat fragmentation leading to migratory movements of species, subsequently contribution to the evolution of emerging and re-emerging diseases in wild and cultured aquatic organisms.

Current Status

Countries of the LVB have equatorial climate and water bodies are suitable for the culture of several alien commercial species, both food fish and ornamental. These organisms have a potential to escape from aquaculture establishments, together with exotic pathogens carried, and invade natural ecosystems. Disease outbreaks in naïve susceptible species, are detrimental to both aquaculture and wild fisheries causing far-reaching negative effects on biodiversity. Lake Victoria system is already eutrophied, therefore, careful planning is required to ensure sustainable cage aquaculture. Otherwise, addition input of nutrients through feeds and wastes from fish may exacerbate deterioration of environmental conditions that may be unfavourable for many native species. Additional concerns exist about the potential genetic impact on indigenous species when genetically improved strains of the same species, such as Nile tilapia, escape from aquaculture establishments. Regular monitoring of environmental conditions should able to track, identify and manage possible concerns associated with pesticides, antibiotic accumulation and resistance, nutrient accumulation and species structuring and composition among others.

Objectives

The Objective of Programme 16 are:

i. to ensure that countries of the LVB address the issues related to ecosystem health during implementation of the PMP-AB, assuring that aquaculture value chains have minimal impact on the surrounding aquatic and terrestrial ecosystems.
ii. to identify invasive species that may carry serious diseases of concern to countries in the LVB

Activities

There is one activity to be accomplished under Programme 16. Most of the other activities outlined in this Strategy will contribute to the overall health of aquatic ecosystems by improving aquatic

biosecurity. However, activities under programme 7 and 15 are particularly relevant to Programme 16.

Activity 42: Develop and operationalize programme for monitoring of biological (including aquatic organisms pathogens of public health importance), chemical (including pesticides, antibiotics) and physical changes and respective remedies in aquaculture system in LVB countries.

- Scenario supported: 1, 4
- Stages facilitated: 1, 2, 3
- *Timeframe*: short
- *Responsibility*: EAC/LVFO and national government of countries of the LVB
- *Description*: Given the importance of ecosystem health to the health of aquatic organisms, Activity 42 is set to guide on the list of parameters to monitor and harmonise procedures of sampling and analyses of changes in biological composition, chemicals, and physical condition within and around the aquaculture establishment, suggest actions to remediate the observed changes and assess effectiveness of the suggested management actions.

5. REFERENCES

Achieng A.P. (1994) Aquaculture Development and Research in Kenya. In Coche A.G. (Ed) Aquaculture development and research in sub-Saharan Africa. National reviews. *CIFA Technical Paper*, No. 23, Suppl. Rome, FAO.

Aura, C. M., Musa, S., Yongo, E., Okechi, J. K., Njiru, J. M., Ogari, Z., Wanyama, R., Charo-Karisa, H., Mbugua, H., Kidera, S., Ombwa, V., Oucho, A. J., 2018. Integration of mapping and socio-economic status of cage culture: Towards balancing lake-use and culture fisheries in Lake Victoria, Kenya. *Aquaculture Research*, 49, 532–545. https://doi.org/10.1111/are.13484.

Balarin, J.D. 1985. National reviews for aquaculture development in Africa. 10. Uganda. *FAO Fisheries Circular*, FIRI/C770.10. Rome, Italy, Food and Agriculture Organization of the United Nations. [Baobab Farm Ltd, Mombasa, Kenya].

Campbell.D., Obuya S. and Spoo M. (1995). A simple method for small scale propagation of Clarias gariepinus in western Kenya. TCP/KEN/4551(T) Field Document No 2. Kisumu, Kenya.

Corsi F., Dunn I. and Felicioni E. (1986) Report of the mission (phase II). Study sub-sector: The fisheries and fish farming in Burundi. Food and Agriculture Organisation (FAO) Roma, Italy

Dadzie, S. (1992) An overview of aquaculture in Eastern Africa. *Hydrobiologia*, 232: 99–110 (1992). https://doi.org/10.1007/BF00014618.

EAC 2019. East African Community Facts and Figures – 2019. East African Community (EAC), Arusha Tanzania.

El-Sayed A-FM. (2020) Current state and future potential. In: El-Sayed A-FM (Ed.) Tilapia Culture. 2nd ed. Elsevier/Academic Press: 1-20.

Egna S.H (1998) Network Analysis of International Aquaculture Research and Development Efforts in Rwanda: Tracing the Flows of Knowledge and Technology in a USAID-Funded Collaborative Research Support Program. PhD Dissertation, Oregon State University, USA.

FAOSTAT 2023a. Food Balances (2010-) https://www.fao.org/faostat/en/#data/FBS

FAO. 2023b. Fishery and Aquaculture Statistics. Global aquaculture production 1950-2021 (FishStatJ). In: FAO Fisheries and Aquaculture Division [online]. Rome. Updated 2023. www.fao.org/fishery/en/statistics/software/fishstatj

FAO. 2023c. The Progressive Management Pathway for Aquaculture Biosecurity – Guidelines for application. *FAO Fisheries and Aquaculture Technical Paper,* No. 689. Rome. https://doi.org/10.4060/cc6858en

Fish Consulting Group (2012) Cage farming of Nile tilapia, *Oreochromis niloticus* in Lake Dogodogo, Burundi. https://fishconsult.org/?p=3807

Hogendoorn, H. (1979). Controlled propagation of the African catfish, *Clarias lazera* (C. & V.): I. Reproductive biology and field experiments. *Aquaculture*, 17(4), 323-333. https://doi.org/10.1016/0044-8486(79)90087-5

Hogendoorn, H., & Vismans, M. M. (1980). Controlled propagation of the African catfish, *Clarias lazera*: II. Artificial reproduction. *Aquaculture*, 21(1), 39-53.

Ibrahim, K. H., Nozawa T. & Lema R., (1975) Preliminary observations on cage culture of *T. esculenta* and *T. zillii* in Lake Victoria waters at the Freshwater Fisheries Institute, Nyegezi, Tanzania. *African Journal of Tropical Hydrobiology and Fisheries*, 4: 121- 126. https://aquadocs.org/handle/1834/35453

INSBU (2023) The National Institute of Statistics of Burundi (INSBU) Annuaire Statistique Du Burundi, Année 2021. No. 86. Institut National de la Statistique du Burundi (INSBU). Bujumbura, Burundi. https://www.insbu.bi/wp-content/uploads/2023/04/Annuaire-Statistique-du-Burundi-2021vf.pdf

Jones, E. S., Molnar, J. J., Atukunda, G., & Walakira, J. (2012) Evaluation and Improvement of Production Technology in Uganda: Case Studies of Small-Holder Cage Culture in Watershed Reservoirs and as an Alternative Livelihood for Fishers. In AquaFish Collaborative Research Support Program. February 2012. *Technical Reports 2009– 2011*, Volume 1. AquaFish CRSP, Oregon State University, Corvallis, Oregon. 1 – 24. http://crsps.net/wp-content/downloads/AquaFish/Inventoried%203.19/8-2012-8-77.pdf

Kampayana, F., Nguyen, S. T., & Le, M. H. (2016). Tilapia cage culture in Rwanda: Current status and prospects for future development. *International Journal of Fisheries and Aquatic Studies*, 4(3), 428-435.

Kabagambe J.B. (1994) Aquaculture development and research in Rwanda. In: Coche, A.G. (ed.) Aquaculture development and research in sub-Saharan Africa. National reviews. *CIFA Technical Paper.* No. 23, Suppl. Rome, Italy

KNBS (2022) Economic Survey 2022. Kenya National Bureau of Statistics (KNBS). Nairobi, Kenya. https://www.knbs.or.ke/wp-content/uploads/2022/05/2022-Economic-Survey1.pdf

LAT–FAO (2022). Sectoral Training Needs Assessment (TNA) and census of aquaculture business operators at the Lake Victoria basin (Kenya, Tanzania and Uganda): Final Report. Lattice Aquaculture Trust (LAT) and Food and Agriculture Organization of the United Nations (FAO). https://lvfo.org/sites/default/files/field/EU%20Truefish%20Census%20and%20TNA%20Final%20report-Updated%281%29_0.pdf

Matsiko, S. D., & Mwanja, T. M. (2008). The current status of catfish culture and research in Uganda. In Proceedings of a Workshop on the Development of a Genetic Improvement Program for African Catfish *Clarias gariepinus* (p. 57).

Mbowa S., Odokonyero T., and Munyaho A.T. (2017) Harnessing Floating Cage Technology to Increase Fish Production in Uganda. *Economic Policy Research Centre (EPRC) Research Series* 138. http://dx.doi.org/10.22004/ag.econ.262886

Munguti, J., Obiero, K., Orina, P., Mirera, D., Kyule, D., Mwaluma, J., Opiyo, M., Musa, S., Ochiewo, J., Njiru, J. and Ogello, E., (2021). State of aquaculture report 2021: towards nutrition sensitive fish food production systems. Nairobi: Techplus Media House, 190.

Musinguzi, L., Lugya, J., Rwezawula, P., Kamya, A., Nuwahereza, C., Halafo, J., Kamondo, S., Njaya, F., Aura, C., Shoko, A.P. and Osinde, R., (2019) The extent of cage aquaculture, adherence to best practices and reflections for sustainable aquaculture on African inland waters. *Journal of Great Lakes Research*, 45(6): 1340-1347. https://doi.org/10.1016/j.jglr.2019.09.011

NISR (2022) Gross Domestic Product – 2021, Rwanda. National Institute of Statistics of Rwanda.

Njiru, J. M., Aura, C. M., & Okechi, J. K. (2018). Cage fish culture in Lake Victoria: A boon or a disaster in waiting? *Fisheries Management and Ecology*, 26(5): 426-434. https://doi.org/10.1111/fme.12283

Nyandat B. (2005) National Aquaculture Sector Overview. Kenya. National Aquaculture Sector Overview Fact Sheets. In: FAO Fisheries and Aquaculture Department [online]. Rome.

Orina, P., Ogello, E., Kembenya, E., Muthoni, C., Musa, S., Ombwa, V., Mwainge, V., Abwao, J., Ondiba, R., Kengere, J. and Karoza, S., (2021). The state of cage culture in Lake Victoria: A focus on sustainability, rural economic empowerment, and food security. *Aquatic Ecosystem Health & Management*, 24(1), pp.56-63. https://doi.org/10.14321/aehm.024.01.09

TNBS (2021) National Sample Census of Agriculture 2019/20 - Key Findings Report – excluding Zanzibar

TNBS (2022a) National Accounts of Tanzania Mainland 2015 – 2021 excluding Zanzibar. Tanzania National Bureau of Statistics (TNBS)

TNBS (2022b) Tanzania in figures 2021 National Bureau of Statistics Tanzania.
UBOS (2022); 2022 Statistical Abstract, Uganda Bureau of Statistics (UBOS), Kampala Uganda.
van der Heijden P.G.M. and Shoko A.P. (2018). Review and analysis of small-scale aquaculture production in East Africa; Part 3. TANZANIA. Wageningen Centre for Development Innovation, Wageningen University & Research. Report WCDI-18-020. Wageningen.

Annex I: LVB RAOHS Implementation Table

Programme 1: Policy, legislation, and enforcement	PMP/AB Stage			Timeframe			Responsibility			Indicative budget (USD)
	1	2	3	Short 2027	Med 2030	Long 2034	LVFO	State	Both	
Activity 1: Assist countries of the LVB to either draft or review and revise their NAOHS, and determine the appropriate PMP-AB scenario and starting Stage	x	x	x	x					x	150,000
Activity 2: Conduct in-depth reviews of aquatic organisms' health-related legislations and biosecurity and harmonize aquatic organisms' health-related legislations with the international legislations (e.g., EU Directive 2006/88/EC) and the WOAH standards)	x	x	x		x				x	158,000
Activity 3: Assess the capacity and effectiveness of enforcement of aquatic organisms health and biosecurity measures to guide programme 2, activity 7	x	x	x		x			x		50,000
Activity 4: Establish and operationalize LVB Technical Working Group for Biosecurity of Shared River Systems and Lake Shorelines	x	x	x		x				x	165,000
Programme 2: Human Resources and Institutional Capacity Development	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 5: Provide short-term training through regional workshops and pilot projects to ensure that LVB countries are familiarized with the PMP-AB and the value chain approach to risk management	x	x	x						x	250000
Activity 6: Transfer of the understanding and requirements of PMP-AB to stakeholders in selected aquaculture value chains within LVB countries	x	x	x	x					x	250000
Activity 7: Increase the knowledge and expertise of national aquatic organism health workers, biosecurity officers and aquaculturists, border-post officers through targeted short-term training	x	x	x		x				x	250000
Activity 8: Mobilize funding to support development of human resources and institutional capacities	x	x	x		x				x	75000
Programme 3: Institutional Structure	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 9: Assess the existing infrastructure against the minimum laboratory standard required to support the implementation of the NAOHS and the PMP/AB	x	x	x	x					x	75,000
Activity 10: Develop appropriate infrastructure including field and laboratory consumables to support the NAOHS and PMP-AB in diagnostics, research, surveillance etc.	x	x	x	x	x	x			x	2,400,000

Programme 4: Pathogen List	PMP/AB Stage			Timeframe			Responsibility			Indicative budget (USD)
	1	2	3	Short 2027	Med 2030	Long 2034	LVFO	State	Both	
Activity 11: Assist LVB countries to draft or update national and regional pathogen lists based uniform criteria for listing and delisting to ensure uniform and up-to-date pathogen and disease nomenclature for approval by the respective government.	x	x	x	x					x	50,000
Programme 5: Disease Diagnostics	PMP/AB Stage			Timeframe			Responsibility			Indicative budget (USD)
	1	2	3	Short 2027	Med 2030	Long 2034	LVFO	State	Both	
Activity 12: Develop and support accreditation process of national diagnostic laboratories in LVB countries	x				x	x		x		2,550,000
Activity 13: Provide targeted training for technicians in aquatic disease diagnostics to LVB countries	x	x	x	x	x	x	x			250,000
Activity 14: Provide targeted training for extension workers and aqua-farm personnel in on-farm diagnostics, disease reporting and sample preparation	x	x	x	x	x				x	375,000
Programme 6: Risk Analysis and management	PMP/AB Stage			Timeframe			Responsibility			Indicative budget (USD)
	1	2	3	Short 2027	Med 2030	Long 2034	LVFO	State	Both	
Activity 15: Organise training activities to increase the capacity and expertise in risk assessment methodologies for LVB countries to effectively implement PMP/AB	x	x	x	x	x				x	250,000
Activity 16: Develop a regional commodity-based risk assessment framework	x	x	x		x		x			100,000
Activity 17: Develop EAC/LVFO -harmonized standards and guidelines for risk management requirements for importing live aquatic organisms	x	x	x		x				x	40,000
Activity 18: Promote cooperation among Competent Authorities to manage aquatic organisms' health (pathogen, genetic and ecological risks) associated with importations	x	x	x		x				x	75,000
Programme 7: Farm-level Biosecurity and Health Management	PMP/AB Stage			Timeframe			Responsibility			Indicative budget (USD)
	1	2	3	Short 2027	Med 2030	Long 2034	LVFO	State	Both	
Activity 19: Identify training needs among stakeholders on Good Aquaculture Practices (GAqPs) and aquaculture biosecurity	x	x	x	x				x		250,000
Activity 20: Develop GAqPs and SOPs for LVB countries implementing PMP-AB process	x	x	x	x				x		40,000
Activity 21: Provide training of extension officers, other first-line personnel and aquaculturists on GAqPs and the importance of good aquaculture biosecurity	x	x	x	x	x			x		250,000
Programme 8: Emergency Preparedness and	PMP/AB			Timeframe			Responsibility			Indicative

Contingency Planning	**Stage**									**budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 22: Organize a regional workshops on contingency planning and emergency preparedness for LVB countries	**x**	**x**	**x**	**x**					**x**	**57,000**
Activity 23: Develop generic disease manuals for diseases of high priority to the LVB Region	**x**	**x**	**x**		**x**	**x**			**x**	**150,000**
Activity 24: Mainstream aquatic organisms health issues into national emergency preparedness & contingency planning strategies	**x**	**x**	**x**	**x**						**50,000**
Activity 25: Design EAC/LVFO's protocol for dealing with requests from LVB countries to provide emergency assistance in case of disease outbreaks	**x**	**x**	**x**	**x**			**x**			**40,000**
Activity 26: Establish and operationalize permanent emergency response team including the membership and terms of reference	**x**	**x**	**x**	**x**	**x**		**x**			**585,000**
Activity 27: Establish a regional emergency response fund and mechanisms from rapid fund mobilization	**x**	**x**	**x**	**x**	**x**	**x**	**x**			**1,000,000**
Programme 9: Border Inspection, Health Certification and Quarantine	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 28: Evaluate current import practices and existing standards for quarantine facilities in LVB countries	**x**	**x**	**x**	**x**					**x**	**100,000**
Activity 29: Harmonize standards for handling importations of live aquatic organisms and their products at regional level, including associated health certification	**x**	**x**	**x**		**x**			**x**		**100,000**
Activity 30: Build capacity at national and regional levels for the safe importation of live aquatic organisms	**x**	**x**	**x**	**x**	**x**	**x**			**x**	**120,000**
Activity 31: Develop/ review a list of aquatic species that should prohibited in the region	**x**	**x**	**x**	**x**	**x**				**x**	**50,000**
Programme 10 Surveillance, Monitoring and Reporting	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 32: Assist LVB countries lacking aquatic disease surveillance programmes to establish passive or active (as appropriate) programmes, and review and improve such programmes in countries undertaking aquatic disease surveillance	**x**	**x**	**x**	**x**	**x**				**x**	**1,000,000**
Programme 11: Zoning and Compartmentalization	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 33: Review the status of zoning and compartmentalization in LVB countries and assess the feasibility of implementing of zones and compartments for aquaculture value chains in countries implementing the PMP-AB	**x**	**x**	**x**	**x**					**x**	**50,000**
Programme 12: Communication and	**PMP/AB**			**Timeframe**			**Responsibility**			**Indicative**

Information System	**Stage**									**budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 34: Develop a regional Aquatic Organism Health module for incorporation into the LVFO Information System	**x**	**x**	**x**	**x**					**x**	**100,000**
Programme 13: Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 35: Review or update provisions in national legislation of LVB countries that regulate the use of veterinary drugs in aquaculture and the status of enforcement	**x**	**x**	**x**		**x**				**x**	**50,000**
Activity 36: Assist LVB countries lacking national action plans (NAPs) for Antimicrobial resistance (AMR) to develop such plans, and review the status and effectiveness of NAPs in countries with AMR-NAPs	**x**	**x**	**x**		**x**				**x**	**250,000**
Programme 14: Research and Development	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 37: Develop a research agenda to prioritize aquatic organism health research and development programmes for the region and nationally	**x**	**x**	**x**	**x**					**x**	**140,000**
Activity 38: Profile research establishments and align their research activities to priority research and development programmes in aquatic organism health within the LVB countries and region	**x**	**x**	**x**		**x**				**x**	**50,000**
Activity 39: Mobilize resources for aquatic organism health research for the LVB Region	**x**	**x**	**x**	**x**	**x**	**x**			**x**	**100,000**
Programme 15: Regional and International Cooperation	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 40: Promote cooperation among LVB countries in the control of the serious aquatic organism diseases existing in the region	**x**	**x**	**x**			**x**			**x**	**100,000**
Activity 41: Promote collaborations in research and technology transfer among the value chain actors as well as local, regional and international aquatic organism health experts	**x**	**x**	**x**		**x**	**x**			**x**	**100,000**
Programme 16: Ecosystem Health under One Health	**PMP/AB Stage**			**Timeframe**			**Responsibility**			**Indicative budget (USD)**
	1	**2**	**3**	**Short 2027**	**Med 2030**	**Long 2034**	**LVFO**	**State**	**Both**	
Activity 42: Develop and operationalize monitoring programme of biological (including aquatic organisms pathogens of public health importance), chemical (including pesticides, antibiotics) and physical changes and respective remedies in aquaculture system in LVB countries	**x**	**x**	**x**	**x**	**x**	**x**			**x**	**2,250,000**
Total indicate cost										**14,485,000**

Annex 2: Detailed indicative budget required to implement the strategy

Programme 1: Policy, legislation, and enforcement	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 1: Assist countries of the LVB to either draft or review and revise their NAOHS, and determine the appropriate PMP/AB scenario and starting Stage	**50,000**	**50,000**	**50,000**								**150,000**	**Each country requires US$ 10,000/ per year for the activity**
Activity 2: Conduct in-depth reviews of aquatic organisms' health-related legislations and biosecurity and harmonize aquatic organisms' health-related legislations with the international legislations (e.g., EU Directive 2006/88/EC) and the WOAH standards)		**58,000**			**50,000**			**50,000**			**158,000**	**Regionally implemented assignment with LVFO providing the technical guidance**
Activity 3: Assess the capacity and effectiveness of enforcement of aquatic organisms health and biosecurity measures to guide programme 2, activity 7		**50,000**									**50,000**	**Each country conducts in-depth field capacity assessments**
Activity 4: Establish and operationalize LVB Technical Working Group for Biosecurity of Shared River Systems and Lake Shorelines	**30,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**165,000**	**LVFO oversees the group activities**
Programme 2: Human Resources and Institutional Capacity Development	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 5: Provide short-term training through regional workshops and pilot projects	**125,000**	**75,000**	**50,000**								**250,000**	**Each country requires US$ 50,000/ for the**

to ensure that LVB countries are familiarized with the PMP-AB and the value chain approach to risk management												**activity**
Activity 6: Transfer of the understanding and requirements of PMP/AB to stakeholders in selected aquaculture value chains within LVB countries	**50,000**	**125,000**	**75,000**								**250,000**	**In-country activities requiring US$ 50,000/ country**
Activity 7: Increase the knowledge and expertise of national aquatic organism health workers, biosecurity officers and aquaculturists, border-post officers through targeted short-term training	**50,000**	**125,000**	**75,000**								**250,000**	**In-country activities requiring US$ 50,000/ country**
Activity 8: Mobilize funding to support development of human resources and institutional capacities	**25,000**		**25,000**		**25,000**						**75,000**	**Development Partners/ LVFO round-table discussions**
Programme 3: Institutional Structure	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 9: Assess the existing infrastructure against the minimum laboratory standard required to support the implementation of the NAOHS and the PMP/AB	**75,000**										**75,000**	**Each country requires USD 15,000 for the activity**
Activity 10: Develop appropriate infrastructure including field and laboratory consumables to support the NAOHS and PMP/AB in diagnostics, research, surveillance etc.		**800,000**			**800,000**			**800,000**			**2,400,000**	**At least USD 160,000 per country every 2 years to cater for field and lab requirements**
Programme 4: Pathogen List	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/	**2025/ 2026**	**2026/ 2027**	**2027/**	**2028/**	**2029/**	**2030/**	**2031/**	**3032/**	**2033/**		

	2025			**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**		
Activity 11: Assist LVB countries to draft or update national and regional pathogen lists based uniform criteria for listing and delisting to ensure uniform and up-to-date pathogen and disease nomenclature for approval by the respective government.	**50,000**										**50,000**	**In-country activities requiring US$ 10,000 per country**
Programme 5: Disease Diagnostics	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 12: Develop and support accreditation process of national diagnostic laboratories in LVB countries				**2,550,000**							**2,550,000**	**At least USD 450,000 per country for lab facilities**
Activity 13: Provide targeted training for technicians in aquatic disease diagnostics to LVB countries	**50,000**	**50,000**	**50,000**	**50,000**	**50,000**						**250,000**	**Each country requires USD 10,000 for the activity**
Activity 14: Provide targeted training for extension workers and aqua-farm personnel in on-farm diagnostics, disease reporting and sample preparation	**75,000**	**75,000**	**75,000**	**75,000**	**75,000**						**375,000**	**Each country requires USD 15,000 for the activity over five years**
Programme 6: Risk Analysis and management	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 15: Organise training activities to increase the capacity and expertise in risk assessment methodologies for LVB countries to effectively implement PMP/AB	**50,000**	**50,000**	**50,000**	**50,000**	**50,000**						**250,000**	**LVFO to guide and oversee the process and each country to send representatives**
Activity 16: Develop a				**35,000**		**25,000**		**20,000**			**80,000**	**LVFO to**

regional commodity-based risk assessment framework												**guide and oversee the process and each country to send representatives**
Activity 17: Develop EAC/LVFO -harmonized standards and guidelines for risk management requirements for importing live aquatic organisms		**40,000**									**40,000**	**LVFO to guide and oversee the process**
Activity 18: Promote cooperation among Competent Authorities to manage aquatic organisms' health (pathogen, genetic and ecological risks) associated with importations			**25,000**			**25,000**			**25,000**		**75,000**	**LVFO to guide and oversee the process**
Programme 7: Farm-level Biosecurity and Health Management	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 19: Identify training needs among stakeholders on Good Aquaculture Practices (GAqPs) and aquaculture biosecurity	**250,000**										**250,000**	**Each country require USD 50,000 for the activity**
Activity 20: Develop GAqPs and SOPs for LVB countries implementing PMP/AB process		**40,000**									**40,000**	**LVFO to oversee the activity**
Activity 21: Provide training of extension officers, other first-line personnel and aquaculturists on GAqPs and the importance of good aquaculture biosecurity		**250,000**									**250,000**	**Each country require USD 50,000 for the training in AVC**
Programme 8: Emergency Preparedness and Contingency Planning	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		

Activity 22: Organize a regional workshops on contingency planning and emergency preparedness for LVB countries		**57,000**									**57,000**	**LVFO to oversee the activity**
Activity 23: Develop generic disease manuals for diseases of high priority to the LVB Region			**75,000**			**75,000**					**150,000**	**LVFO to oversee the activity**
Activity 24: Mainstream aquatic organisms health issues in national emergency preparedness & contingency planning strategies			**50,000**								**50,000**	**Each country require USD 10,000 for the activity**
Activity 25: Design EAC/LVFO's protocol for dealing with requests from LVB countries to provide emergency assistance in case of disease outbreaks		**40,000**									**40,000**	**LVFO to coordinate the designing**
Activity 26: Establish and operationalize permanent emergency response team including the membership and terms of reference	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**58,500**	**585,000**	**LVFO to coordinate the activities of response team**
Activity 27: Establish a regional emergency response fund and mechanisms from rapid fund mobilization	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**	**1,000,000**	**LVFO to coordinate the activity**
Programme 9: Border Inspection, Health Certification and Quarantine	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 28: Evaluate current import practices and existing standards for quarantine facilities in LVB countries		**100,000**									**100,000**	**Each country require USD 20,000 for the activity**
Activity 29: Harmonize standards for handling importations of live aquatic		**100,000**									**100,000**	**LVFO to coordinate the activity**

organisms and their products at regional level, including associated health certification												
Activity 30: Build capacity at national and regional levels for the safe importation of live aquatic organisms			**40,000**			**40,000**			**40,000**		**120,000**	**LVFO to coordinate the activity**
Activity 31: Develop/ review a list of aquatic species that should prohibited in the region				**50,000**							**50,000**	**Each country require USD 10,000 for the activity**
Programme 10 Surveillance, Monitoring and Reporting	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 32: Assist LVB countries lacking aquatic disease surveillance programmes to establish passive or active (as appropriate) programmes, and review and improve such programmes in countries undertaking aquatic disease surveillance	**50,000**	**190,000**	**190,000**	**190,000**	**190,000**	**190,000**					**1,000,000**	**After harmonising document, each country will require USD 38,000/ year for active and passive surveillance**
Programme 11: Zoning and Compartmentalization	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 33: Review the status of zoning and compartmentalization in LVB countries and assess the feasibility of implementing of zones and compartments for aquaculture value chains in countries implementing the PMP-AB	**50,000**										**50,000**	**LVFO to coordinate the activity**
Programme 12: Communication and Information System											**Total (USD)**	**Comment**
Activity 34: Develop and	**20,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**110,000**	**LVFO to**

maintain a regional Aquatic Organism Health module for incorporation into the LVFO Information System												**coordinate the activity**
Programme 13: Use of Veterinary Drugs and Avoidance of Antimicrobial Resistance	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 35: Review and update provisions in national legislation of LVB countries that regulate the use of veterinary drugs in aquaculture and the status of enforcement		**50,000**									**50,000**	**LVFO to coordinate the activity**
Activity 36: Assist LVB countries lacking national action plans (NAPs) for Antimicrobial resistance (AMR) to develop such plans, and review the status and effectiveness of NAPs in countries with AMR-NAPs			**75,000**	**75,000**	**100,000**						**250,000**	**LVFO to coordinate the activity**
Programme 14: Research and Development	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 37: Develop a research agenda to prioritize aquatic organism health research and development programmes for the region and nationally		**100,000**	**40,000**								**140,000**	**Each country require USD 20,000 & LVFO USD 40,000 for the activity**
Activity 38: Profile research establishments and align their research activities to priority research and development programmes in aquatic organism health within the LVB countries and region			**50,000**								**50,000**	**LVFO to coordinate the activity**
Activity 39: Mobilize	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**100,000**	

resources for aquatic organism health research for the LVB Region												
Programme 15: Regional and International Cooperation	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 40: Promote cooperation among LVB countries in the control of the serious aquatic organism diseases existing in the region	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**100,000**	**LVFO to coordinate the activity**
Activity 41: Promote collaborations in research and technology transfer among the value chain actors as well as local, regional and international aquatic organism health experts	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**100,000**	**LVFO to coordinate the activity**
Programme 16: Ecosystem Health under One Health	**Short term**			**Medium term**			**Long term**				**Total (USD)**	**Comment**
	2024/ 2025	**2025/ 2026**	**2026/ 2027**	**2027/ 2028**	**2028/ 2029**	**2029/ 2030**	**2030/ 2031**	**2031/ 2032**	**3032/ 2033**	**2033/ 2034**		
Activity 42: Develop and operationalize monitoring programme of biological (including aquatic organisms pathogens of public health importance), chemical (including pesticides, antibiotics) and physical changes and respective remedies in aquaculture system in LVB countries	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**	**2,250,000**	**Each country require USD 45,000 to conduct monitoring per year**
	1,513,500	**2,763,500**	**1,433,500**	**3,513,500**	**1,778,500**	**793,500**	**438,500**	**1,308,500**	**503,500**	**438,500**	**14,485,000**	

This draft has been produced by the members of the:

Lake Victoria Fisheries Organization, AQUATIC ANIMAL HEALTH TECHNICAL WORKING GROUP (LVFO AAHTWG)

With technical support of the following FAO officers and consultants

Dr David Huchzermeyer
Mr Ramesh Perera
Dr Melba Reantaso
Dr Dismas Mbabazi
Mr Jose Parajua
Dr Hamisi Nikuli
Dr Peter Akoll

LAKE VICTORIA FISHERIES ORGANIZATION SECRETARIAT
Plot 7B/E Busoga Square, Bell Avenue
P. O. Box 1625, Jinja-Uganda | Tel: +256 434 125000
email: lvfo-sec@lvfo.org, Website: www.lvfo.org