



Univerzitet u Sarajevu



Strengthening Resilience and Biosecurity in Aquatic Food Systems:

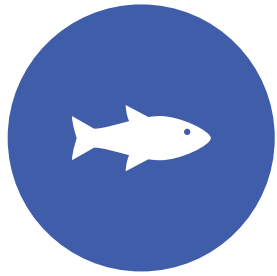
Reshaping Preparedness and Response to Biological Hazards

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**15th International Aquaculture Conference
Vukovar, Croatia, 2025**

Topics



EMERGENCIES/
DISASTER IN
AQUACULTURE



EXISTING
INTERNATIONAL
POLICIES AND
GUIDELINES



ASSESSMENT
AND ANALYSIS



RECOMMENDATIONS

Aquatic food emergencies/disasters

Type of emergencies/disasters

	Natural	Biological	Technological	Complex
	Storms	Diseases	oil and chemical spills	wars
	cyclones/hurricanes	Harmfull algal blooms	nuclear/radioactive	post-conflict
	flooding and tidal surges	Invasive speces		protracted crisis
	tsunamis	GMO		bioterorism
	earthquakes	Living modified organism		agriterorism
	droughts	Antimicrobial resistance		
	floods	animal/agri waste		
	landslides			

Pathogen/Disease Emergence in Aquaculture

Legend: Parasites Bacteria Virus Fungi

1970s



Gyrodactylus (salmon)

MBV (shrimp)

LCDV (tilapia)

EUS (many finfish)



1980s



Sea lice (salmon)

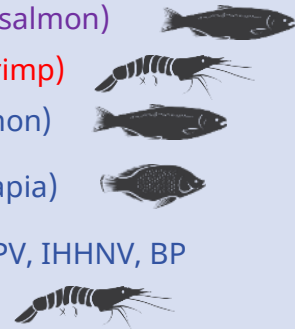
NHP (shrimp)

ISA (salmon)

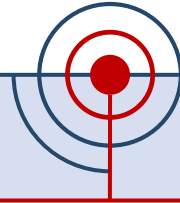
IPNV (tilapia)

WSSV, HPV, IHNV, BP

(shrimp)



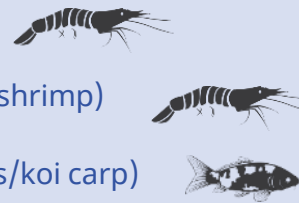
1990s



Vibriosis: *Vibrio* (*harveyi*,
damsla, *alginolyticus*,
vulnificus, *penaeicida*)
(shrimp)

YHV, TSV (shrimp)

KHV (carps/koi carp)



2000s



EHP *Enterocytozoon*
hepatopenaei (shrimp)

MoV, IMNV, CMNV,
LSNV (shrimp)

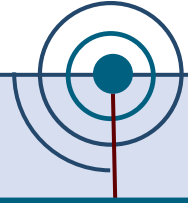
AHPND (shrimp)

TiLV (tilapia)

VNN (tilapia and
marine finfish)



Future

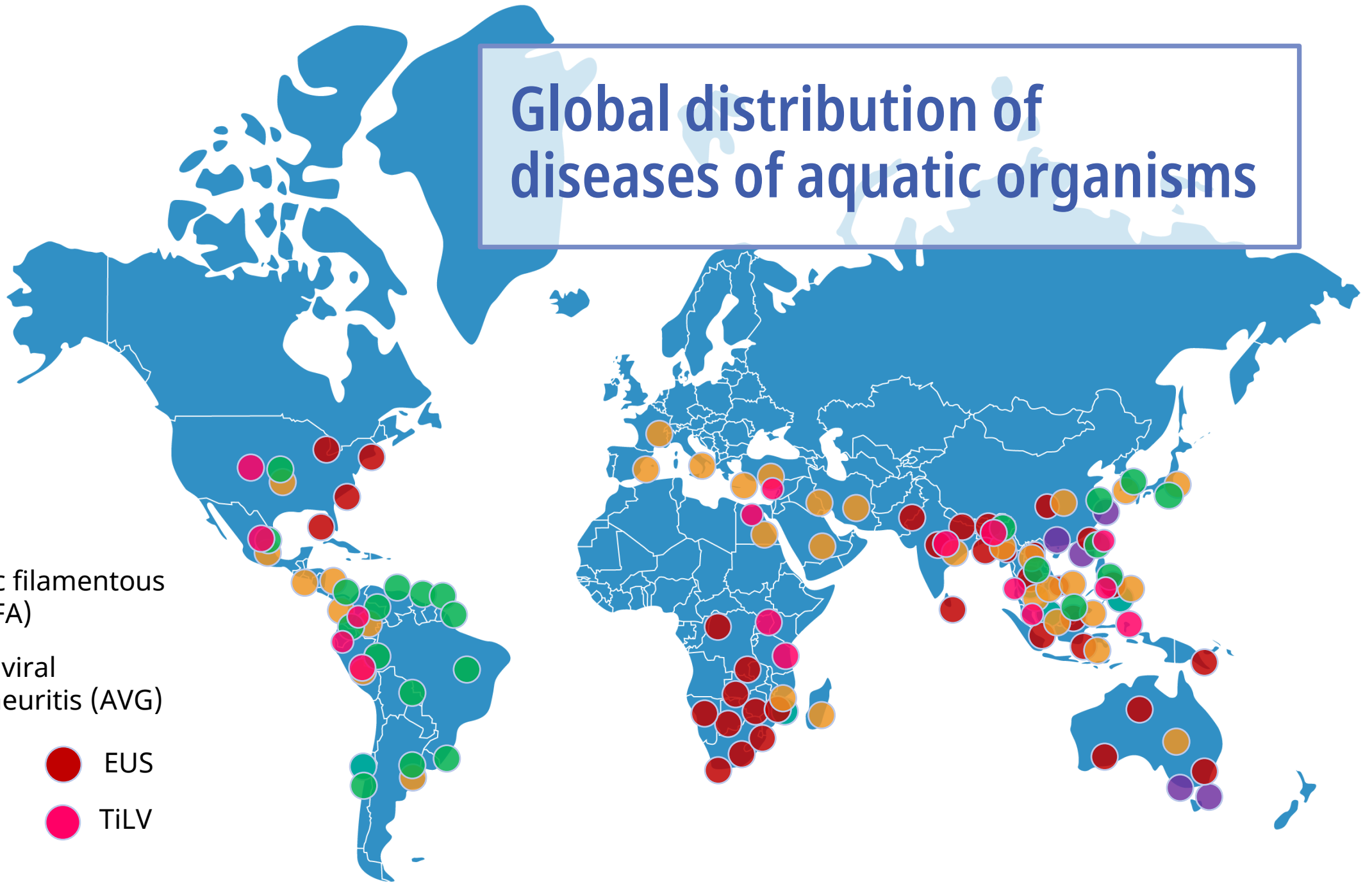


**We expect more
diseases (exotic,
endemic, emerging) if
no biosecurity actions
are taken**

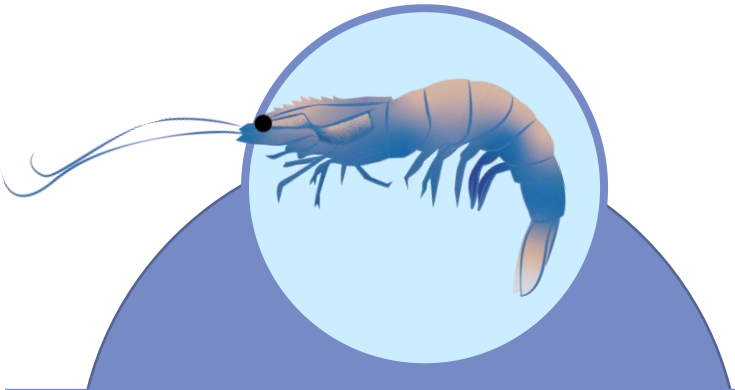
**These pathogens affect different phases of production
(hatchery, nursery, grow-out).**

Global distribution of diseases of aquatic organisms

- Epiphytic filamentous algae (EFA)
- Abalone viral ganglioneuritis (AVG)
- WSSV
- APHND
- EUS
- TiLV

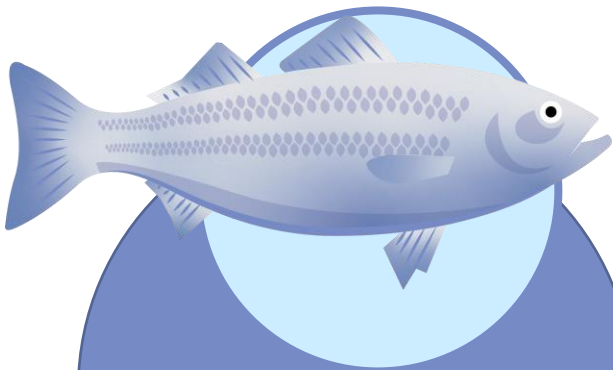


Unmanaged disease outbreaks with high economic losses reflect an immature aquaculture industry



Period	Disease	Losses
1987-1994	Several pathogens	3 019 million ¹
2010-2017	AHPND	12 billion ²
2015	AHPND	>26 million ²
2017	Several pathogens	1.6 billion ³

¹Israngkura and Sae-Hae, 2002
²Shinn *et al.*, 2018;
³Annual Report on Aquatic Animal Health in China, 2017



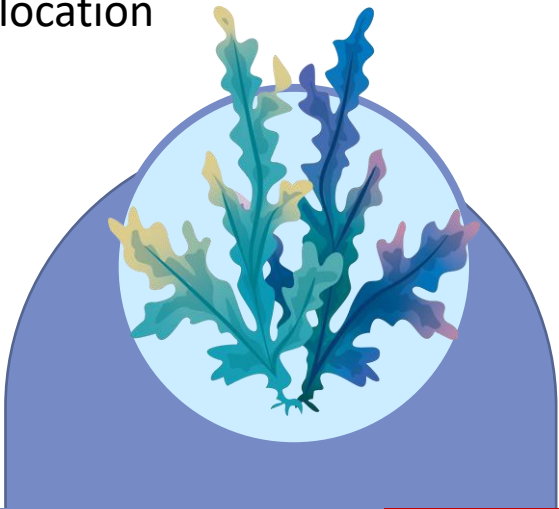
Period	Disease	Losses
1998-1999	ISA	39 million ¹

¹Hastings *et al.*, 1999

A maturing aquaculture industry requires a focus on disease prevention supported by:

- Improved governance
- Understanding disease impacts (burdens and investments)

The current approach to disease challenges needs to be supplemented with an economic dimension for improved responses and more efficient resource allocation



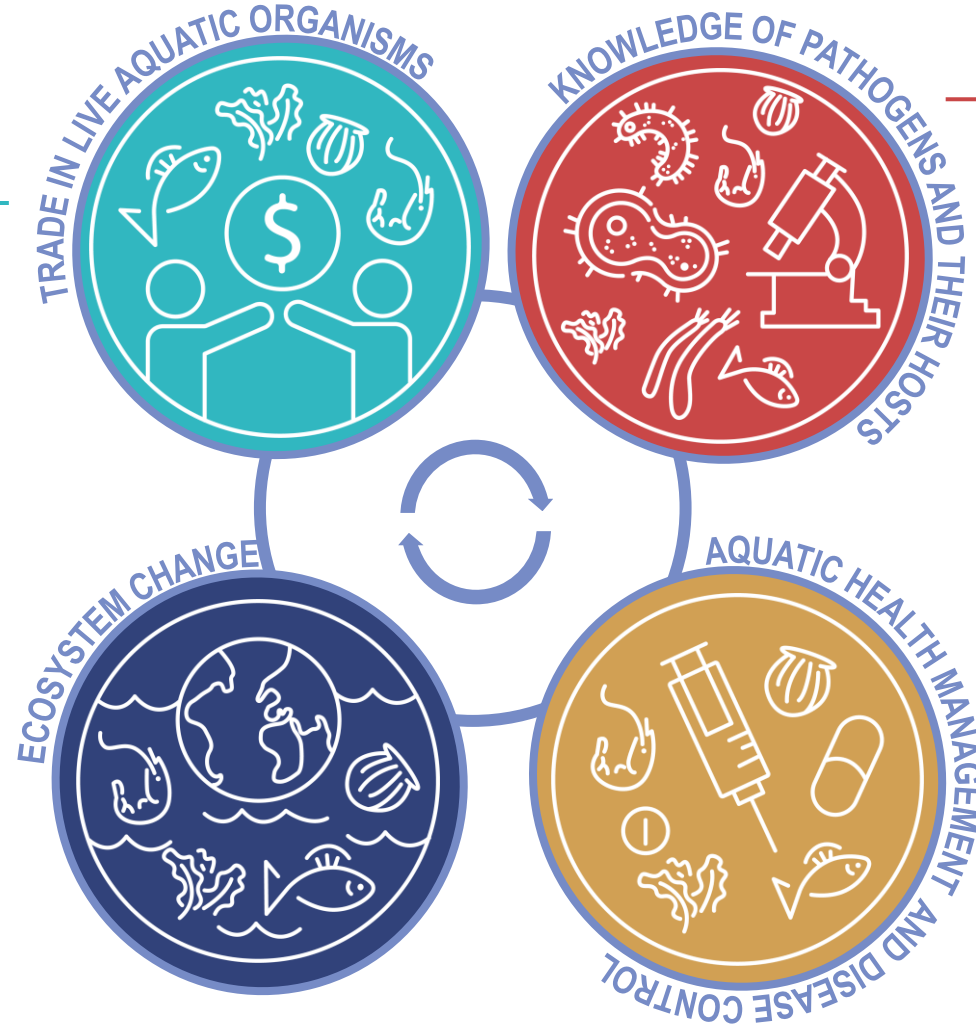
Period	Disease	Losses
2017	Several pathogens	190 million ¹

¹Annual Report on Aquatic Animal Health in China, 2017

FACTORS, DRIVERS AND PATHWAYS TO AQUATIC DISEASE EMERGENCE IN AQUACULTURE

TRADE

- Highly traded commodity (70% exposed to international trade);
- Live aquatic organisms (larvae, fry, adults) and their products (live, fresh, frozen) traded internationally;
- Invasive aquatic species and pathogens can be traded with primary host



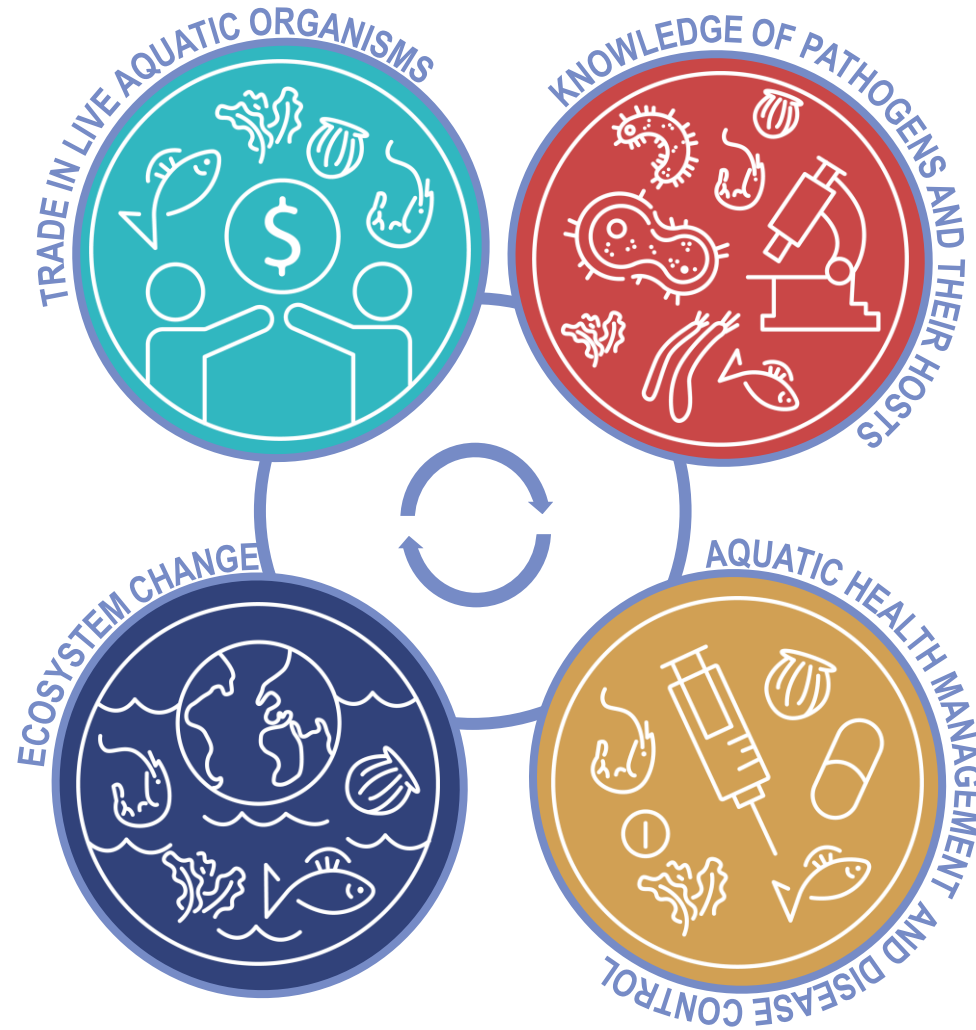
KNOWLEDGE OF PATHOGENS AND THEIR HOSTS

- Unique aquatic medium;
- For unknown diseases and even known diseases there are still significant knowledge gaps regarding transmission, immunity, genetics.
- Diagnostics are focused on known/listed diseases;
- Breeding strategies are not in place for many species and there are limited availability of efficacious and affordable vaccines.

FACTORS, DRIVERS AND PATHWAYS TO AQUATIC DISEASE EMERGENCE IN AQUACULTURE


ECOSYSTEM CHANGE

- Physico-chemical conditions in aquaculture are often sub-optimum for host;
- Aquatic hosts are cold-blooded (highly responsive to stressors);
- Aquatic medium is pathogen rich, diversity changes with environment conditions;
- Pathogens evolve and spill-over and spill-back relative to wild populations



AQUATIC HEALTH MANAGEMENT AND DISEASE CONTROL

- Multiple institutions involved in AHM;
- Inadequate or poorly implemented biosecurity measures/low capacity for emergencies;
- Perceived low incentive to report on known and emergent diseases (trade);
- Weak regulatory framework and public-private sector partnership



Review of emergency preparedness documents and guidelines



FAO



WOAH



EU

- **Aquatic Animal Health Code:** This code provides standards for the improvement of aquatic animal health worldwide, including measures for disease prevention, surveillance, and control. It serves as a reference for international trade and the establishment of health regulations.
- **Manual of Diagnostic Tests for Aquatic Animals:** Complementing the Aquatic Animal Health Code, this manual details diagnostic protocols for aquatic animal diseases, ensuring standardized and reliable testing methods globally
- **WOAH Aquatic Animal Health Strategy 2021–2025**



European
Union

- **Regulation (EU) 2016/429 - Animal Health Law:** This comprehensive regulation establishes a framework for the prevention and control of animal diseases transmissible to animals or humans, including provisions specific to aquatic animals. It addresses disease preparedness, surveillance, and control measures within the EU.
- **Commission Delegated Regulation (EU) 2020/687:** This regulation supplements the Animal Health Law by detailing rules for the prevention and control of certain listed diseases, including those affecting aquatic animals. It outlines measures for disease awareness, preparedness, and response.



Food and Agriculture Organization
of the United Nations

- **Preparedness and Response to Aquatic Animal Health Emergencies:** This document provides guidance to assist developing countries in improving national emergency preparedness to maximize the efficiency of response to aquatic animal health emergencies. It outlines principles and practical steps for contingency planning and response.
- **Manual for the Management of Operations During an Animal Health Emergency:** Focusing on operational aspects, this manual offers detailed procedures for managing animal health emergencies resulting from diseases, infections, or infestations, including those affecting aquatic animals.
- **The Emergency Prevention System for Animal Health (EMPRES-AH):** EMPRES-AH works to enhance global early warning, prevention, and control of transboundary animal diseases, including those affecting aquatic species. The system emphasizes risk assessment, early detection, and rapid response.
- The Good Emergency Management Practice (**GEMP**) manual and the Progressive Pathway for Emergency Preparedness (**PPEP**).
- **PMP/AB (Progressive management pathway for Aquatic biosecurity)**

1 Stepwise Guidance of
PMP/AB

2 Governance

3 Biosecurity action plans
(farm, national &
regional)

4 Risk analysis in the
aquaculture value-chain

5 Contingency planning
and mass mortality
events (MMEs)

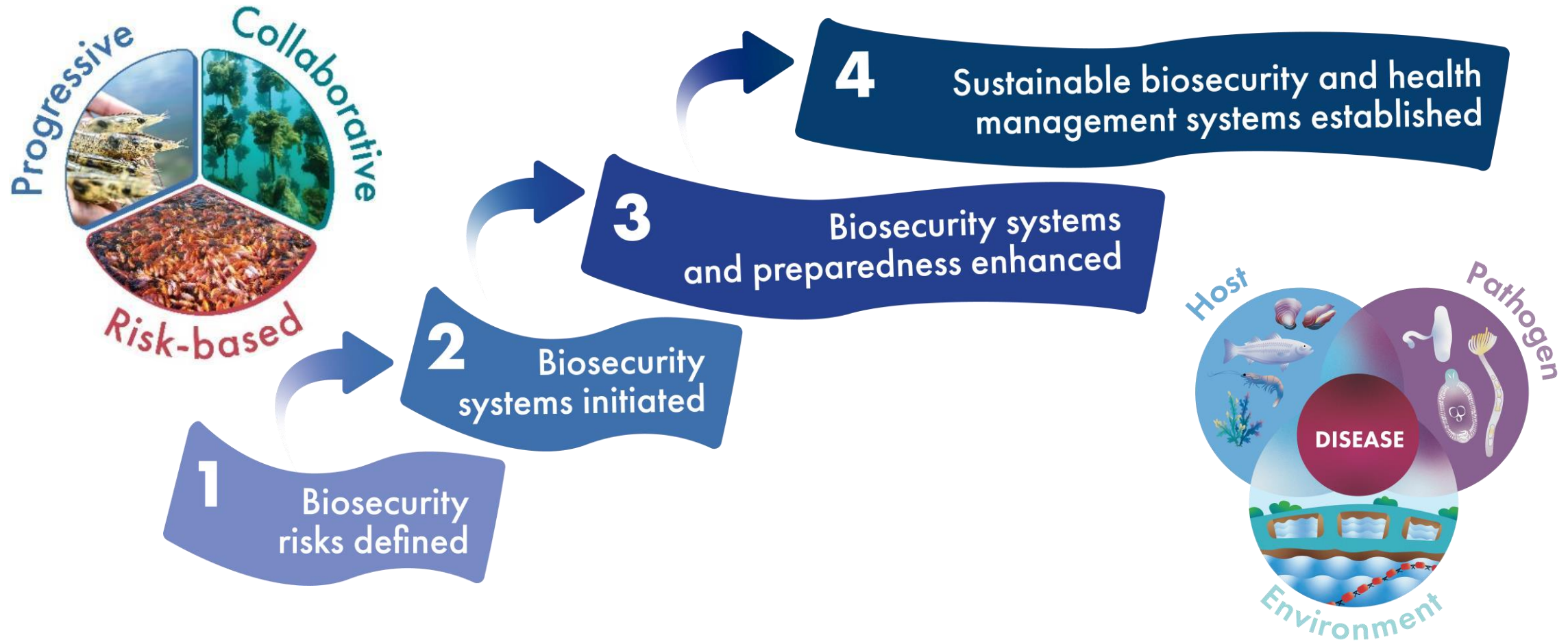
6 Training modules

7 Public-private
partnerships

8 Cost-benefit analysis of
aquatic biosecurity
systems

9 Communication
strategy

FAO: PMP/AB Toolkits



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

National Aquatic Organism Health (NAOH) Strategy (FAO, 2007)

within the
PMP/AB (2020, 2022)

RISK-BASED
PROGRESSIVE
COLLABORATIVE

- STAGE 1
- STAGE 2
- STAGE 3



Toolkit 4: Risk analysis in the aquaculture value chain

<https://elearning.fao.org/course/view.php?id=979>

Food and Agriculture Organization of the United Nations

FAO eLearning Academy

Pathway to aquaculture biosecurity: managing disease risks in the value chain

CERTIFIED COURSE

Released in: AUGUST 2023

> 1 h 35 m of learning

THILMAI K. ABLA: Fisheries and aquaculture, Food and nutrition security, and health

2 SDG 14
5 Gender
14 Life below water

Lesson 1



Introduction to the PMP/AB

Lesson 2



Introduction to risk analysis

Lesson 3



Import risk analysis

Lesson 4



Risk analysis along the aquaculture value chain

Lesson 5



Application of risk analysis along the aquaculture value chain

RISK ASSESSMENT (WITH ILLUSTRATIONS)



A person enters into the cage and is feeding the lion

Possibility: 5

Severity: 5

Possibility X Severity = 25

EXTREME RISK



A person wearing protective devices enters into the cage and is feeding the lion

Possibility: 5

Severity: 4

Possibility X Severity = 20

MODERATE RISK



A person is feeding the lion through a specially designed feed opening

Possibility: 3

Severity: 3

Possibility X Severity = 9

TOLERABLE RISK



A person is feeding the lion in a specially designed feeding cage

Possibility: 0

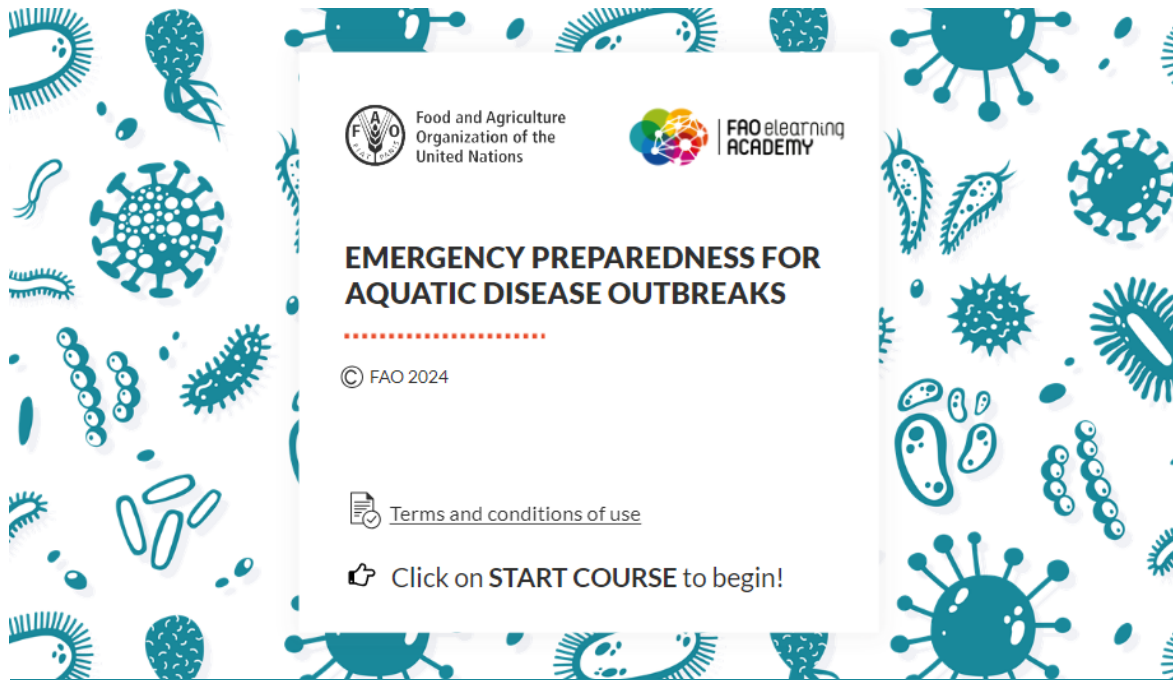
Severity: 0

Possibility X Severity = 0

ZERO RISK

Toolkit 5: Contingency planning for mass mortality events (MMEs)

e-Learning Course:



- **Lesson 1:** Why and how do aquatic organisms get sick
- **Lesson 2:** Disease outbreak investigation
- **Lesson 3:** Aquatic disease diagnostics
- **Lesson 4:** 12-point checklist for active surveillance of diseases of aquatic organisms
- **Lesson 5:** Contingency planning for mass mortality events in aquatic populations

Disease Strategy Manuals

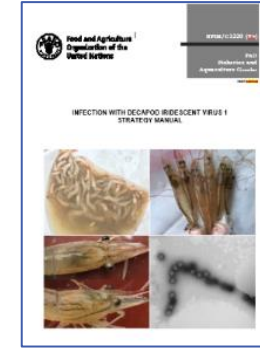
EHP



EUS



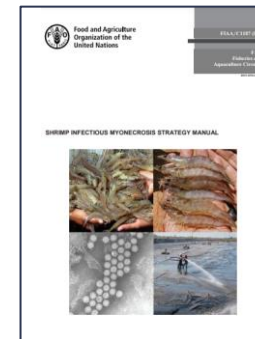
DIV1



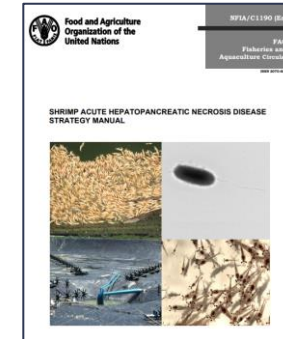
WSSV



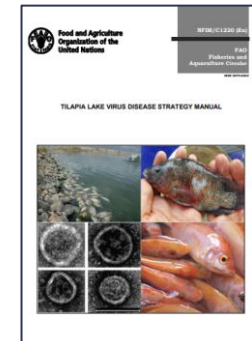
IMNV



APHND



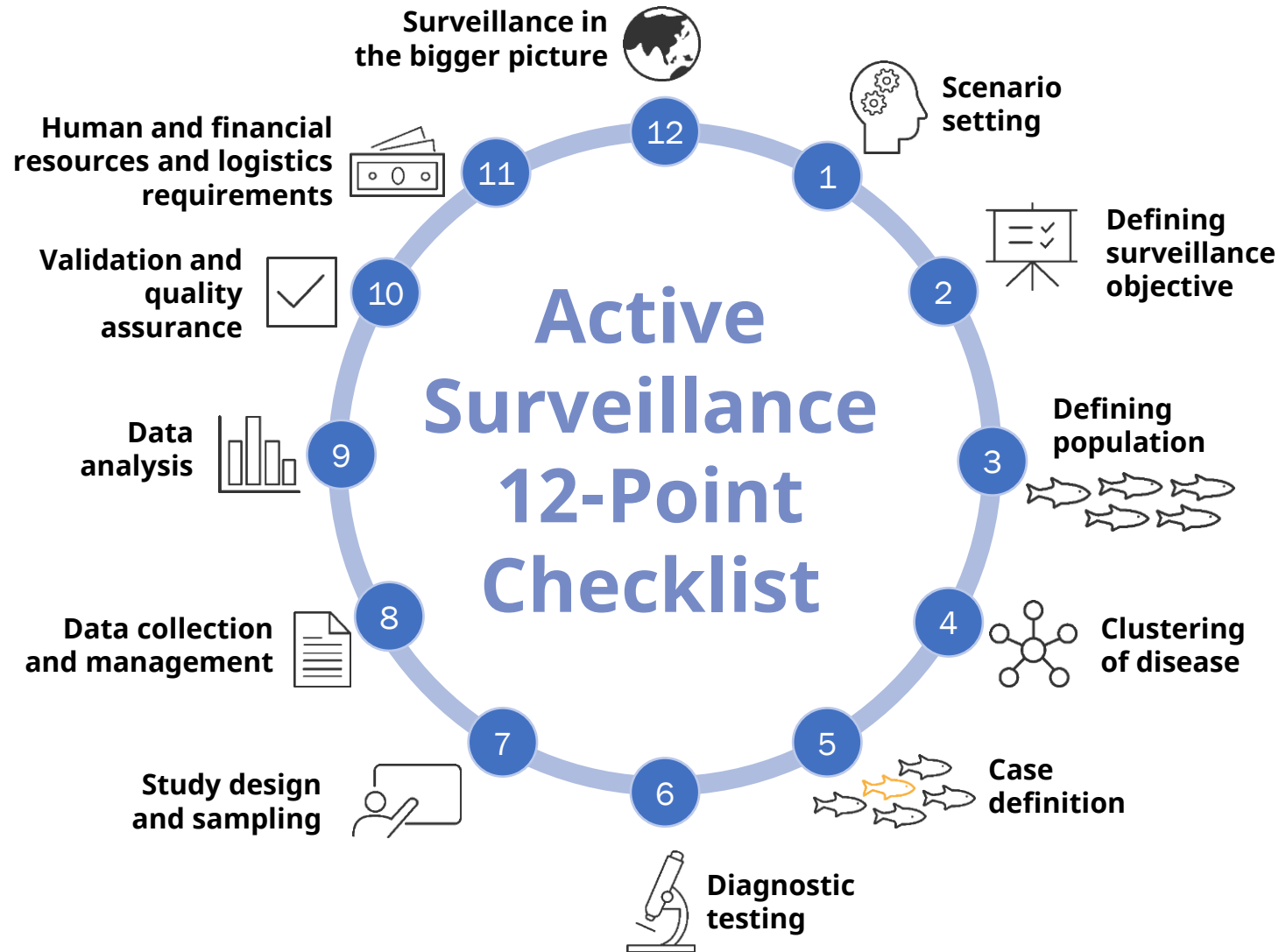
TiLV



Face to Face Training Course on Aquatic Disease
Emergency Preparedness

Toolkit 6: Training modules

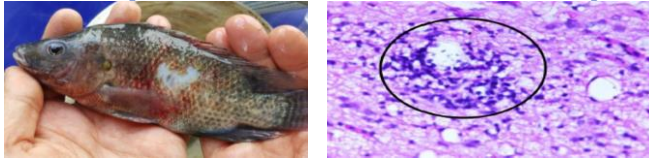
<https://onlinelibrary.wiley.com/doi/full/10.1111/raq.12530>



- Step-wise; pragmatic
- Model to build targeted surveillance competency (capacity/capability)
- Basic reference when starting surveillance or to improve existing surveillance programs.
- 2 Modalities:
 - **Virtual:** 27 hours, 3 weeks, 3 days/week, 3 hours/day
 - **In-person:** 6-day intensive fac-to-face course

Operationalization of the 12-point checklist

Tilapia Lake Virus (TiLV): tilapia









Angola, Colombia, Ethiopia, Ghana, Nigeria, Philippines, Uganda, Zambia

Epizootic Ulcerative Syndrome (EUS): many finfish species



Malawi, Zambia

Countries related to different projects

-  GCP/RAF/510/MUL: Enhancing capacity/risk reduction of emerging Tilapia Lake Virus (TiLV) to African tilapia aquaculture
Angola, Ghana, Egypt, Nigeria, Kenya, Uganda
-  TCP/EGY/3705: Enhancing biosecurity governance to support sustainable aquaculture production in Egypt
Egypt
-  TCP/ETH/3805 (709982): Technical assistance to strengthening fish disease diagnosis, surveillance and monitoring capacity
Ethiopia
-  TCP/INT/3707: Strengthening biosecurity (policy and farm level) governance to deal with Tilapia lake virus (TiLV)
Colombia, Philippines, Viet Nam
-  TCP/MLW/3804: Enhancing capacity to respond and manage the risk of Epizootic Ulcerative Syndrome (EUS) in Malawi
Malawi
-  UTF/ZAM/077/ZAM: Technical Assistance to the Zambia Aquaculture Enterprise Development
Zambia

Enterocytozoon hepatopenaei (EHP): shrimp



Philippines

Streptococcus agalactiae: tilapia



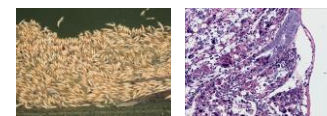
Philippines

Viral nervous necrosis (VNN): milkfish



Photo by Aziz Abdullah
Philippines

Acute hepatopancreatic necrosis disease (AHPND): shrimp



Philippines

GCP/GLO/352/NOR: Responsible use of fisheries and aquaculture resources for sustainable development

Toolkit 8: Cost-benefit analysis of aquatic biosecurity system

CBA framework being pilot-tested using 4 country case studies:

- **India:** National aquatic *Saprolegnia* infection surveillance in freshwater finfish in India
- **Kingdom of Saudi Arabia:** Use of Specific Pathogen Free (SPF) and Specific Pathogen Tolerant Shrimp (SPT) in the Kingdom of Saudi Arabia
- **Madagascar:** Investigation and containment of WSSV in shrimp farms in Madagascar
- **Philippines:** Emergency response to an outbreak of TiLV in farmed tilapia in the Philippines



January 2023 | Clark, Philippines



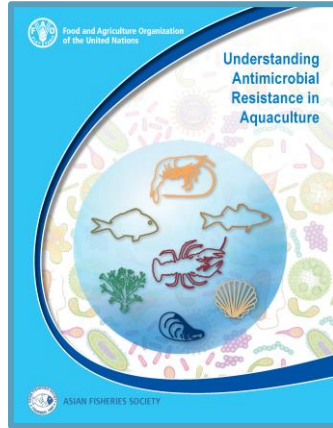
March 2024 | Rome, Italy

AMR in Aquaculture

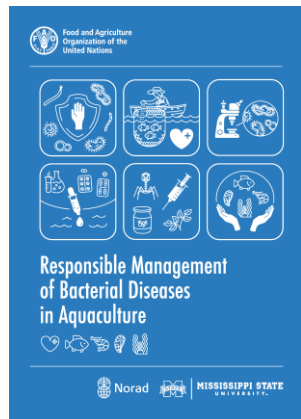
National action plans on AMR



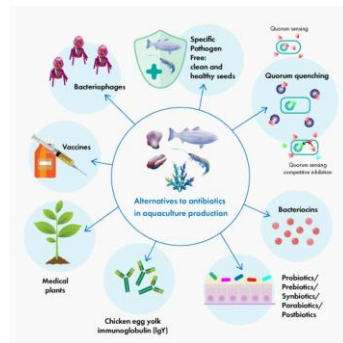
A global analysis of national action plans



Special issue on AMR NAPs



Bacterial Book



Review of antibiotic use/ SOFIA 2024



The analysis of existing policies, guidelines, and tools (WOAH, FAO, EU) has identified several findings pertinent to emergency management in aquatic food systems:

- **Primary:** Lack of harmonization and alignment of key emergency management terminologies, materials, guides, and protocols.
 - Forms of working are not aligned across sectors and lead to varying emergency management actions.
 - GEMP and PPEP were not adopted for aquatic food systems.
- **Secondary:** Lack of, aligned training materials, capacity-building processes, and simulation exercises that build national and local level emergency management capacities.
 - GEMP, PPEP, PMP based training materials and guidelines for aquatic food systems (among other tools)
 - Need for advocacy – communication guidelines
- **Tertiary:** Lack of harmonized regulatory and legal framework tools.

Recommendations for Implementation of Emergency Management Policies at International, Regional, and National Levels

International Level

- Establish **global guidelines and standards** through FAO's Good Emergency Management Practice (GEMP), Progressive Pathway for Emergency Preparedness (PPEP) and PMP AB ensuring consistent international application and harmonization.
- Strengthen **international collaboration** frameworks involving key organizations (FAO, WOA, EU) to coordinate comprehensive emergency management policies.
- Develop **standardized training modules, tools, and simulation** exercises suitable for international dissemination and implementation.
- Enhance **global early warning systems** (EWS) capabilities to effectively monitor and communicate risks across international borders.

Regional Level

- Encourage **regional cooperation among neighboring** countries for harmonized **disease surveillance and disaster preparedness and response**, particularly for aquatic food systems emergencies.
- Implement **regional coordination mechanisms**, such as regional Incident Coordination Groups (ICGs), to enhance joint response capabilities and resource mobilization.
- Develop **regional contingency plans and simulation exercises** that address cross-border emergencies and foster collaboration between regional stakeholders.

National Level

- Establish dedicated **National Focal Points for Emergency Management** to streamline implementation and coordination at the national level.
- Conduct legislative reviews **to align national regulations and guidelines** with international standards provided by WOAHA Strategy, FAO's GEMP, PPEP, and PMP AB frameworks.
- **Develop and pilot nationally adapted PPEP, GEMP and PMP** frameworks specifically targeting aquatic food systems, with periodic assessments and revisions based on emerging needs.
- Enhance national capacities through **systematic training and regular simulation exercises**, incorporating lessons learned from regional and international experiences.
- Improve **national early warning and risk communication systems** to effectively manage emergencies, including robust advocacy and public awareness campaigns.

Thank you for your kind attention!