World Organisation for Animal Health

Regional Workshop on Antimicrobial Resistance in Aquaculture for English-Speaking African Countries

13 - 15 August 2025
Harare, Zimbabwe

The Fleming Fund

Funded by UK Government

World Fish Centre: Regional activities of World Fish on Aquaculture and AMR

David Verner-Jeffreys

The Fleming Fund
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Our Vision

An inclusive world of healthy, well-nourished people and a sustainable blue planet, now and in the future.

Our mission

To end hunger and advance sustainable development by 2030 through science and innovation to transform food, land and water systems with aquatic foods for healthier people and planet.

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WHERE
we are

WorldFish has a global presence in **20 countries** in **3 continents** with **422 staff** representing **30 nationalities**

The Fleming Fund
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WorldFish and partners have supported several initiatives and projects regarding Aquatic Animal Health in Africa

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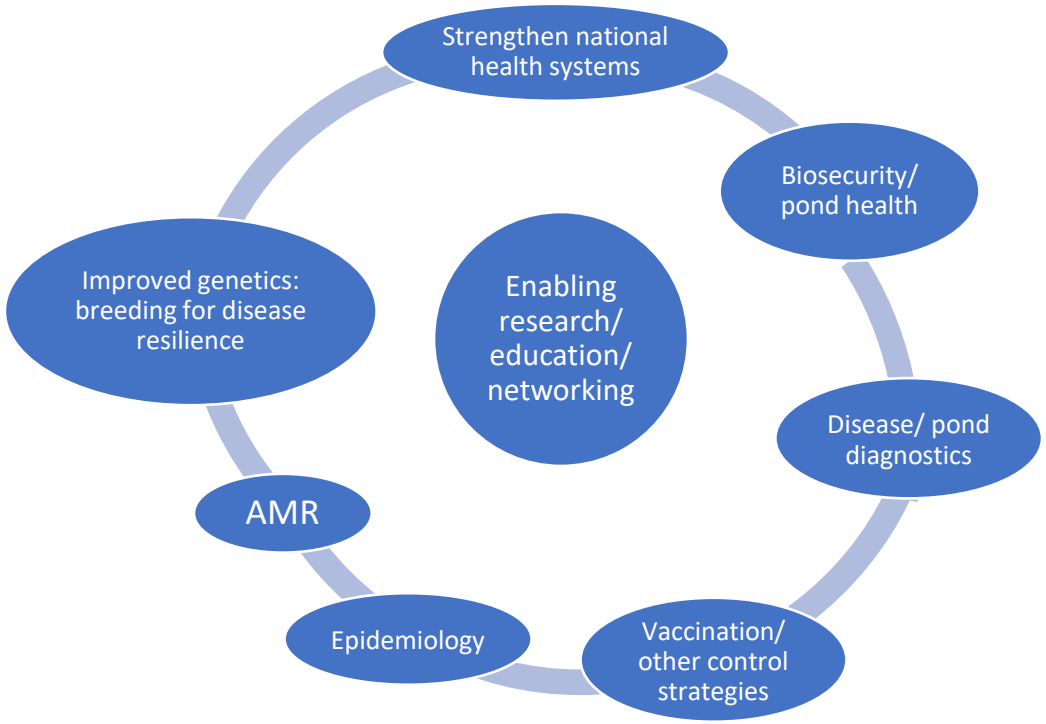
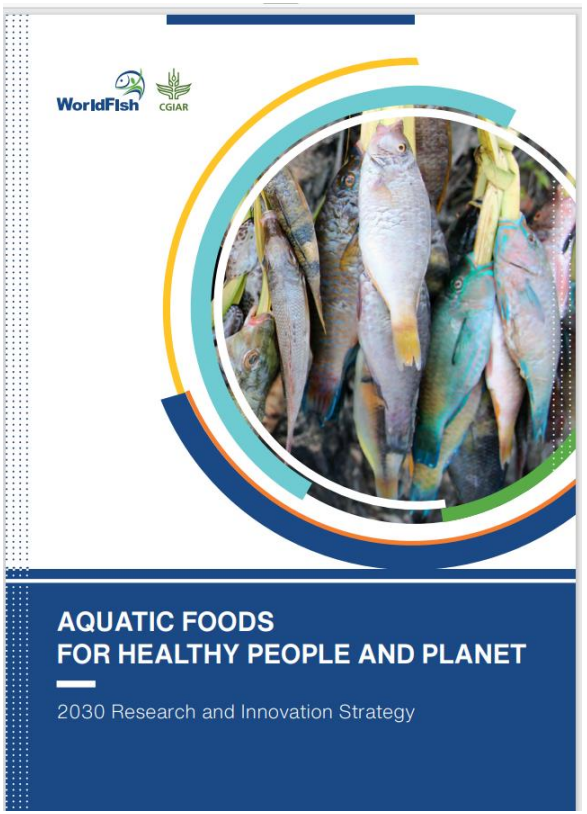
WorldFish Aquatic Animal Health program of work





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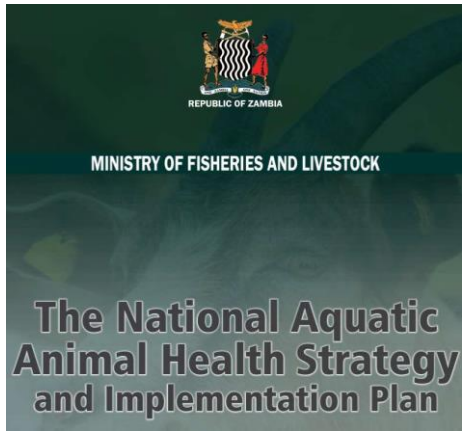
Strengthen national aquatic animal health systems

- Support to governments
  - Develop Regulations & Guidance
  - Promote and embed a One Health approach
  - Strengthen early disease detection, emergency preparedness and response
  - Improve capacity to meet international trade standards
  - Collaboration with WOAH/ FAO/ other providers operating in Asia and Africa
  - Provide training: health professionals and farmers (all elements)



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Biosecurity/pond health management

- Improve on-farm biosecurity: central to disease control
- Secure supplies of disease-free seed (e.g., WF breeding platforms)
- Improve pond health: water quality/ stocking densities/ nutrition: healthy animals

Aquaculture 584 (2024) 740664

Contents lists available at ScienceDirect

Aquaculture

journal homepage: www.elsevier.com/locate/aquaculture

Understanding aquaculture biosecurity to improve catfish disease management in Ogun and Delta states, Nigeria

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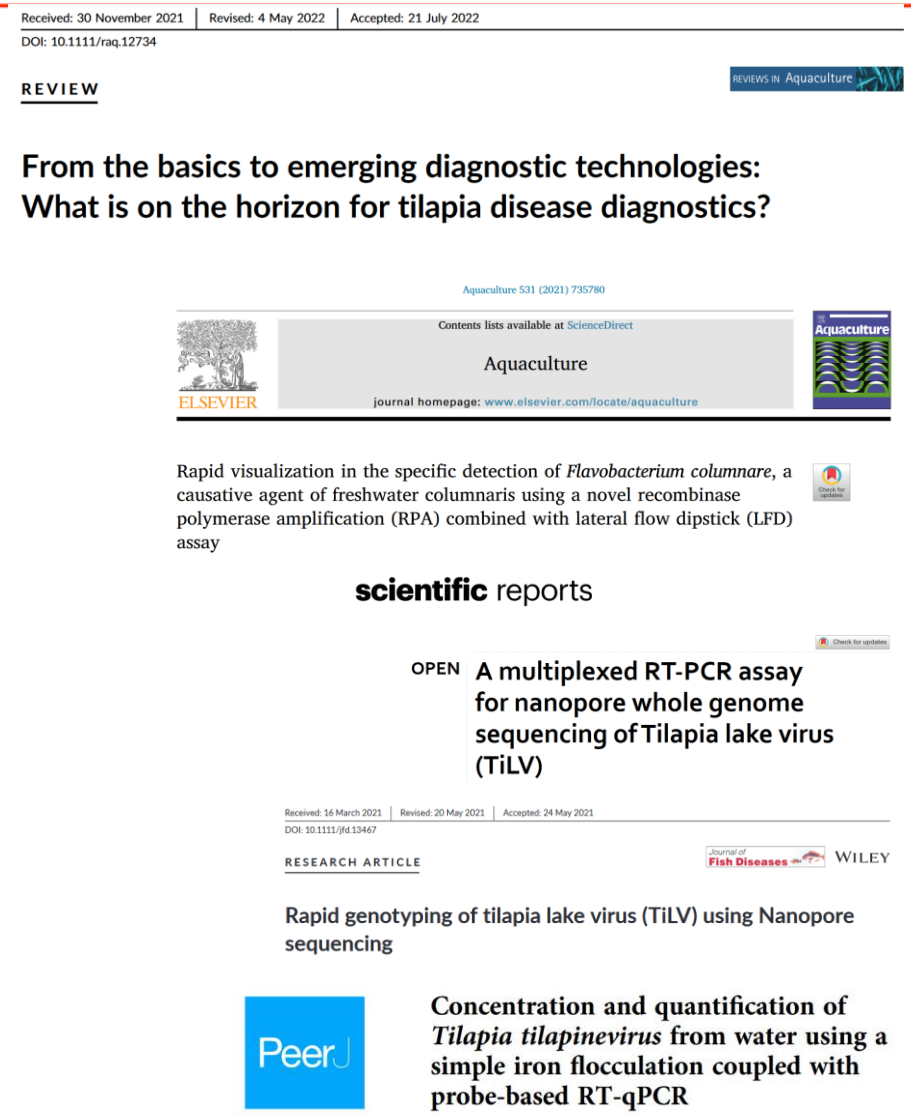
Disease/pond diagnostic

- Develop accurate, rapid disease diagnostics systems
- Pond and lab-based systems (centralized and decentralized)
- Integrate with real-time water quality measurements



Received: 30 November 2021 | Revised: 4 May 2022 | Accepted: 21 July 2022
DOI: 10.1111/raq.12734

REVIEW

REVIEWS IN Aquaculture

From the basics to emerging diagnostic technologies: What is on the horizon for tilapia disease diagnostics?

Aquaculture 531 (2021) 735780

Contents lists available at ScienceDirect

Aquaculture

journal homepage: www.elsevier.com/locate/aquaculture

ELSEVIER

Rapid visualization in the specific detection of *Flavobacterium columnare*, a causative agent of freshwater columnaris using a novel recombinase polymerase amplification (RPA) combined with lateral flow dipstick (LFD) assay

scientific reports

OPEN

A multiplexed RT-PCR assay for nanopore whole genome sequencing of Tilapia lake virus (TiLV)

Received: 16 March 2021 | Revised: 20 May 2021 | Accepted: 24 May 2021
DOI: 10.1111/jfd.13467

RESEARCH ARTICLE

Journal of Fish Diseases

WILEY

Rapid genotyping of tilapia lake virus (TiLV) using Nanopore sequencing

PeerJ

Concentration and quantification of *Tilapia tilapinevirus* from water using a simple iron flocculation coupled with probe-based RT-qPCR

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Vaccination/other control strategies

- Develop and advocate cost-effective vaccination-based disease control strategies
- Explore the development and deployment of alternative strategies (e.g., immunostimulants/ modulators, pre and probiotics, phage therapy)
- Develop disease-resistant stocks

Received: 1 July 2021 | Revised: 18 September 2021 | Accepted: 24 October 2021
DOI: 10.1111/raq.12633

REVIEW

REVIEWS IN Aquaculture

Autogenous vaccination in aquaculture: A locally enabled solution towards reduction of the global antimicrobial resistance problem

Received: 18 January 2024 | Revised: 25 February 2024 | Accepted: 1 March 2024
DOI: 10.1111/jfd.13941

REVIEW

Journal of Fish Diseases WILEY

Review of quorum-quenching probiotics: A promising non-antibiotic-based strategy for sustainable aquaculture

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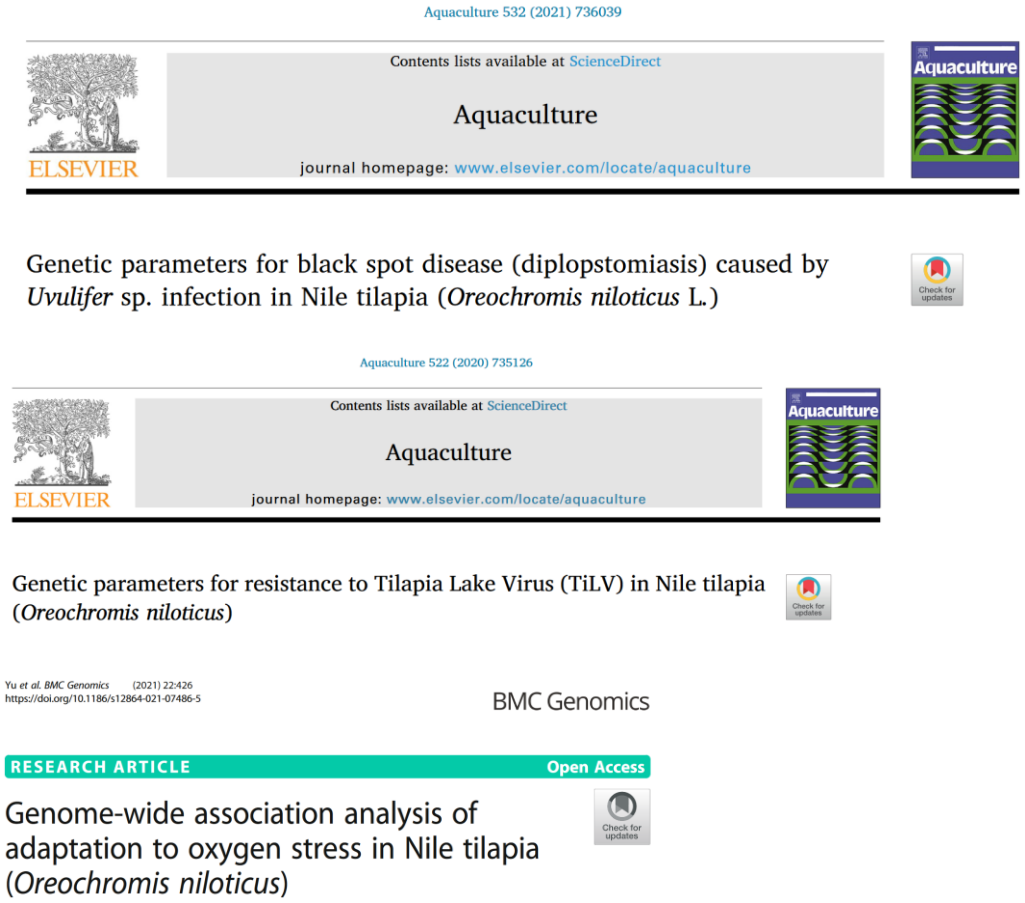
Improved genetics: breeding for disease resilience

Disease-free Genetic Improvement Programs (GIPs)

Emphasis on disease screening and biosecurity

- *Oreochromis niloticus* – Abassa, Egypt
- *O. andersonii*- Zambia
- *O. Shiranus* in Malawi



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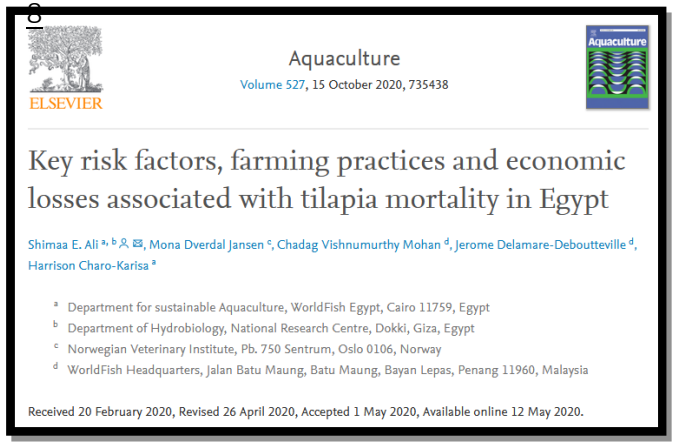
Insight in aquatic epidemiology using digital surveys

https://doi.org/10.1016/j.aquaculture.2020.735438



Aquaculture
Volume 527, 15 October 2020, 735438

Key risk factors, farming practices and economic losses associated with tilapia mortality in Egypt

Shimaa E. Ali [a, b], Mona Dverdal Jansen [c], Chadag Vishnumurthy Mohan [d], Jerome Delamare-Debouteville [d], Harrison Charo-Karisa [a]

[a] Department for sustainable Aquaculture, WorldFish Egypt, Cairo 11759, Egypt
[b] Department of Hydrobiology, National Research Centre, Dokki, Giza, Egypt
[c] Norwegian Veterinary Institute, Pb. 750 Sentrum, Oslo 0106, Norway
[d] WorldFish Headquarters, Jalan Batu Maung, Batu Maung, Bayan Lepas, Penang 11960, Malaysia

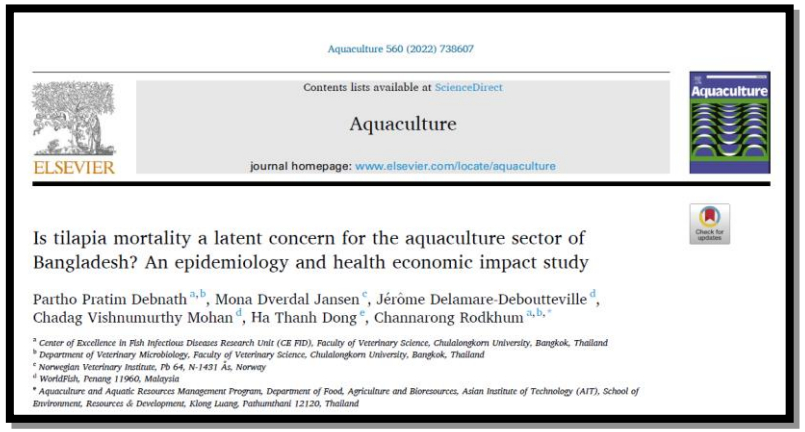
Received 20 February 2020, Revised 26 April 2020, Accepted 1 May 2020, Available online 12 May 2020.

Egypt

113 tilapia farms

(2018)

https://doi.org/10.1016/j.aquaculture.2022.738607



Aquaculture 560 (2022) 738607

Contents lists available at ScienceDirect

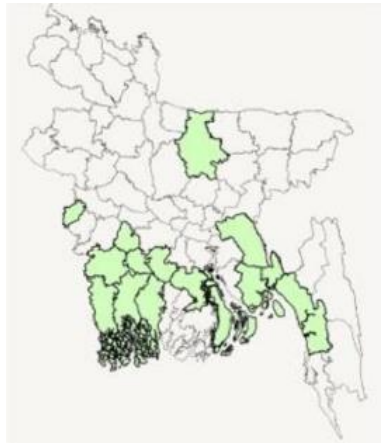
Aquaculture

journal homepage: www.elsevier.com/locate/aquaculture

Is tilapia mortality a latent concern for the aquaculture sector of Bangladesh? An epidemiology and health economic impact study

Partho Pratim Debnath [a,b], Mona Dverdal Jansen [c], Jérôme Delamare-Debouteville [d], Chadag Vishnumurthy Mohan [d], Ha Thanh Dong [e], Channarong Rodkhum [a,b,*]

[a] Center of Excellence in Fish Infectious Diseases Research Unit (CE FID), Faculty of Veterinary Science, Chulalongkorn University, Bangkok, Thailand
[b] Department of Veterinary Microbiology, Faculty of Veterinary Science, Chulalongkorn University, Bangkok, Thailand
[c] Norwegian Veterinary Institute, Pb 64, N-1431 Ås, Norway
[d] WorldFish, Penang 11960, Malaysia
[e] Aquaculture and Aquatic Resources Management Program, Department of Food, Agriculture and Bioresources, Asian Institute of Technology (AIT), School of Environment, Resources & Development, Klong Luang, Pathumthani 12120, Thailand



Bangladesh

550 tilapia farms

(2017-2019)

Nigeria

399 catfish farms (2021)

Kenya

164 farms (2023)

Ghana

(2023 ongoing)

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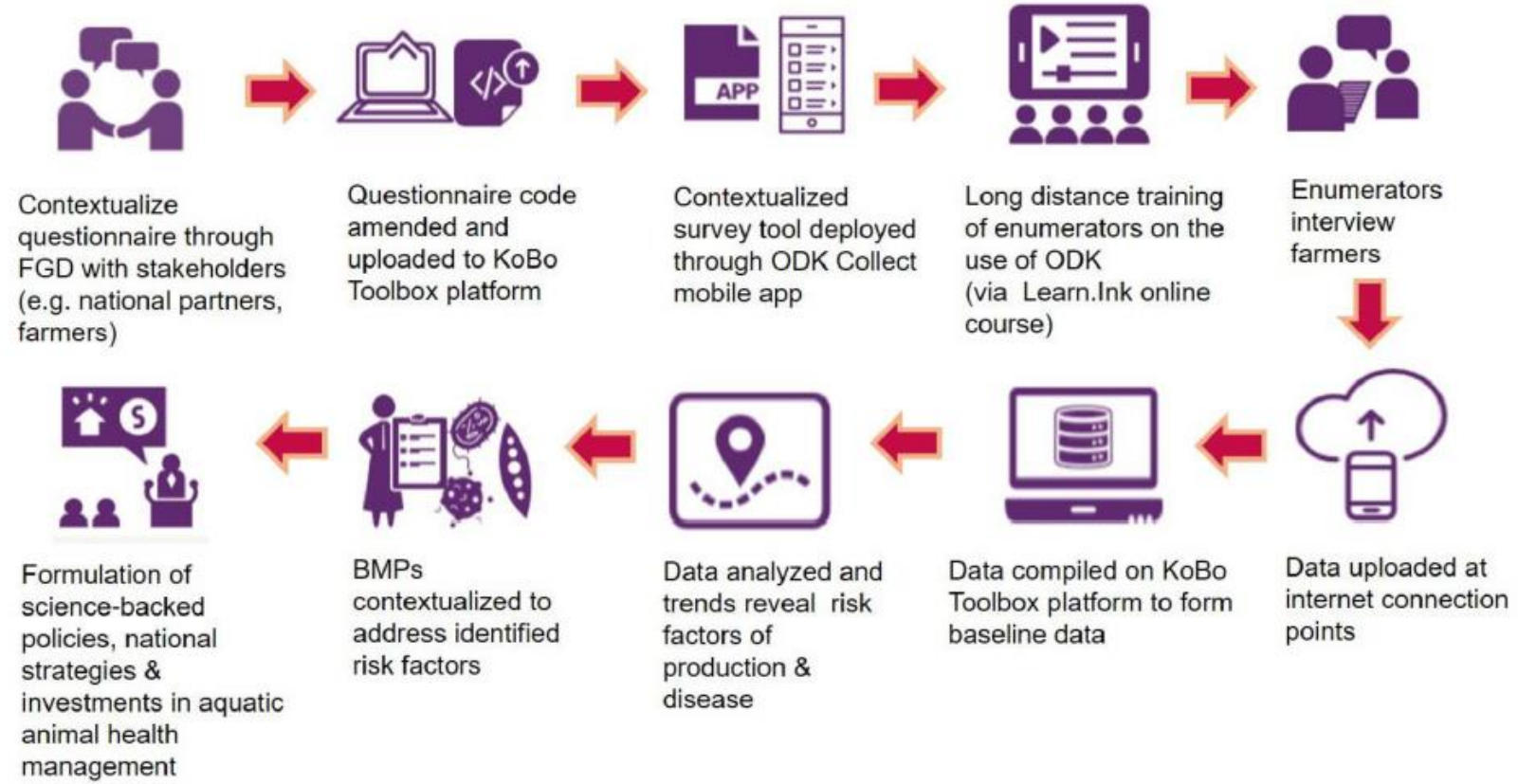
Contribution of baseline data to stakeholder engagement, development of best practices & NAAHs



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World Organisation for Animal Health

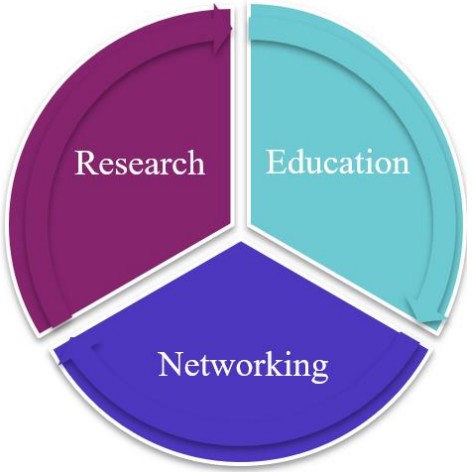
Increased Sustainability in the Aquaculture Sector in SSA through Improved Aquatic Animal Health Management (AHA project)

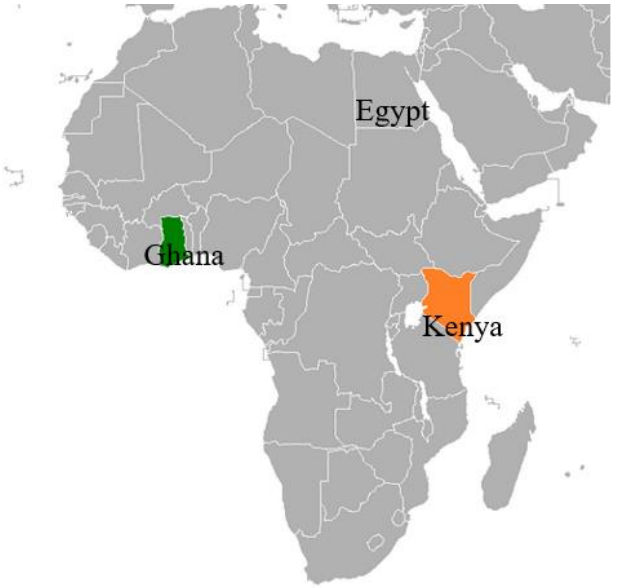
Norad

This program aimed to increase sustainability and resilience in the aquaculture sector in sub-Saharan Africa through improved aquatic animal health management and biosecurity governance.

Project website

3 Major Components





WorldFish

Veterinærinstituttet
Norwegian Veterinary Institute

UNIVERSITY OF GHANA
COLLEGE OF BASIC AND APPLIED SCIENCES

The Fleming Fund
Funded by UK Government

World Organisation for Animal Health

AHA Norad project

Norad

Research

Research capacity on aquatic animal health management in SSA countries improved.

Assessment of health status and economic impact of aquaculture diseases

13 Master research studentships in Ghana & Kenya

Field and laboratory studies to elucidate and characterize endemic and emerging pathogens of economic significance

Aquatic animal health management and biosecurity governance gaps identified and policy analyses under the one health framework

The Fleming Fund
Funded by UK Government

AHA Norad project

Norad

Education

Training and supervision of thirteen MSc students (UoG and UoN)

Developed and delivered range of online and in person training resources training modules on aquaculture and aquatic animal health management in SSA

Institutional capacity and learners' knowledge and practical skills on aquatic animal health to improve the aquaculture related educational services and extension capacity enhanced.

The Fleming Fund
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World Organisation for Animal Health

Projet AHA Norad

In-person training

Norad

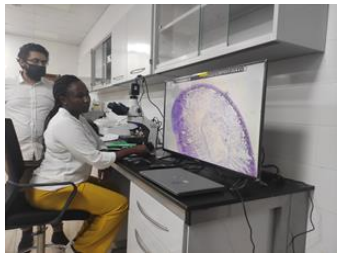
Education

Face-to-face training programs for SSA at FAIH/Abbassa Egypt

6 training courses on on General Aquaculture & Aquatic Animal Health Management Conducted

A total of 100 participants representing 8 countries have been trained physically at Abbassa/ Egypt



Renforcement des capacités institutionnelles et des connaissances et compétences pratiques des apprenants en matière de santé des animaux aquatiques afin d'améliorer les services éducatifs et les capacités de vulgarisation liés à l'aquaculture.

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World Organisation for Animal Health

AHA Norad project

Online self-learning

Norad

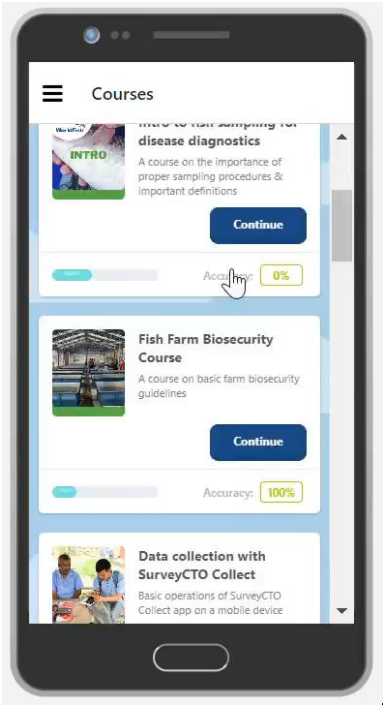
Education

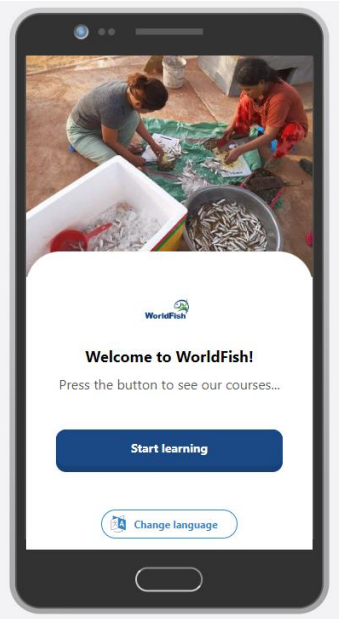
Aquatic Animal Health resources developed for research and education

Learn.ink courses for knowledge sharing among Africa countries

What is LEARN INK ?

- A third-party training & learning digital platform for disseminating training materials remotely using simulated chatbot learning on mobile devices.
- User guidelines on how to access Learn.ink courses and/or printable rapid protocols (with content from courses) can be developed as supplementary material.





The Fleming Fund
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World Organisation for Animal Health

AHA Norad project

Online self-learning

Norad

Education

Aquatic Animal Health resources developed for research and education

13 courses released by Aquatic Animal Health team

Fish Syndromic Surveillance Course

A short training course to help users understand the basics of...

Antimicrobial Usage (AMU) Survey for Aquatic Systems

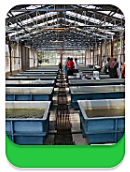
General overview & guidelines on how to use the Antimicrobial...

Wet mount sampling

A course on wet mount sampling preparations and protocol

Bacteriology sampling

A course on bacteriology sampling preparations and protocol



Fish Farm Biosecurity Course

A course on basic farm biosecurity guidelines

Intro to fish sampling for disease diagnostics

A course on the importance of proper sampling procedures &...

Microbiome sampling

A course on microbiome sampling preparations and protocol

Molecular Diagnostics & Virology sampling

A course on molecular diagnostics & virology sampling preparation...

Aquaculture survey with ODK

This module prepares enumerators, survey team leader...

Foundations in fish disease sampling

A course on points to be considered before sampling &...

Blood sampling

A course on blood sampling preparations and protocol

Histology sampling

A course on histology sampling preparations and protocol

Data collection with SurveyCTO Collect

Basic operations of SurveyCTO Collect app on a mobile device

See full list of links to courses at: https://worldfishcenter.org/publication/aquatic-animal-health-remote-training-courses-learnink-platform

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Field resource: Poster identifying major clinical signs of fish disease

Content Photos & description of major clinical signs of fish disease for identification & standardized reporting

Users Farmers, service providers, vets, extension workers & enumerators

https://www.worldfishcenter.org/publication/tilapia-major-clinical-signs

The Fleming Fund
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World Organisation for Animal Health

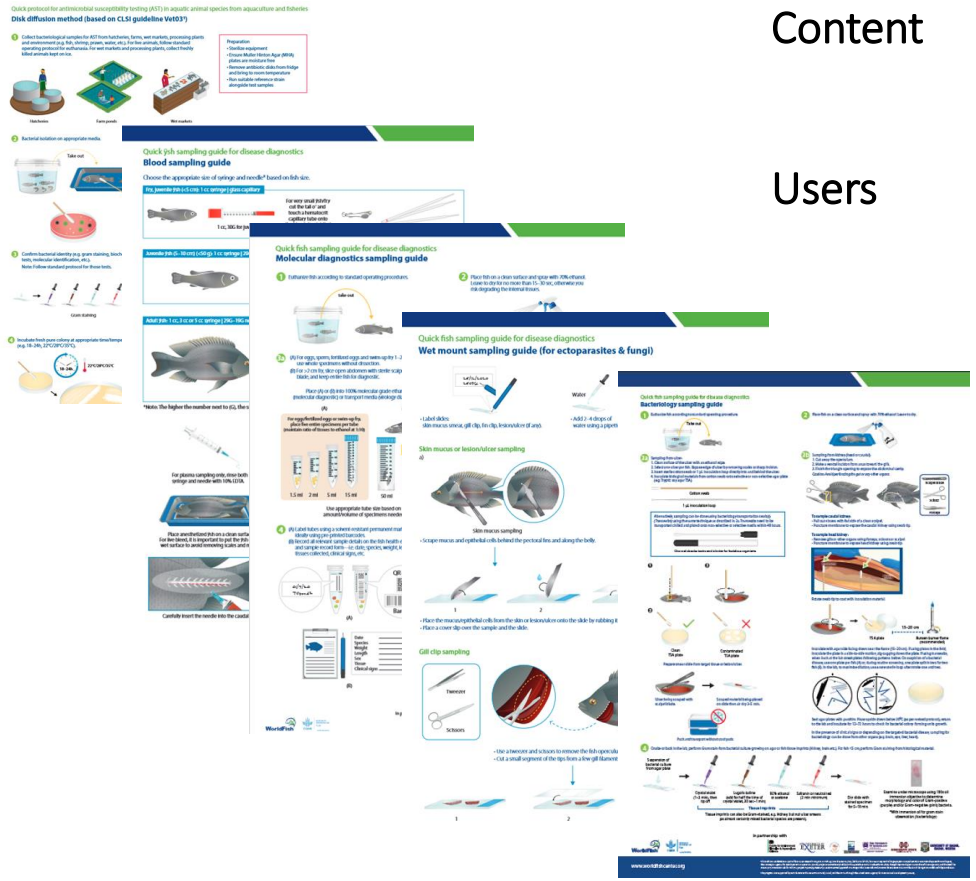
AHA Norad project

Norad

Education

Aquatic Animal Health resources developed for research and education

Field resource: Quick fish sampling guides for disease diagnostics



Content

Pictorial fish sampling steps for 6 diagnostic protocols: wet mount, microbiome, blood, bacteriology, molecular diagnostics/virology & histology

Users

Vets, researchers, sample collectors & students

- Sampling materials for fish disease diagnostics https://hdl.handle.net/20.500.12348/4836
- Wet mount sampling guide (for ectoparasites & fungi) https://hdl.handle.net/20.500.12348/4837
- Microbiome sampling guide https://hdl.handle.net/20.500.12348/4838
- Blood sampling guide https://hdl.handle.net/20.500.12348/4839
- Bacteriology sampling guide https://hdl.handle.net/20.500.12348/4840
- Molecular diagnostics sampling guide https://hdl.handle.net/20.500.12348/4841
- Histology sampling guide https://hdl.handle.net/20.500.12348/4842

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AHA Norad project

Networking

Activities and strategies/approaches for harnessing and sharing knowledge and lessons identified/developed

100 participants representing 8 countries and various institutions

Data sets created for AHA partners, collaborators, students and trainees

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Multi-sectorial collaboration on AMR under the CGIAR One Health Initiative & New CGIAR Science program: Sustainable Animal Aquatic Food

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

IFPRI
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

WorldFish

Meet the CGIAR AMR team

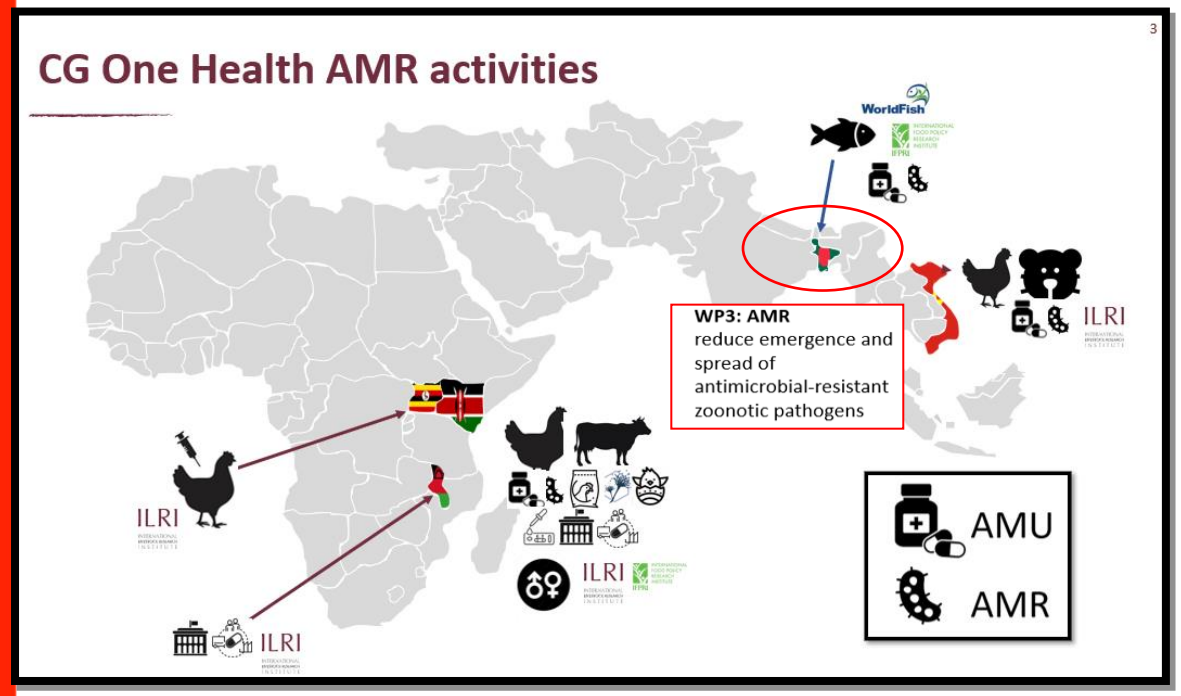
The Fleming Fund
Funded UK Gov
CGIAR

World Organisation for Animal Health

Focal country for AMU/AMR work by WorldFish

CGIAR Initiative

"Protecting Human Health through a One Health approach"



Food Safety Authority, Ministry of Livestock and Fisheries, Bangladesh Livestock Research Institute

Regional Workshop on Antimicrobial Resistance in Aquaculture for English-Speaking African Countries

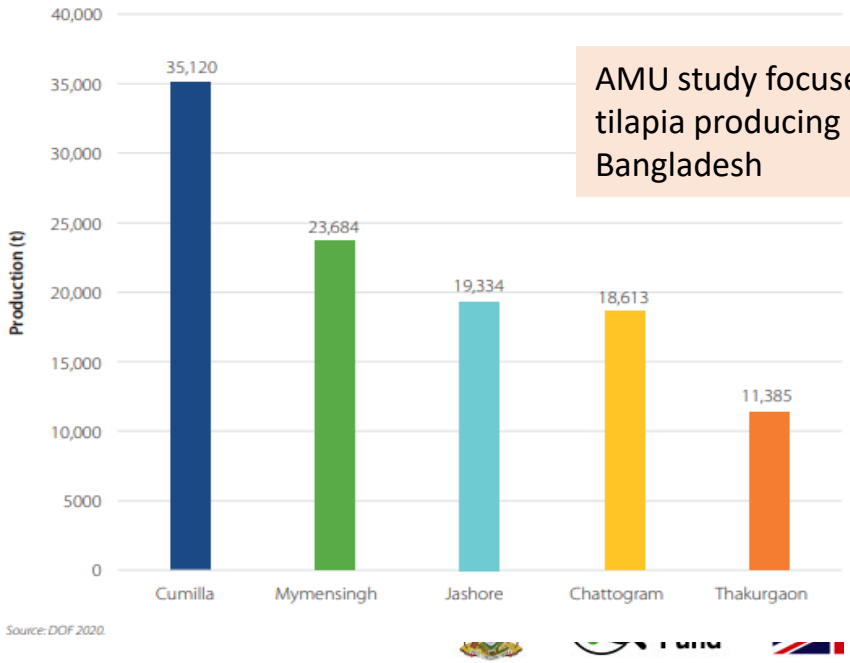
13 - 15 August 2025 Harare, Zimbabwe

Why is Bangladesh vulnerable to AMR?

In Bangladesh **Aquaculture**: 46 chemicals including seven antibiotics are commonly used in aquaculture farms

3rd on the Asian list of number of antibiotics (21 compounds) used in aquaculture

Over 100,000 licensed and 100,000 unlicensed retail drug shops selling drugs including antibiotics over-the-counter.



AMU study focused on top-five tilapia producing districts in Bangladesh

WorldFish CGIAR

AMR

The Fleming Fund

(1) Fleming Fund Fellowship phase I Bangladesh, phase II Nigeria, and Sierra Leone

(2) Point prevalence survey, Research, and capacity building in collaboration with FF CG BD

(3) Fleming Fund OH Regional grant BD, Nepal, Pakistan

(4) Fleming Fund OH Regional grant West Africa: Ghana, Nigeria, Sierra Leone and Senegal, and East Africa: Tanzania

(5) West Africa regional AMR aquaculture

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One Health workshops

Two-day AMR workshop, in Dhaka on ‘’AMR Surveillance in Veterinary and Aquaculture Settings in Bangladesh”.

40 experts: Bangladesh Government policy, Government scientists, Fleming Fund Country Grant, FAO

Identified areas to improve AMR/AMU surveillance in aquatic and terrestrial animal systems

Approaches to strengthen surveillance structures and policy frameworks were discussed in participatory break-out sessions. Dhaka, Bangladesh in March

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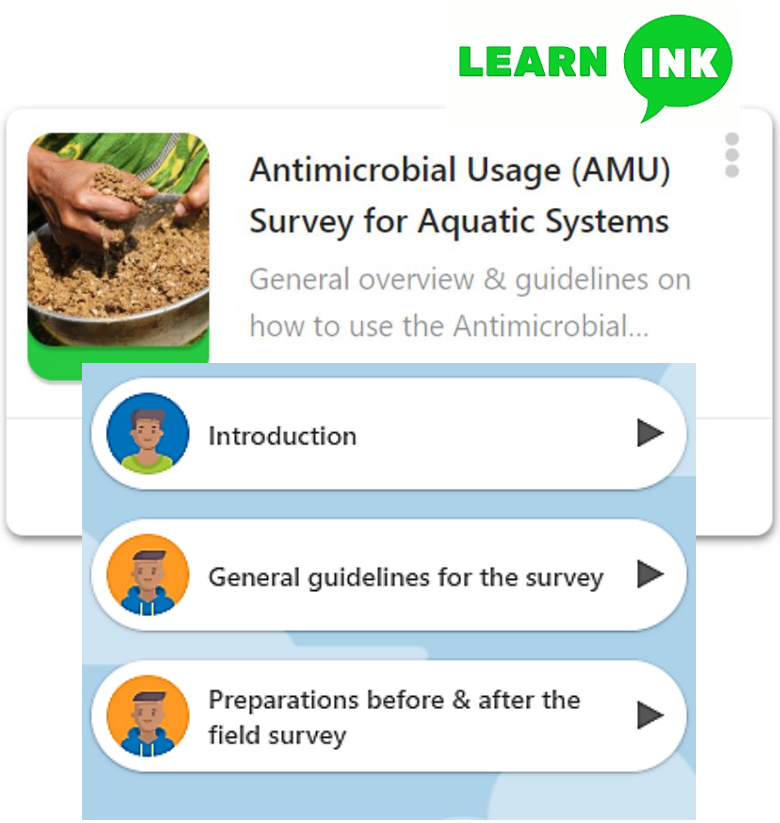
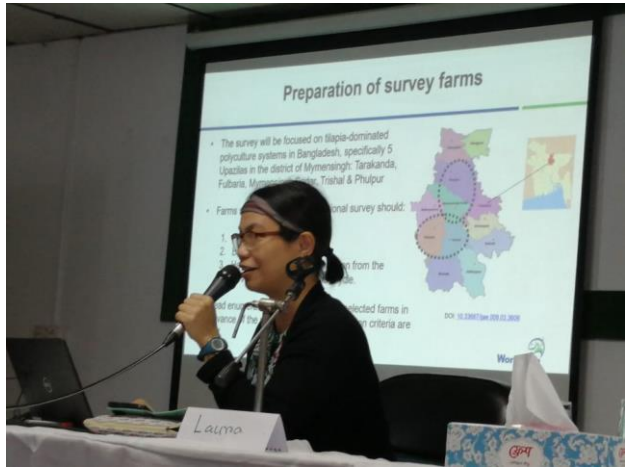
Trainings of enumerators on AMU/AMR data collection

Pretraining using Learn.ink courses, in-person trainings & demonstrations



Quick overview of survey tools, selecting the survey pond for capturing inputs & outputs.



Hands-on training on the survey & biological sampling

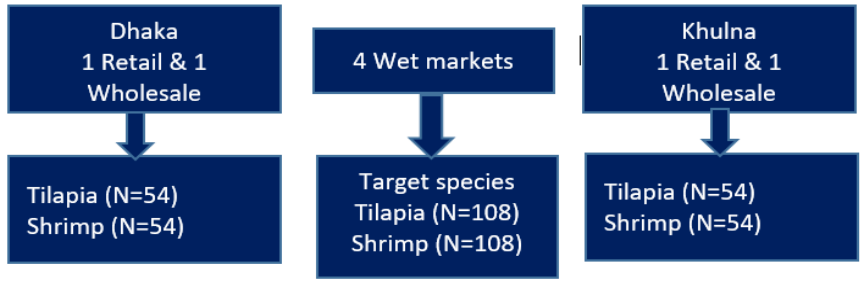
Assessment of AMR at wet markets

https://doi.org/10.3389/fmicb.2024.1329620

frontiers | Frontiers in Microbiology

Nanopore sequencing for identification and characterization of antimicrobial-resistant *Escherichia coli* and *Salmonella* spp. from tilapia and shrimp sold at wet markets in Dhaka, Bangladesh

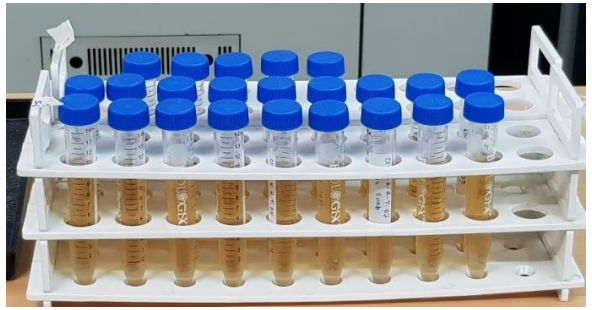
Shafiq Rheman[1*†], Sabrina Hossain[1†], Md Samun Sarker[2], Farhana Akter[1], Laura Khor[3], Han Ming Gan[4], Andy Powell[5,6], Roderick M. Card[7], Yaovi Mahuton Gildas Hounmanou[8], Anders Dalsgaard[8], Chadag Vishnumurthy Mohan[3], Zamila Bueaza Bupasha[2], Mohammed A. Samad[2], David W. Verner-Jeffreys[5,6] and Jérôme Delamare-Debouteville[3*]



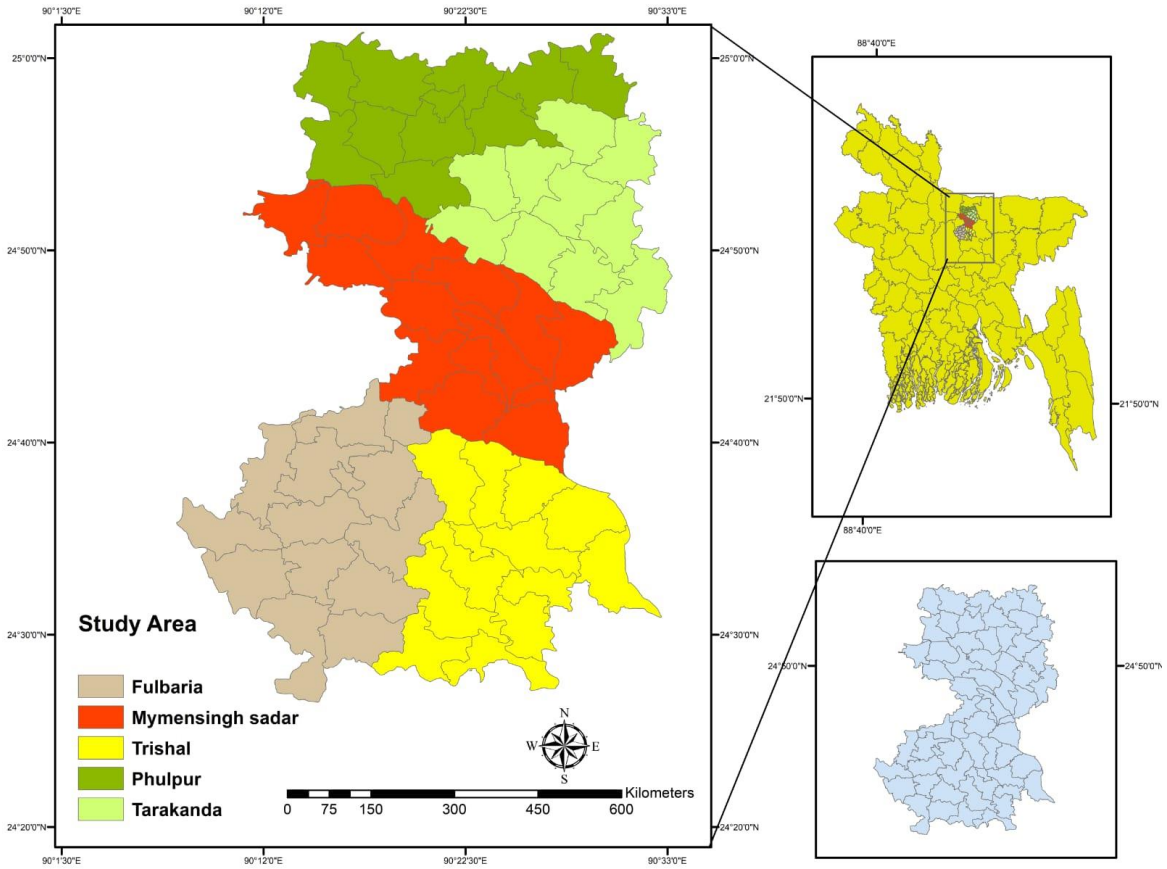
Collection of wet market samples

Processing of fish & shrimp samples

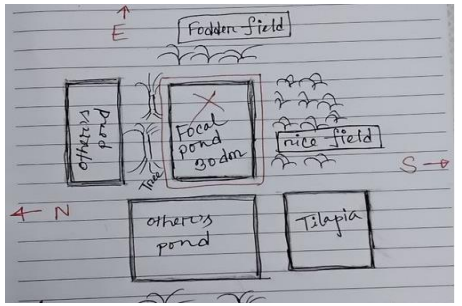
	Tilapia	Shrimp
Skin	✓	X
Gills	✓	X
Muscle	✓	✓
Intestine	✓	✓



AMU/AMR Cross-sectional & Longitudinal Survey on Tilapia-dominant systems



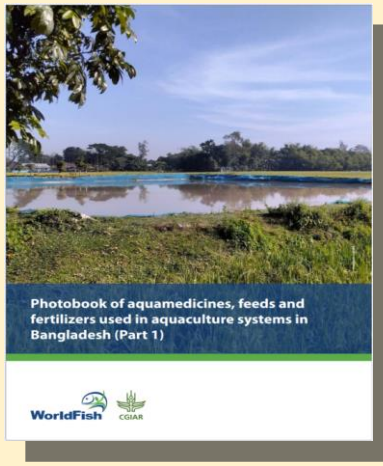
- Questionnaire developed in collaboration with ILRI, IFPRI for harmonization with poultry production dataset
- Observation of 1 pond through 1 cycle (6 months) on farm biosecurity practices, inputs (including antimicrobials) & outputs



Five upazilas within Mymensingh districts in Bangladesh where the study was conducted

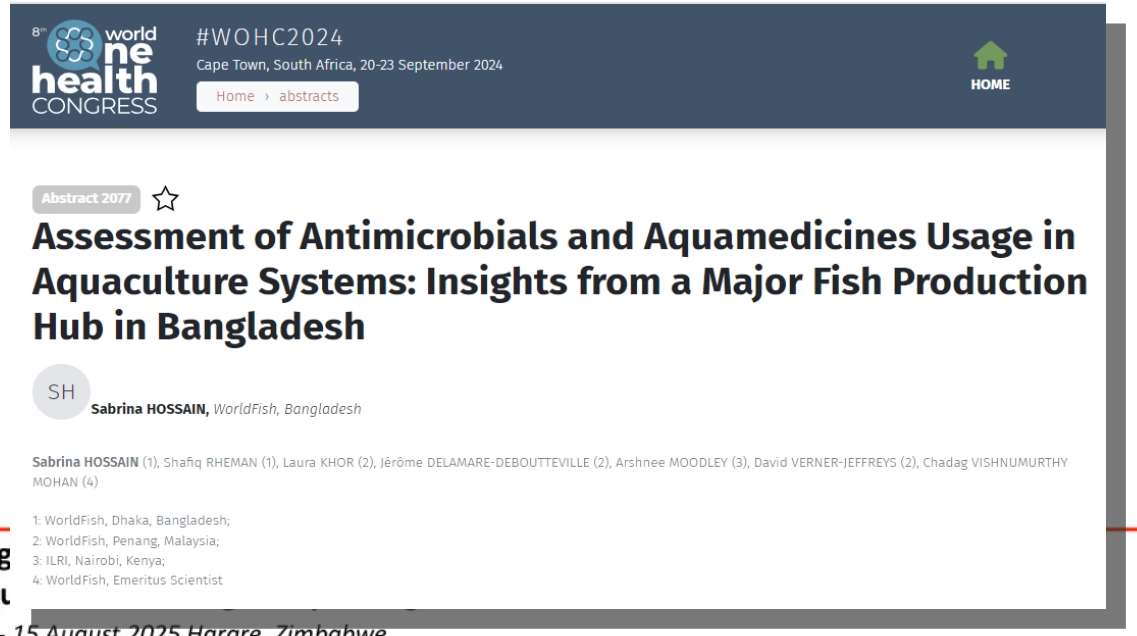
Development of aquamedicines photobook for AMU referencing

- Photobook of aquamedicines developed from farm product photos and input shop data.
  - Jute bags provided to observe packages of aquamedicines which includes antimicrobials (antiparasitics, antibiotics, antivirals, antifungals)
  - Survey of 52 input shops under 7 Upazilas in Mymensingh District for listing agro-chemicals and antimicrobials commonly provided to aquaculture farmers.
- Aquamedicines categorized into antimicrobials, insecticides, oxygen suppliers, harmful gas removers, probiotics, feed supplements and growth promoters.
- List of product photos, brand name, manufacturer and active ingredients.



Agrovet shop survey

- Sales and use of antibiotics in aquaculture
- Practitioner's knowledge, attitude and practices.
- More than 300 aquamedicine brands were documented.
- Sixty-seven antibiotic brands belonging to 9 CIAs and 8 HIAs were reported.



8th world one health CONGRESS

#WOHC2024

Cape Town, South Africa, 20-23 September 2024

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HOME

Abstract 2077 ☆

Assessment of Antimicrobials and Aquamedicines Usage in Aquaculture Systems: Insights from a Major Fish Production Hub in Bangladesh

SH **Sabrina HOSSAIN,** *WorldFish, Bangladesh*

Sabrina HOSSAIN (1), Shafiq RHEMAN (1), Laura KHOR (2), Jérôme DELAMARE-DEBOUTTEVILLE (2), Arshnee MOODLEY (3), David VERNER-JEFFREYS (2), Chadag VISHNUMURTHY MOHAN (4)

1: WorldFish, Dhaka, Bangladesh;
2: WorldFish, Penang, Malaysia;
3: ILRI, Nairobi, Kenya;
4: WorldFish, Emeritus Scientist

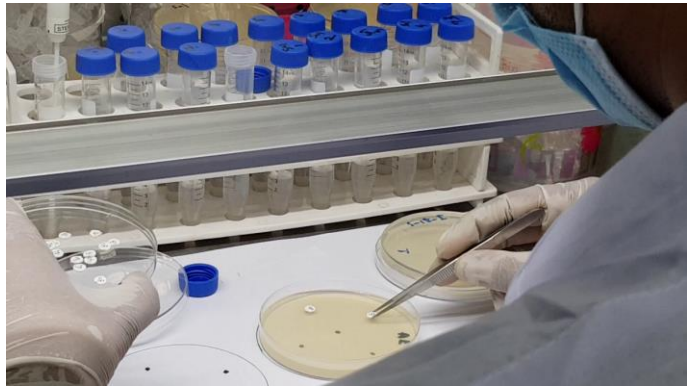
World Organisation for Animal Health

Work with local research institutions for AMR surveillance

Bacteriological sampling and processing for AST profiling training **in Khulna University**

Bacteriological sampling and AST profiling training at **BLRI**

AST profiling by disk diffusion method on fish bacteria samples in **WF-KU lab**



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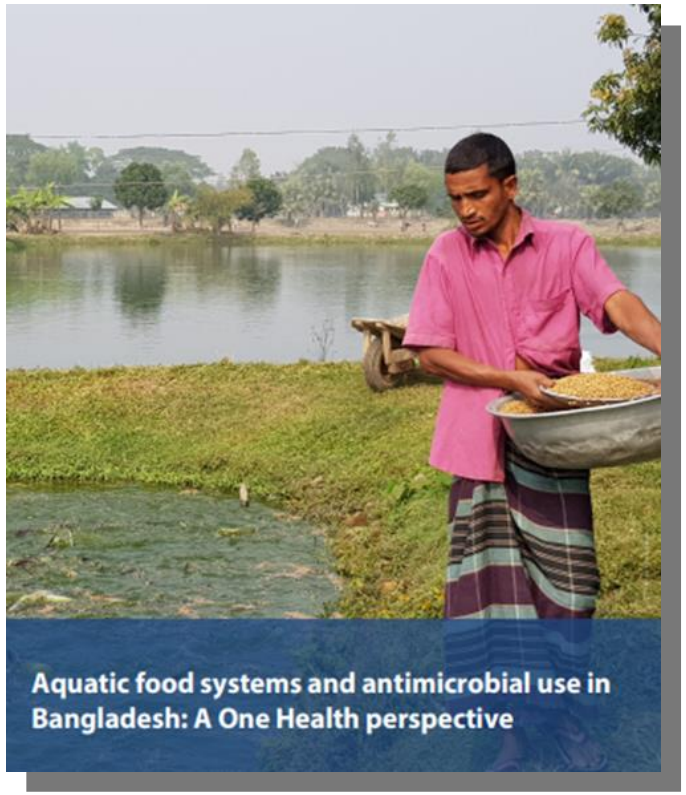
Other published materials, presentations & activities on AMU and AMR work



Scoping review on aquatic food systems and antimicrobial use in Bangladesh aquaculture

WorldFish's collaborative participatory research with Cefas, FAO-ECTAD, and the Department of Fisheries.

Development of a biosecurity training module for improving biosecurity practices in finfish aquaculture systems in Bangladesh.

Assessment of Antimicrobials and Aquamedicines Usage in Aquaculture Systems: Insights from a Major Fish Production Hub in Bangladesh
Author(s): HOSSAIN, Sabrina; RHEMAN, Shafiq; KHOR, Laura; DELAMARE-DEBOUTTEVILLE, Jérôme; MOODLEY, Arshnee; VERNER-JEFFREYS, David; VISHNUMURTHY MOHAN, Chadag
Presenting Author: HOSSAIN, Sabrina
Submission Type / Conference Track: 8th World One Health Congress Scientific and Science Policy Interface Program

Improving biosecurity practices to reduce antimicrobial resistance in finfish aquaculture in Bangladesh
Author(s): PAPADOPOULOU, Athina; WORSWICK, John; RHEMAN, Shafiq; HOSSAIN, Sabrina; NAHER, Kamrun; RAHMAN, Habibur; ALI, Nowsher; DELAMARE-DEBOUTTEVILLE, Jérôme; VERNER-JEFFREYS, David
Presenting Author: PAPADOPOULOU, Athina
Submission Type / Conference Track: 8th World One Health Congress Scientific and Science Policy Interface Program

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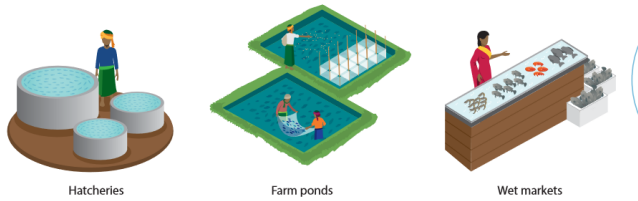
Learning resource materials & field guides for AMR sampling work

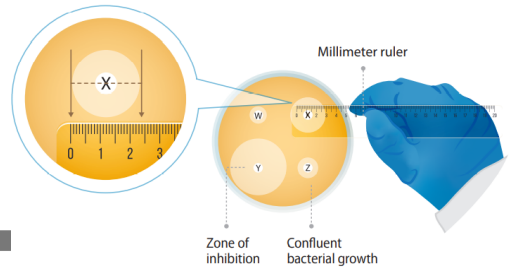
Protocol for antimicrobial susceptibility testing (AST) in aquatic animal species: https://hdl.handle.net/20.500.12348/4862

Disk diffusion method (based on CLSI guideline Vet03[1])

1 Collect bacteriological samples for AST from hatcheries, farms, wet markets, processing plants and environment (e.g. fish, shrimp, prawn, water, etc.). For live animals, follow standard operating protocol for euthanasia. For wet markets and processing plants, collect freshly killed animals kept on ice.



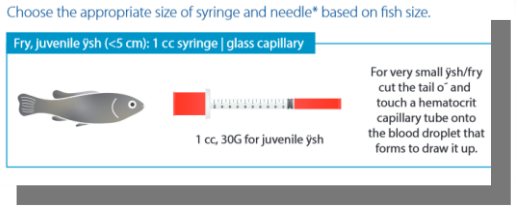
14 Measure inhibition zone diameter under appropriate illumination as per protocols.

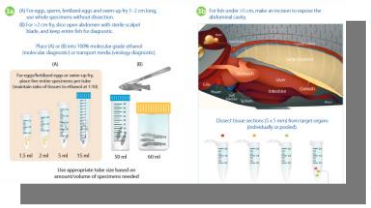


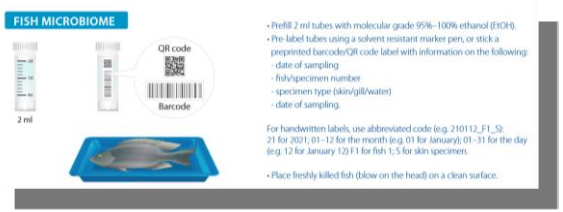
15 Ensure zone sizes for reference strain are within range and determine epidemiological cut-off values (ECV/ECOFF)/clinical breakpoints if available.

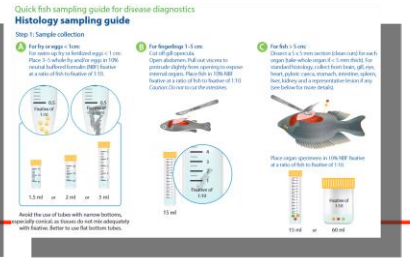
Antimicrobial agent	Disk content	Interpretive categories and zone diameter, ECVs nearest whole mm	
		WT	NWT
W	25 µg	≥ 27	≤ 26
X	30 µg	≥ 28	≤ 27
Y	5 µg	≥ 30	≤ 29
Z	10 µg	≥ 18	≤ 17

Quick fish sampling guides (sampling protocols for wet mount, microbiome, blood, bacteriology, molecular diagnostics and virology, histology)









Partnerships and collaborations (WorldFish work with partners)

- Application of a ***systems-thinking approach*** to aquaculture systems for ***identifying hotspots*** for antibiotic resistance emergence, elucidating pathways to human exposure and to identify and assess feasibility of ***potential interventions*** (RVCL)
- Assessment of Aquatic food systems from a ***One Health lens*** – Bangladesh work (C*efas UK)*
- ***Microbiomes*** and AMR in aquatic food systems in Malawi and Bangladesh *(UoE UK)*
- AMR ***Learning platforms*** and ***participatory modelling approaches***
  (SRC, University of Waterloo Canada)
- **Behavior and practice change** (SBCC) of aquatic food value chain actors including producers in Bangladesh (UoE UK)
- Fleming Fund country grants (Nigeria and Bangladesh) and FF Fellowship programs- ***embedding aquatic food systems*** in their AMR surveillance and One health work.
- ***CGIAR AMR and CGIAR Covid hub*** *(ILRI, IFPRI, IWMI and WorldFish) and* ***CGIAR SAAF AoW3*** *. U Copenhagen*
- ***Rapid genomic detection*** *of aquaculture pathogens (UQ, WilderLab, Centex Mahidol, GeneSEQ, Cefas, UoE)*
- **Future work with:**
- ***Fleming Fund Regional grant on AMROH activities*** *in South Asia (from 2024)*

Future…

- Further support aquatic animal health system strengthening in Africa
- Continue to work with partners in target countries to develop and implement research, education, training, and networks/ communities of practice among health professionals.
- Establish a more robust regional presence.
- Employ dedicated health staff embedded in the countries where WorldFish and the NVI operate. These staff can deliver training and support efforts to strengthen the capacity to undertake disease investigations, etc.

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Funded by UK Government

Outcomes

- Enhancing research capabilities on aquatic animal health management in SSA
- Improving knowledge and practical skills for aquaculture-related education services and extension capacity
- Disseminating new insights on aquatic animal health within the One Health and One Food Systems framework across SSA through sustainable networking.

The Fleming Fund
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Outcomes

- Robust and resilient aquatic animal health systems based on a one-health approach
- Reduced losses, more stable ‘shockproof’ production, improved food security
- Increased trade, maximizing export revenues
- Reduced use of antibiotics
- Increased profitability, income & investment
- Reduced biodiversity losses and climate change impacts

Relevant WorldFish priority actions in its countries in Asia and Africa
1.1 Enable sustainable production of diverse aquatic foods
1.2 Cut down on loss and waste
1.3 Enhance climate resilience and reduce greenhouse gas emissions
2.2 Support sustainable livelihoods, decent work and well-being
3.2 Ensure aquatic foods are safe and healthy for human consumption

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Thank You

Norad

Veterinærinstituttet
Norwegian Veterinary Institute

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Department of Fisheries Zambia

FIT Fund
Farmers In Transition

BANQUE AFRICAINE DE DEVELOPPEMENT
AFRICAN DEVELOPMENT BANK

idh the sustainable trade initiative

SADC
SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
TOWARDS A COMMON FUTURE

IFAD
Investing in rural people

Norwegian Embassy
Cairo

The League Of Arab States
Arab Organization For Agricultural Development

SKRETTING
a Nutreco company

LUANAR

care

UNIVERSITY OF GHANA
COLLEGE OF BASIC AND APPLIED SCIENCES

JICA

USSEC
U.S. SOYBEAN EXPORT COUNCIL

Kafrelsheikh University

UNIVERSITY OF STIRLING

WAGENINGEN
UNIVERSITY & RESEARCH

Food and Agriculture Organization of the United Nations

Regional Workshop on Antimicrobial Resistance in Aquaculture for English-Speaking African Countries

13 - 15 August 2025 Harare, Zimbabwe

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