



Food and Agriculture
Organization of the
United Nations

Progressive
Management
Pathway for
Aquaculture
Biosecurity

FAO's Efforts on AMR in aquaculture

Résistance aux antimicrobiens (RAM) en aquaculture

Tunis, Tunisia

11–12 July 2024



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*Progressive Management Pathway
for Aquaculture Biosecurity*

Antimicrobial Resistance: not a stand-alone issue

- **68th World Health Assembly (May 2015)**
 - Adoption of the Global Action Plan (GAP) on AMR (FAO and OIE contribution)
- **83rd World Assembly of the OIE (WOAH) Delegates (May 2015)**
 - Adoption of Resolution No. 26 on AMR
- **39th Food and Agriculture Organization (FAO) Conference (June 2015)**
 - Adoption of the Resolution 4/2015 on AMR
- **71st UN General Assembly (UNGA) - High Level Meeting on AMR (September 2016)**
 - UN Member States adopted a political declaration on AMR
 - **WHO/FAO/OIE Tripartite:** Since 2018, FAO, OIE (WOAH), and WHO, the three agencies joined forces as a Tripartite to strengthen their long-standing partnership, with a renewed focus on tackling AMR from a One Health approach.
 - **WHO/FAO/WOAH/UNEP Quadripartite:** In 2022, the Tripartite became formally the Quadripartite as it welcomed the United Nations Environment Programme (UNEP) in the alliance to accelerate coordinated strategy on human, animal and ecosystem health.

One Health collaboration



WHO

Global leader
for human health



FAO

Global leader
for food and
agriculture



WOAH

Global leader
for animal health
and welfare
standards



UNEP

Global leader for
environmental
issues

FAO Action Plan on AMR 2021-2025

Five Objectives

Food and agriculture sectors, dependent livelihoods and economies are made resilient to the impacts of AMR

Strengthening **governance** and allocating **resources** to accelerate and sustain progress

Increasing stakeholder **awareness** and **engagement** to foster change

Promoting **responsible use** to keep antimicrobials working

Strengthening **surveillance** and **research** to support evidence-based decisions

Enabling **good practices** to prevent infections and control the spread of resistant microbes



AMR Working Group Leadership Team: multidisciplinary and multi-sectoral



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Tools to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR

**Code of Conduct for Responsible Fisheries
(CCRF) Technical Guidelines:
Recommendations for Prudent and Responsible
Use of Veterinary Medicines in Aquaculture**



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ISSN 1020-5292

FAO
TECHNICAL GUIDELINES FOR
RESPONSIBLE FISHERIES

5

Suppl. 8

AQUACULTURE DEVELOPMENT

8. Recommendations for prudent and responsible
use of veterinary medicines in aquaculture



Tools to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR

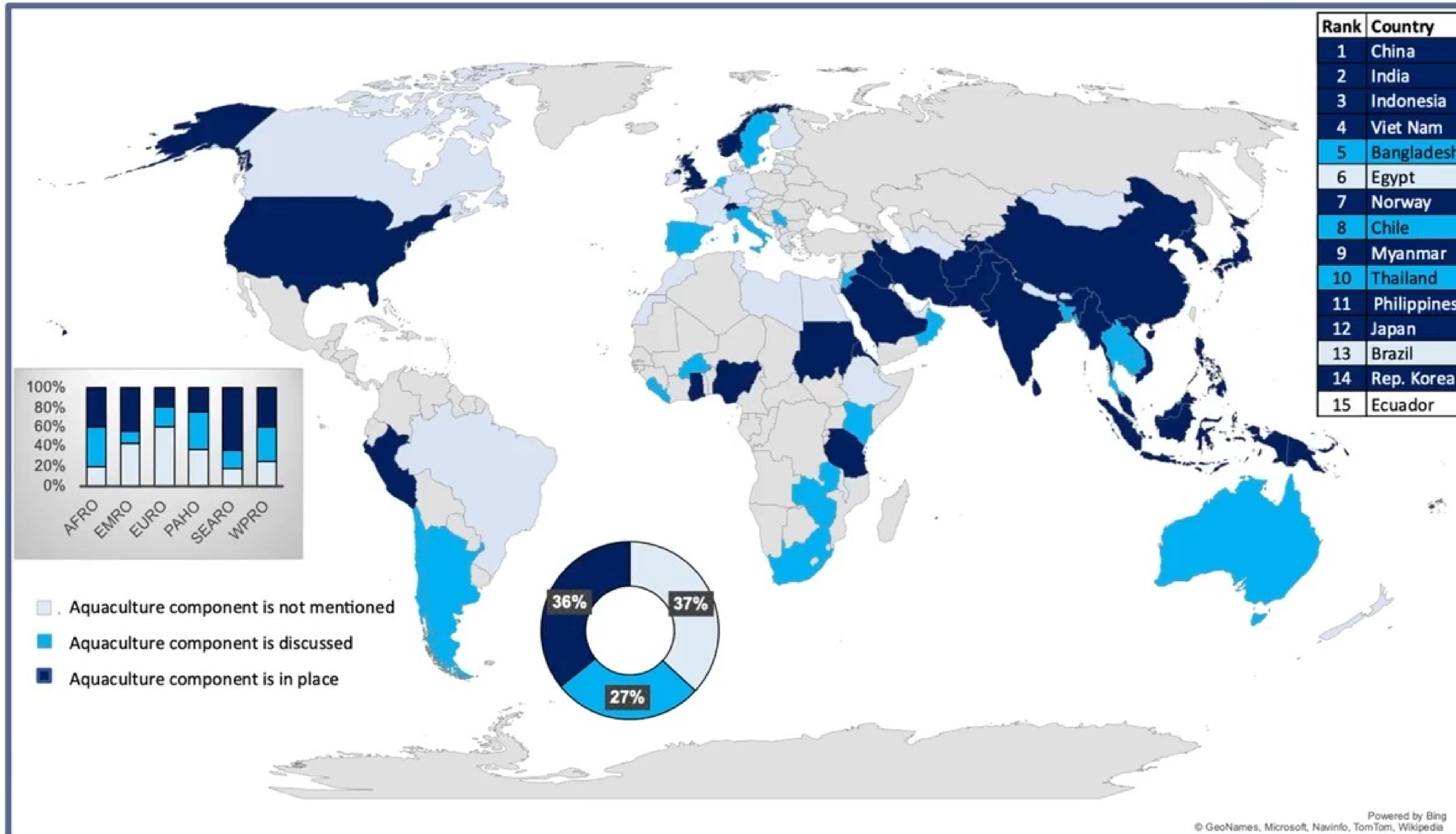
REVIEWS IN **Aquaculture**



REVIEW |  Open Access |    

Antimicrobial resistance in aquaculture: A global analysis of literature and national action plans

Andrea Caputo, Melba G. Bondad-Reantaso  Iddya Karunasagar, Bin Hao, Patricia Gaunt, David Verner-Jeffreys, Sophie Fridman, Alejandro Dorado-Garcia



Review of 95 National Action Plans on AMR and the 15 top aquaculture-producing aquaculture countries.

Almost 40% do not acknowledge aquaculture as a critical component where AMR should be further investigated and contained along the entire supply chain.

<https://onlinelibrary.wiley.com/doi/10.1111/raq.12741>

Tools to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR

REVIEWS IN **Aquaculture**

REVIEW |  Open Access | 

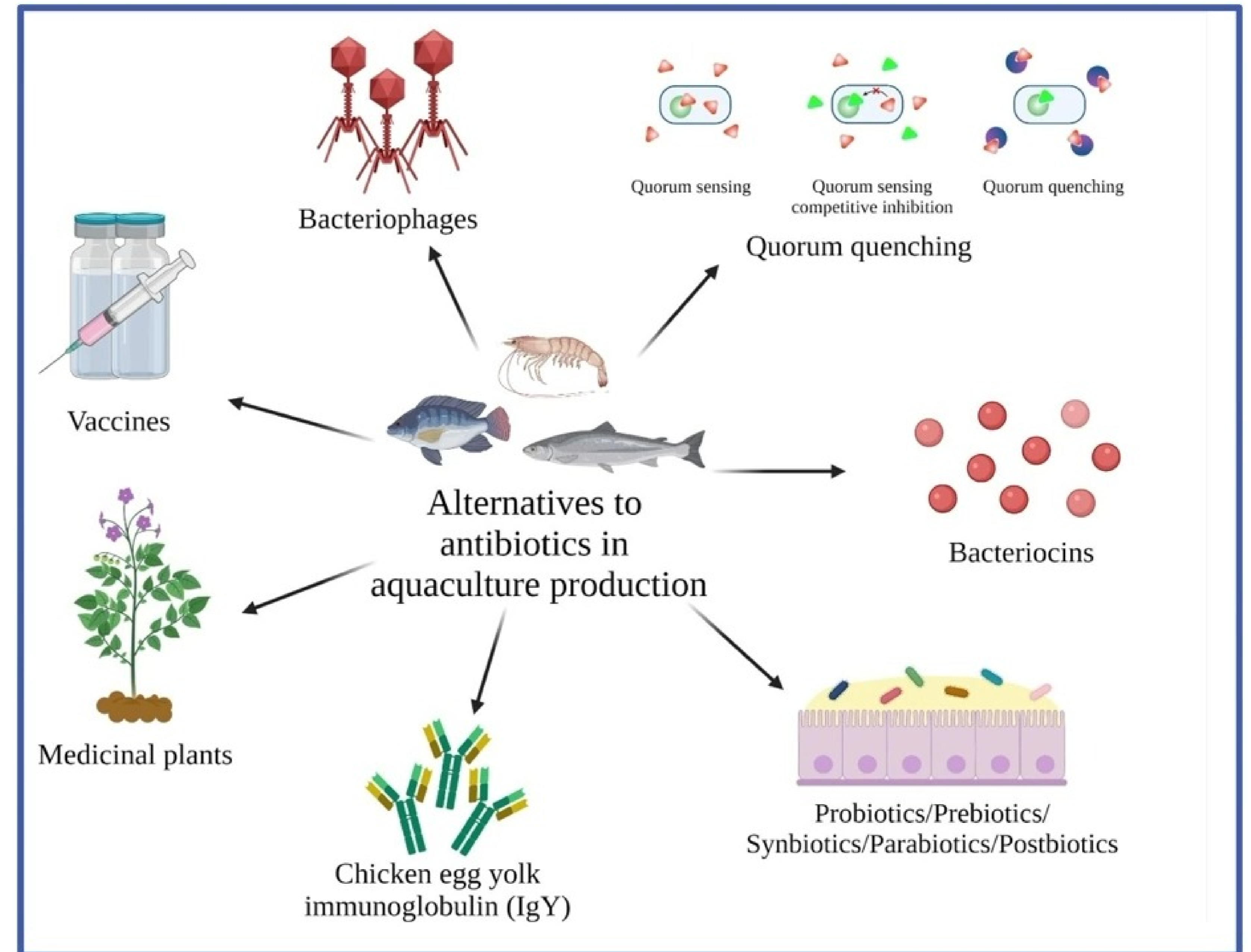
Review of alternatives to antibiotic use in aquaculture

Melba G. Bondad-Reantaso , Brett MacKinnon, Iddya Karunasagar, Sophie Fridman, Victoria Alday-Sanz, Edgar Brun, Marc Le Groumellec, Aihua Li, Win Surachetpong, Indrani Karunasagar, Bin Hao, Andrea Dall'Occo, Ruggero Urbani, Andrea Caputo ... [See fewer authors](#) ^

First published: 24 February 2023 | <https://doi.org/10.1111/raq.12786> | Citations: 9

Review of alternatives to antibiotic use in aquaculture

<https://onlinelibrary.wiley.com/doi/10.1111/raq.12786>



Vaccines

- **preparations** made of **pathogenic microorganisms** (bacteria, viruses and so forth and their metabolites), which are artificially attenuated, inactivated or genetically modified to **prevent** and control infectious diseases
 - Microorganisms inactivated or killed
 - With or without adjuvants
 - Immersion/injection routes
- **Bacterial/viral** diseases
- Humoral **antibody response** or **cell-mediated** immunity
- First commercially available vaccines for fish: 1942
 - *Aeromonas salmonicida* in Cutthroat trout (*Onchorhynchus clarkii*)



Specific Pathogen Free (SPF): starting with clean and healthy seed

- exclusion of pathogens is a strategy that has been practiced in agriculture for decades.
- SPF strategy used in aquaculture was copied from the poultry industry developed in the 1950s when they realized that poultry research was dependent on the use of animals free of pathogens.
- whiteleg shrimp, *Penaeus vannamei*, in the late 1980s; initially developed for research purposes and has been the basis of the most successful breeding programs, and over the years, SPF shrimp jumped into industrial-scale commercial operations taking the lead within the aquaculture industry and allowing the exponential growth of *P. vannamei* in Asia.
- nowadays also applied in the salmon industry and is increasingly being embraced by other aquaculture species (i.e., Mediterranean species, barramundi, tilapia, and Chinese mandarin fish)
- should be given high priority in biosecurity for preventing disease outbreaks and subsequent losses

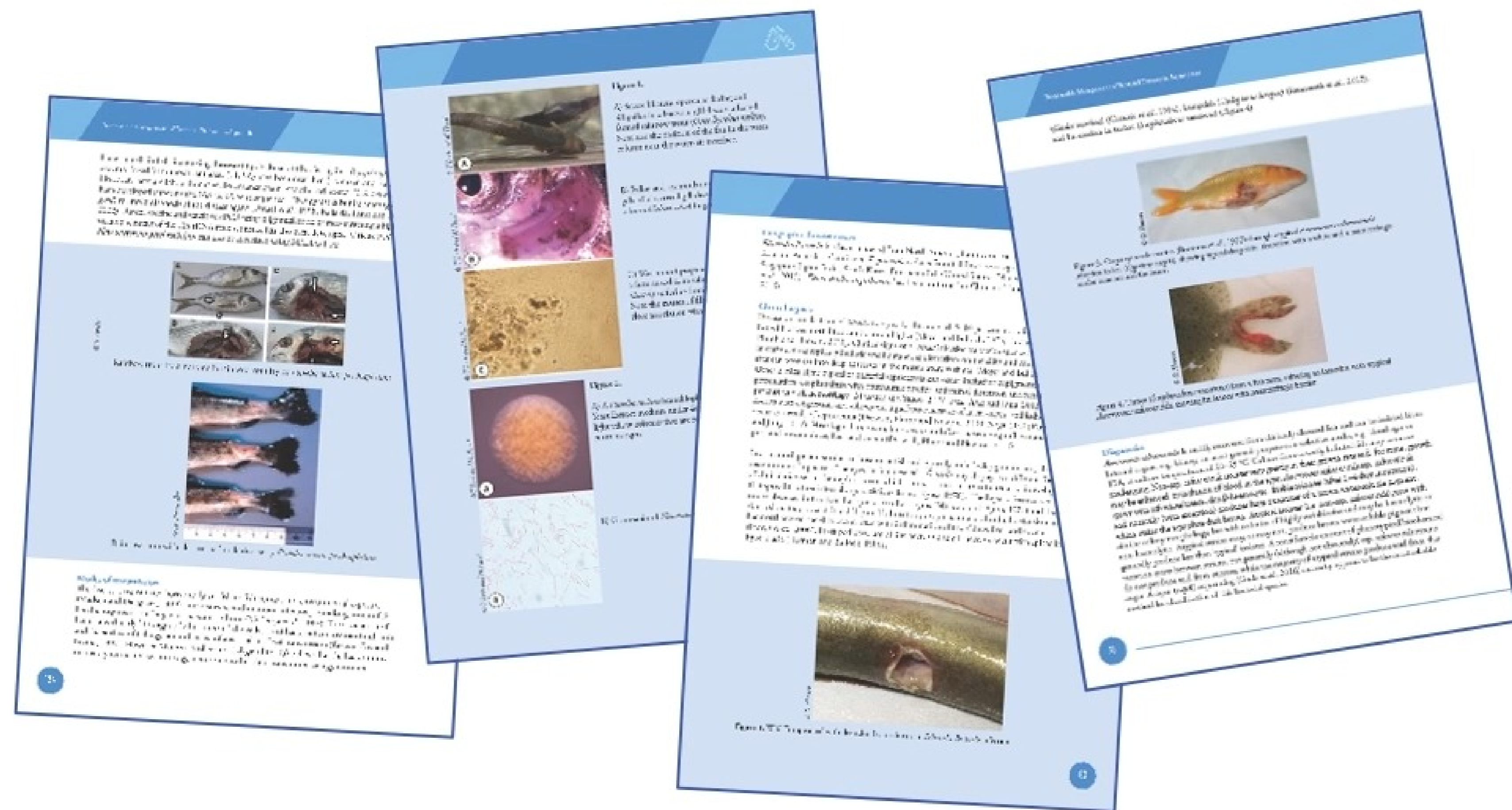
Aquatic scenario

- Aquatic organisms live among an array of microbes, some of which are potential pathogens, depending on a variety of factors specific to the host, pathogen and environment.
- Most bacterial pathogens in aquatic organisms are aerobic, gram-negative rods and, for this reason, most antibiotics used in aquaculture are effective against gram-negative bacteria



Tools to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR

Ongoing work on Responsible Management of Bacterial Diseases in Aquaculture



Responsible Management of Bacterial Diseases in Aquaculture





FAO book: major bacterial diseases affecting aquaculture

Criteria used for making the draft list of most important bacterial pathogens in aquaculture

- economic importance of affected species
- socio-economic impact
- zoonotic potential



Gram-negative bacteria

Vibriosis

(*V. anguillarum*, *V. harveyi* clade, *V. parahaemolyticus*, *Aliivibrio salmonicida* (*V. salmonicida*), *V. vulnificus*, *Photobacterium damsela*)

Aeromonas

(Motile *Aeromonas* spp.: *Aeromonas caviae*, *A. hydrophila*, *A. sobria*, *A. veronii*, *A. jandaei*; *A. salmonicida*)

Edwardsiellosis

(*Edwardsiella anguillarum*, *E. ictaluri*, *E. piscicida*, *E. tarda*, *Yersinia ruckeri*)

Pseudomonas

(*Pseudomonas anguilliseptica*, *P. fluorescens*)

Flavobacteriosis

(*Flavobacterium branchiophilum*, *F. columnare*, *F. psychrophilum*, *Tenacibaculum maritimum*)

Infection with Intracellular Bacteria

(*Piscirickettsia salmonis*, *Hepatobacter penaei*, *Francisella noatunensis*, *Chlamydia* spp.)

Gram-positive bacteria

Mycobacteriosis

(*Mycobacterium fortuitum*, *M. marinum*, *Nocardia asteroides*, *N. crassostreae* (ostreae), *N. seriolae*)

Streptococcosis

(*Streptococcus agalactiae*, *S. iniae*, *Lactococcus garvieae*, *Aerococcus viridans*)

Renibacteriosis

(*Renibacterium salmoninarum*)

Infection with Anaerobic Bacteria

(*Clostridium botulinum*, *Enterobacterium catenabacterium*)

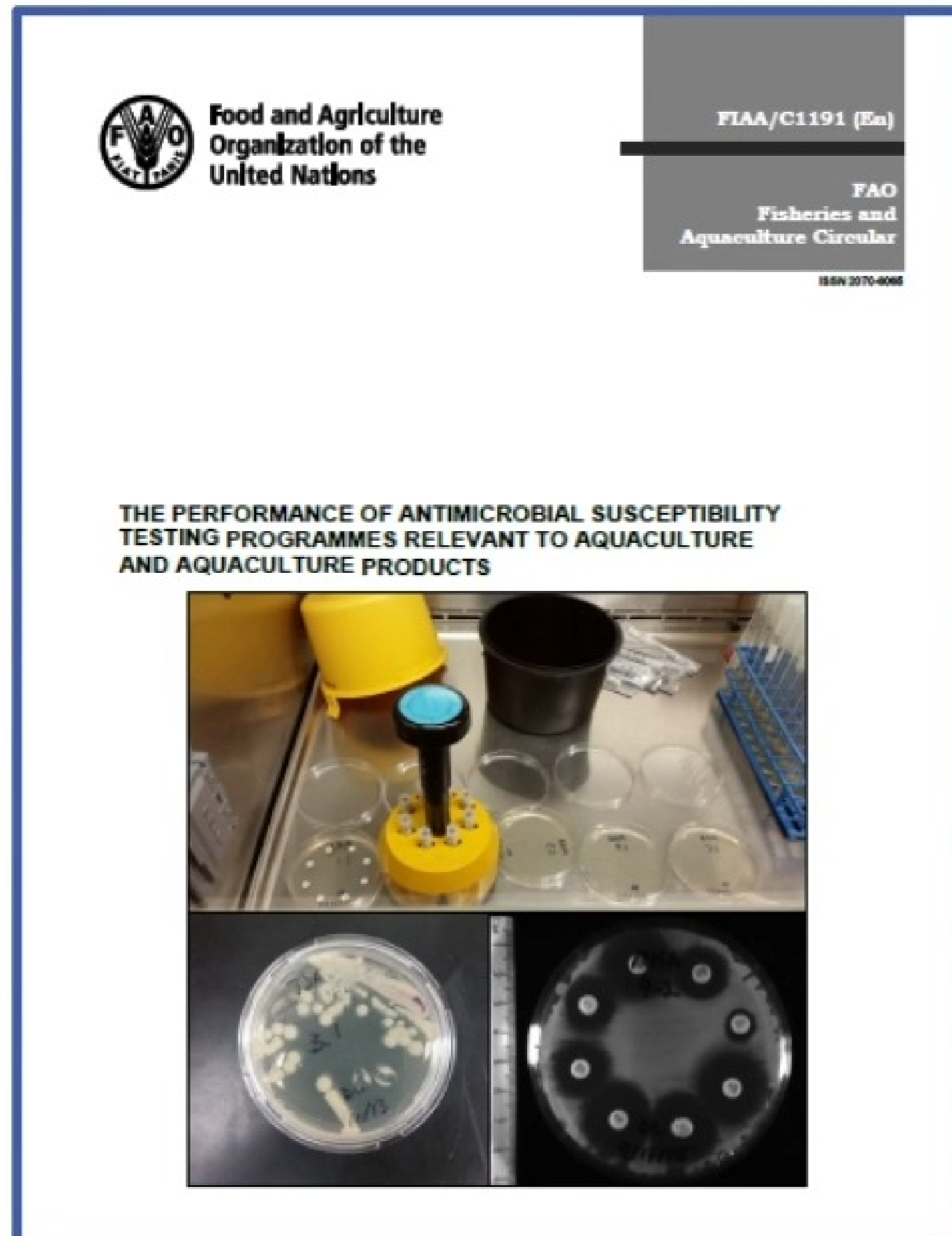
In **red**: considered important for tropical regions

Cold: Appr 0-15°C

Temperate: 5-25°C

Tropical: 20-37°C

Tools to support responsible and prudent use of antimicrobials in aquaculture and reduce AMR



Guidance document on **Performance of antimicrobial susceptibility testing (AST) programmes relevant to aquaculture and aquaculture products**

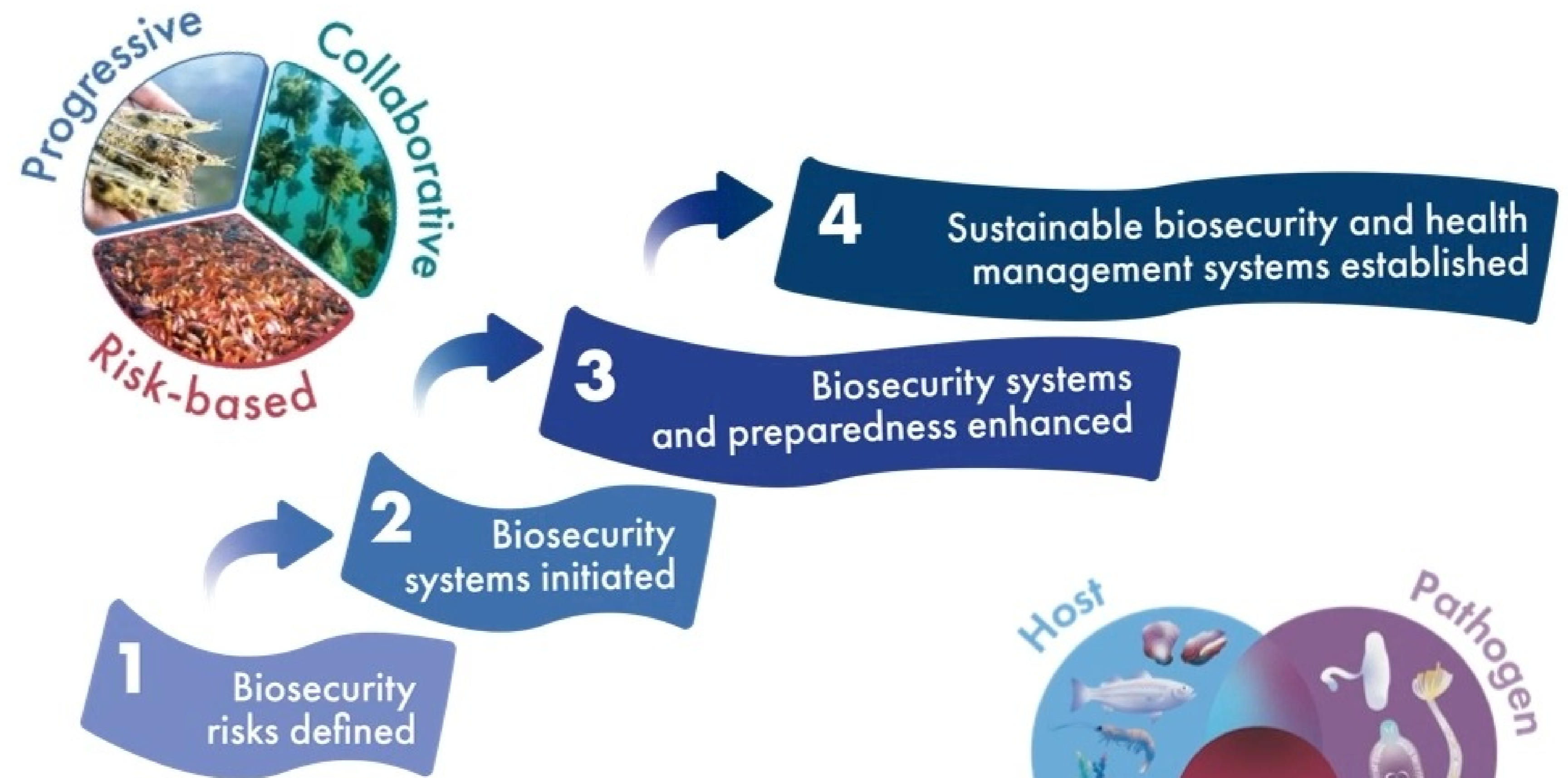
This technical paper addresses best practice guidelines for the performance of antimicrobial susceptibility testing of bacteria isolated from aquatic animals as part of a monitoring or surveillance programme or to provide guidance for clinical treatments of diseased animals. It contains six sections, namely:

- Section 1: relevance of the document to the Action Plan;
- Section 2: principles of antimicrobial susceptibility testing;
- Section 3: standard protocols recommended for use in antimicrobial susceptibility testing of bacteria isolated from aquatic animals;
- Section 4: design of programmes aimed at monitoring or surveillance of AMR associated with the use of antimicrobial agents in the rearing of aquatic animals;
- Section 5: conclusions; and
- Section 6: references

<http://www.fao.org/3/ca6028en/ca6028en.pdf>

Insights on Adaptive Management of Bacterial Diseases in Aquaculture

Prevention	Control
BAP/GAP/BMP	Antibiotics
Enhancing gut immunity/influencing intestinal microbiome	Alternative to antibiotics: bacteriophages, quorum quenching, bacteriocins, chicken egg yolk immunoglobulin and medicinal plants.
Optimising immune status (vaccination)	
Use of SPF/SPT seeds, use of clean seeds	



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





Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity


2015

OSRO/RAS/502/USA: Addressing Antimicrobial Usage in Asia's Livestock, Aquaculture and Crop Production Systems
1 October 2015 — 31 December 2021

FAO-USAID Regional Project on AMR in Asia, focusing on three countries: Indonesia, Thailand and Viet Nam.

Addressing Antimicrobial Usage in Asia's livestock, aquaculture and crop production systems

Project activities include improving understanding and documentation of antimicrobial usage (AMU) and AMR in livestock production; enhancing awareness; establishing regional platform for promotion of AMU stewardship; and, strengthening capacities in surveillance of AMR and antimicrobial residue





Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

2017

FMM/RAS/298: Strengthening capacities, policies, and national action plans on prudent and responsible use of antimicrobials in fisheries



Regional Workshop 1

10—12 April 2017

Mangalore, India

© FAO/Melba Reantaso



Regional Workshop 2

7—9 August 2017

Putrajaya, Malaysia

© FAO/Melba Reantaso



Regional Workshop 3

12—14 December 2017

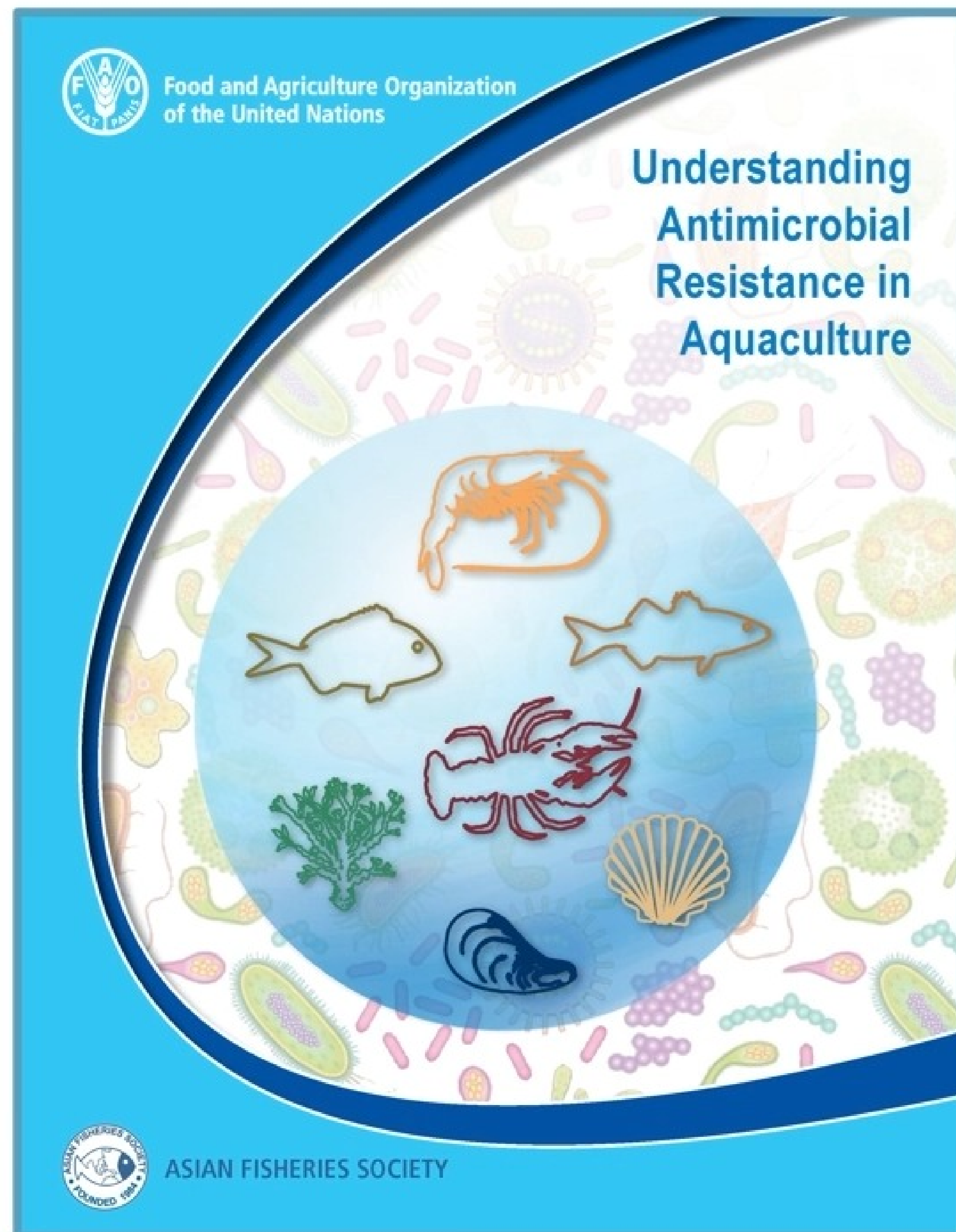
Singapore

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Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity



FMM/RAS/298: Strengthening capacities, policies, and national action plans on prudent and responsible use of antimicrobials in fisheries

Publication of Special issue of Asian Fisheries Science: Understanding AMR in Aquaculture

17 papers based on technical presentations based on the three regional workshops held in 2017.

<https://www.asianfisheriessociety.org/publication/archivedetails.php?id=volume-33-special-issue-understanding-antimicrobial-resistance-in-aquaculture&q=1>



Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity



**Side event on AMR
FAO COFI Sub-Committee on Aquaculture
(COFI-SCA) 9th Session**
25 October 2017
Rome, Italy
© FAO/Giuseppe Carotenuto



Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

FAO Expert Working Group Meeting "Scoping Exercise"

26—29 November 2018

Palermo, Italy

© FAO/Melba Reantaso



2018

- FAO Expert Group Workshop: to better understand the risks of AMR (risk assessment) in aquaculture
- Participants include representatives from five candidates (during that time) **FAO Reference Centres on AMR and Aquaculture Biosecurity:**
 - Centre for Environment Fisheries and Aquaculture Sciences (CEFAS), United Kingdom
 - Mississippi State University, United States of America
 - Nitte University, India
 - Yellow Sea Fisheries Research Institute of the Chinese Academy of Fisheries Science (CAFS), China
 - Pearl River Fisheries Research Institute of the Chinese Academy of Fisheries Science (CAFS), China
- Topics and activities included the overview and status of AMR at that time; AMR risk analysis in aquaculture: WOAHA framework and observations on the WOAHA risk analysis framework; CODEX framework; AMR risk factors in the oral delivery of medicines through aqua feed; risk profiling of bacterial pathogen groups (*Vibrio parahaemolyticus* and *Streptococcus* spp.)



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2019

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10th Session of the COFI Sub-Committee on Aquaculture
23—27 August 2019
Trondheim, Norway

Congressional briefing in the U.S. Senate: Aquaculture Biosecurity – The Invisible Threat of Antimicrobial Resistance

23 July 2019

FAO North America & Mississippi State University

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Stakeholder meeting with aquaculture
From Nellore, Andhra Pradesh, India
June 2019
India





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Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

- Benefits of SPF stocks in shrimp aquaculture
- Microbial management protocols to reduce AMR and as part of Good Aquaculture Practices
- Vaccines as prevention strategy and alternative to antimicrobials



Virtual dialogue on the road to the 34th COFI

15 July 2020

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2020



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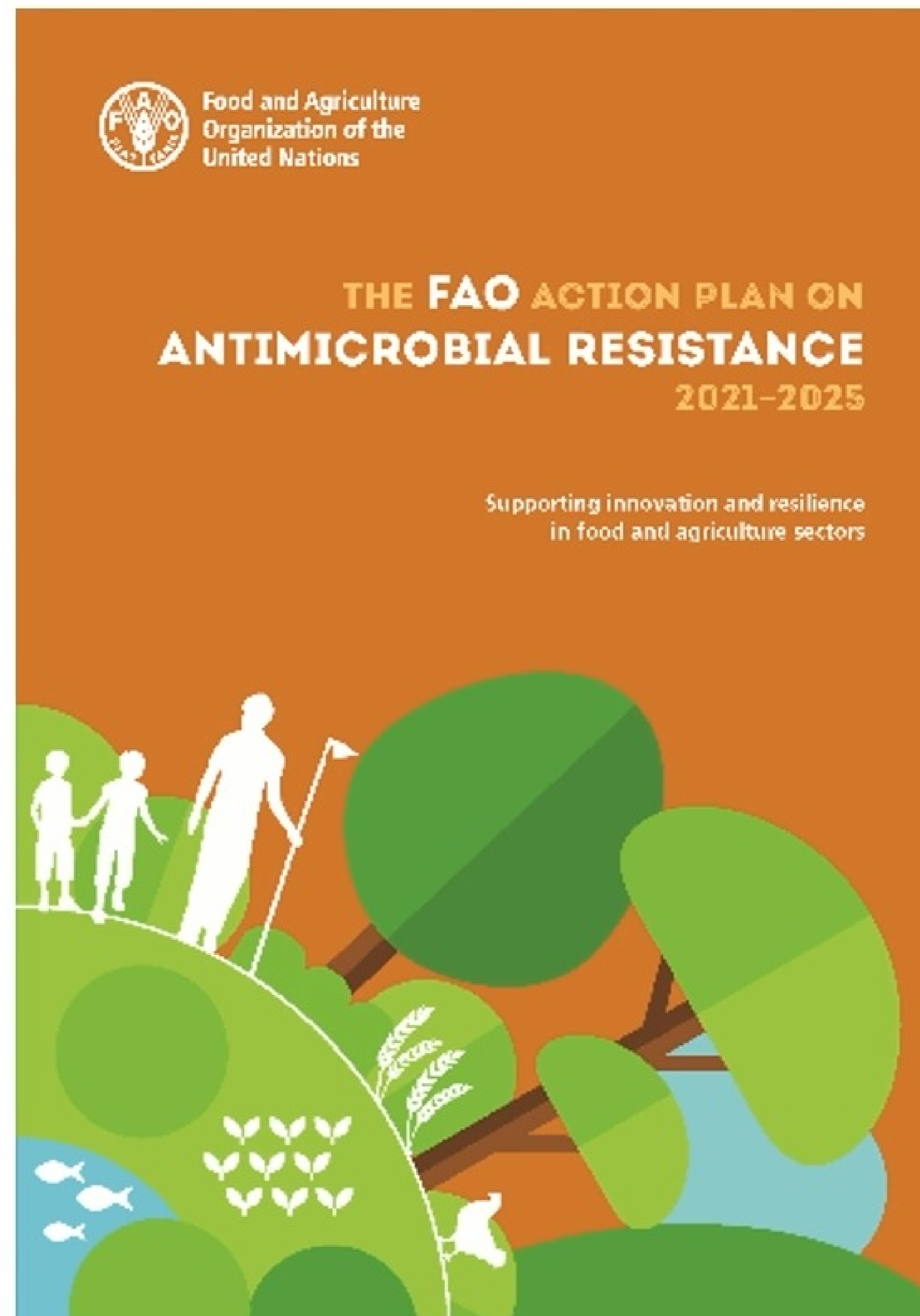


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Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

2021

**34th Session of the
Committee
on Fisheries
(COFI)**
1—5 February 2021



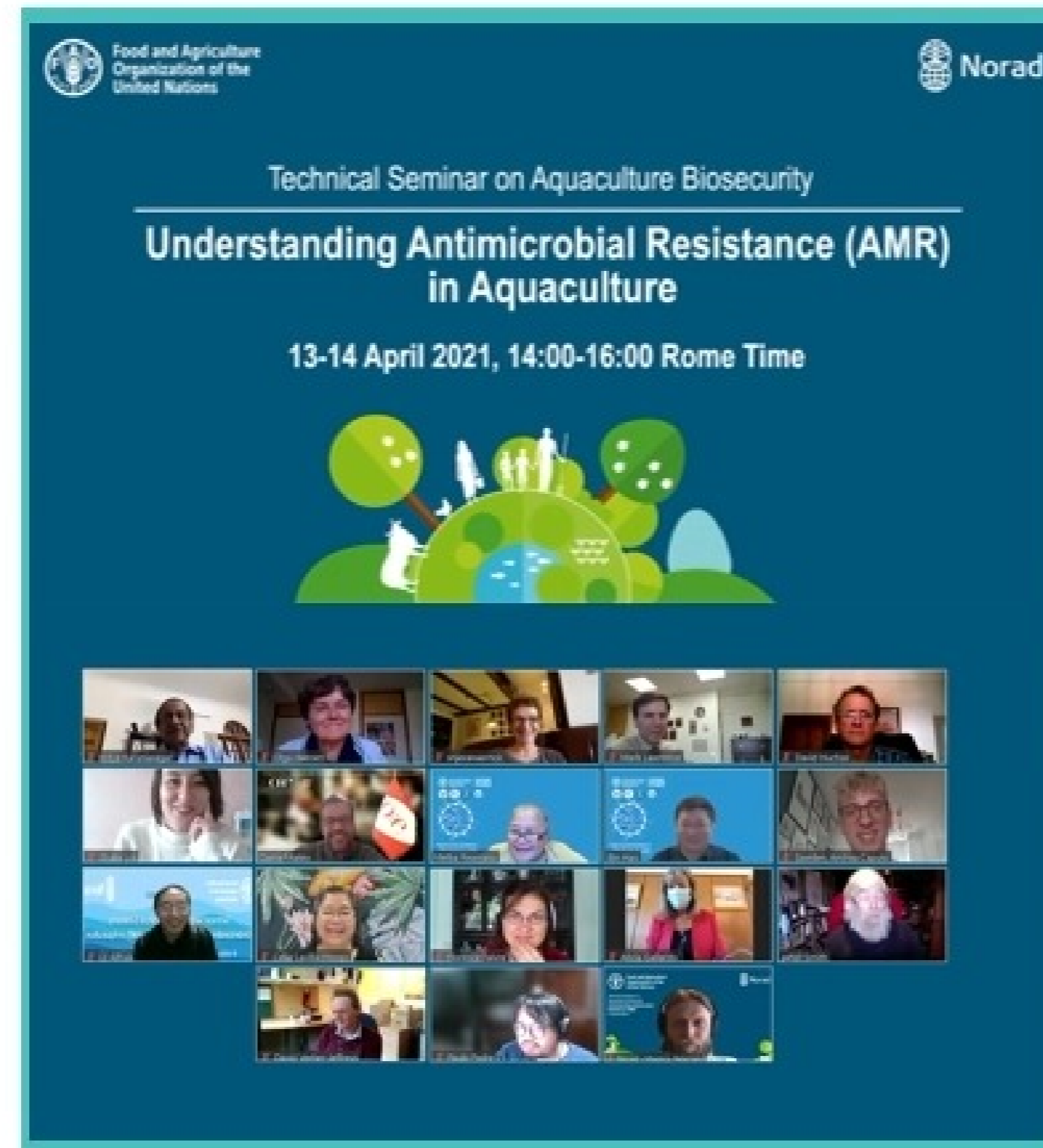
**The FAO Action
Plan on
Antimicrobial
Resistance
2021-2025**

Supporting
innovation and
resilience in food
and agriculture
sectors





Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity



Understanding AMR: Technical Seminar on Aquaculture Biosecurity 13—14 April 2021

Attended by over 700 participants from ninety countries

© FAO/Paulo Padre

Technical Seminar on Aquaculture Biosecurity

Understanding Antimicrobial Resistance (AMR) in Aquaculture

13-14 April 2021, 14:00-16:00 Rome Time





Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity



TCP/RAS/3702: Support Mitigation of Antimicrobial Resistance (AMR) Risk Associated with Aquaculture in Asia Virtual Workshop

23—24 November 2021

India, Indonesia and Viet Nam

Attended by 60 participants from governance agencies, the academe, technical experts and external partners

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2022

35th Session of the Committee on Fisheries (COFI)

5—9 September 2022

Rome, Italy

Food and Agriculture
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SUSTAINABLE
DEVELOPMENT
GOALS

Preventing Antimicrobial Resistance Together Go blue for AMR

Virtual webinar of the FAO Reference Centers on
AMR and Aquaculture Biosecurity
30 November 2022, CET

In support of the celebration of the World Antibiotic Awareness Week (WAAW) 2022

Virtual Launch of the FAO Reference Centres for AMR and Aquaculture Biosecurity

30 November 2022

Attended by over 400 participants from sixty-eight countries

© FAO/Paulo Padre



2023

Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

Reviews in Aquaculture: Review papers

- **Antimicrobial resistance in fish pathogens and alternative risk mitigation strategies.**
Deekshit VK, Maiti B, Krishna Kumar B, Kotian A, Pinto G, Bondad-Reantaso MG, Karunasagar I, Karunasagar I., Kumar AK,
<https://onlinelibrary.wiley.com/doi/abs/10.1111/raq.12715>
- **Bacterial diseases of tilapia, their zoonotic potential and risk of antimicrobial resistance**
Haenen OLM, Dong HT, Hoai TD, Crumlish M, Iddya Karunasagar I, Barkham T, Chen SL, Zadoks R, Kiermeier A, Wang B, Gamarro E, Takeuchi M, Noor Amal Azmai M, Fouz B, Pakingking Jr. R, Wei Wei Z, Bondad-Reantaso MG. 2023.
<https://onlinelibrary.wiley.com/doi/full/10.1111/raq.12743>
- **Biosecurity: Reducing the burden of disease**
Rohana Subasinghe, Victoria Alday-Sanz, Melba G. Bondad-Reantaso, Huang Jie, Andrew P. Shinn, Patrick Sorgeloos
<https://onlinelibrary.wiley.com/doi/full/10.1111/jwas.12966>
- **Strategies to enhance tilapia immunity to improve their health in aquaculture**
Bei Wang, Kim D. Thompson, Eakapol Wangkahart, Jidapa Yamkasem, Melba G. Bondad-Reantaso, Puntanat Tattiyapong, Jichan Jian, Win Surachetpong
<https://onlinelibrary.wiley.com/doi/full/10.1111/raq.12731>



Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

Launch of the FAO Reference Centers for AMR and Aquaculture Biosecurity

26 June 2023
Rome, Italy



MARIA HELENA SEMEDO
DEPUTY DIRECTOR-GENERAL
FAO



AUDUN LEM
DEPUTY DIRECTOR
FISHERIES AND AQUACULTURE DIVISION
FAO



MANUEL BARANGE
DIRECTOR
FISHERIES AND AQUACULTURE DIVISION
FAO



The FAO Reference Centres (RCs) for Antimicrobial Resistance (AMR) and Aquaculture Biosecurity

MISSISSIPPI STATE UNIVERSITY

United States of America

- Webinars
- Capacity Building

CENTRE FOR ENVIRONMENT, FISHERIES, AND AQUACULTURE SCIENCE (CEFAS)

United Kingdom

- E-learning on Introduction to AMR in aquaculture

NITTE UNIVERSITY

India

- AMR Risk Profile for *Vibrio parahaemolyticus*
- AMU survey and AMR surveillance

YELLOW SEA FISHERIES RESEARCH INSTITUTE

China

- Webinars
- Capacity Building

PEARL RIVER FISHERIES RESEARCH INSTITUTE

China

- Webinars
- Capacity Building

• Ongoing projects

Twenty-six institutions applied in April, 2017. Of the 26 institutions, 13 passed evaluations by a selection panel in 2018 and from there, the FAO Reference Centres for AMR and Aquaculture Biosecurity were chosen.



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Highlights of FAO's efforts in combatting AMR and improving aquaculture biosecurity

Food and Agriculture Organization of the United Nations

**Technical seminar:
Challenges in aquatic
AMR mitigation and
possible solutions**

Tuesday, 27 June

14:00 – 17:00

The Philippines Room (C-277)
FAO Headquarters
Rome, Italy

Technical seminar: Challenges in aquatic AMR mitigation and possible solutions

27 June 2023

Rome, Italy





Other FAO presentations

**UNOC Side event
on Managing
Antibiotics in
Aquaculture**

30 June 2022
Lisbon, Portugal

2022

2023

**ASEAN Regional Training on
Mitigation of Antimicrobial
Resistance (AMR) Risks in
Aquaculture**

7 March 2023

**Inception Meeting for Sustainable
Development of Coastal Communities
(SDCC 23): Biosecurity Session**

12 June 2023
Bari, Italy

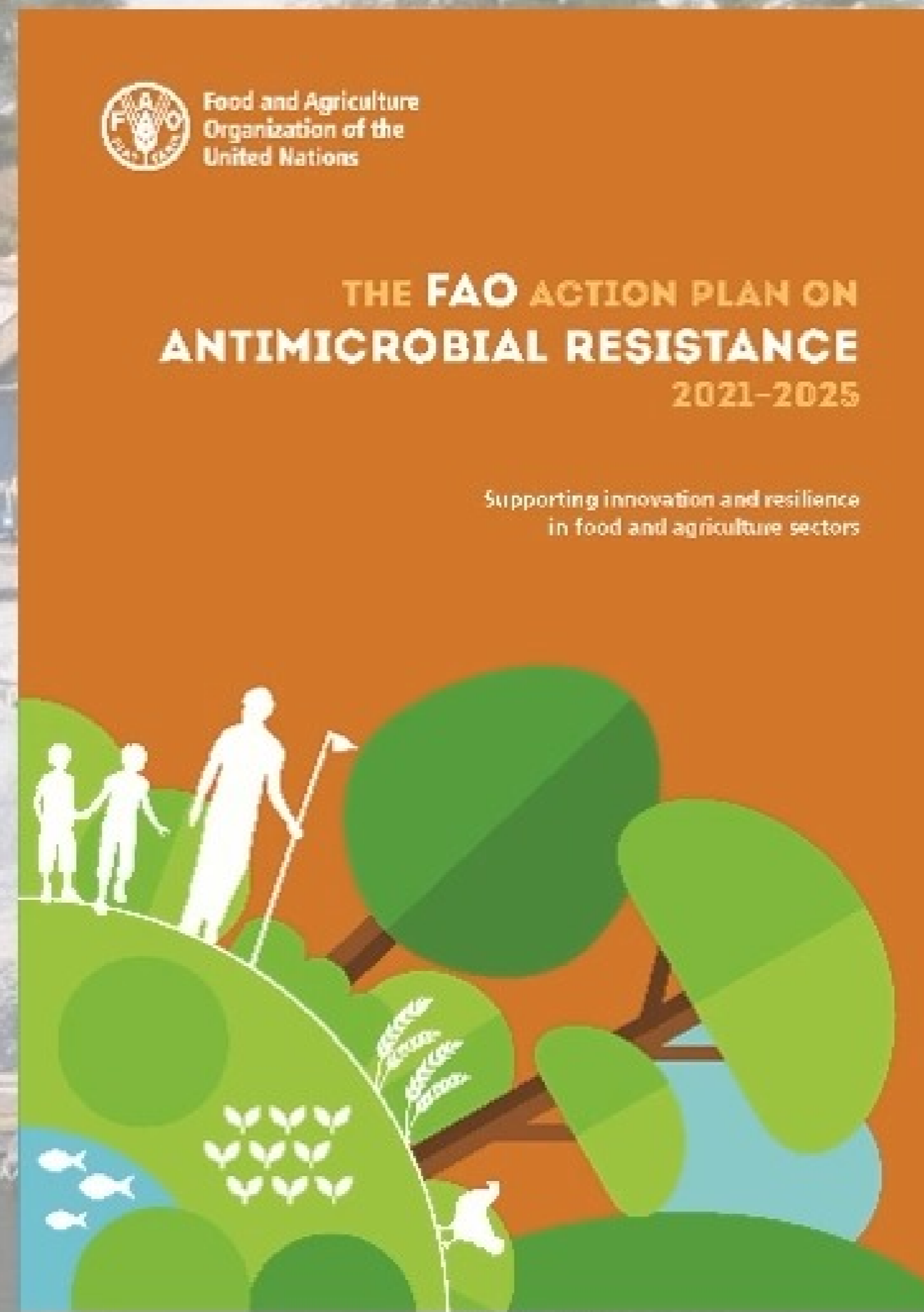
**RECOFI Workshop on Enhancing Knowledge
of Aquatic Health Management and
Biosecurity and Understanding of
Antimicrobial Resistance in Aquaculture**

10-13 July 2023
Jeddah, Kingdom of Saudi Arabia

**WOAH Antimicrobial Resistance (AMR)
in Aquaculture: FAO's Efforts on AMR
in Aquaculture**

5 October 2023
Kigali, Rwanda

FAO's work on AMR is anchored in





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**FAO's work
on AMR is
anchored in**



Tools for AMR

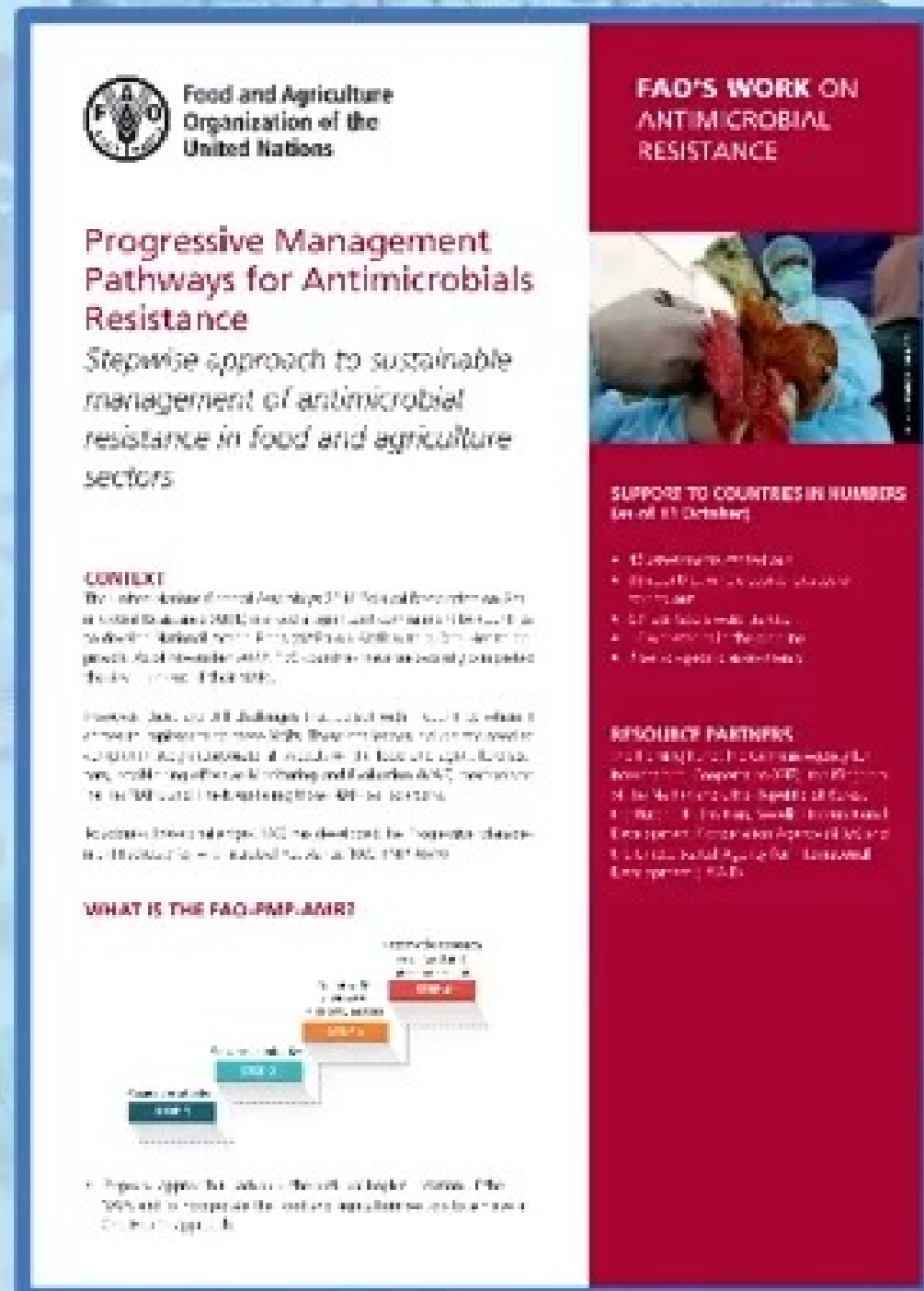
PMP-AMR

ATLASS

InFARM

RENOFARM

Regional Guidelines for Monitoring and surveillance of antimicrobial resistance in bacterial pathogens from aquaculture



Food and Agriculture Organization of the United Nations

Progressive Management Pathways for Antimicrobials Resistance
Stepwise approach to sustainable management of antimicrobial resistance in food and agriculture sectors

FAO'S WORK ON ANTIMICROBIAL RESISTANCE

SUPPORT TO COUNTRIES IN NUMBERS (as of 31 October)

CONTEXT
The antimicrobial resistance (AMR) crisis is a global health and development challenge. AMR is a leading cause of death and disability worldwide, and its impact is expected to increase significantly in the coming years.

RESOURCE PARTNERS
The AMR crisis is a global health and development challenge. AMR is a leading cause of death and disability worldwide, and its impact is expected to increase significantly in the coming years.

WHAT IS THE FAO PMP-AMR?

The PMP-AMR is a stepwise approach to sustainable management of antimicrobial resistance in food and agriculture sectors.



FAO regional expert "Relative burden of antimicrobial resistance (AMR) in food and agriculture" (2022-2023)

FAO Assessment Tool for Laboratories and Antimicrobial Resistance Surveillance Systems (FAO ATLASS) – Assessors training

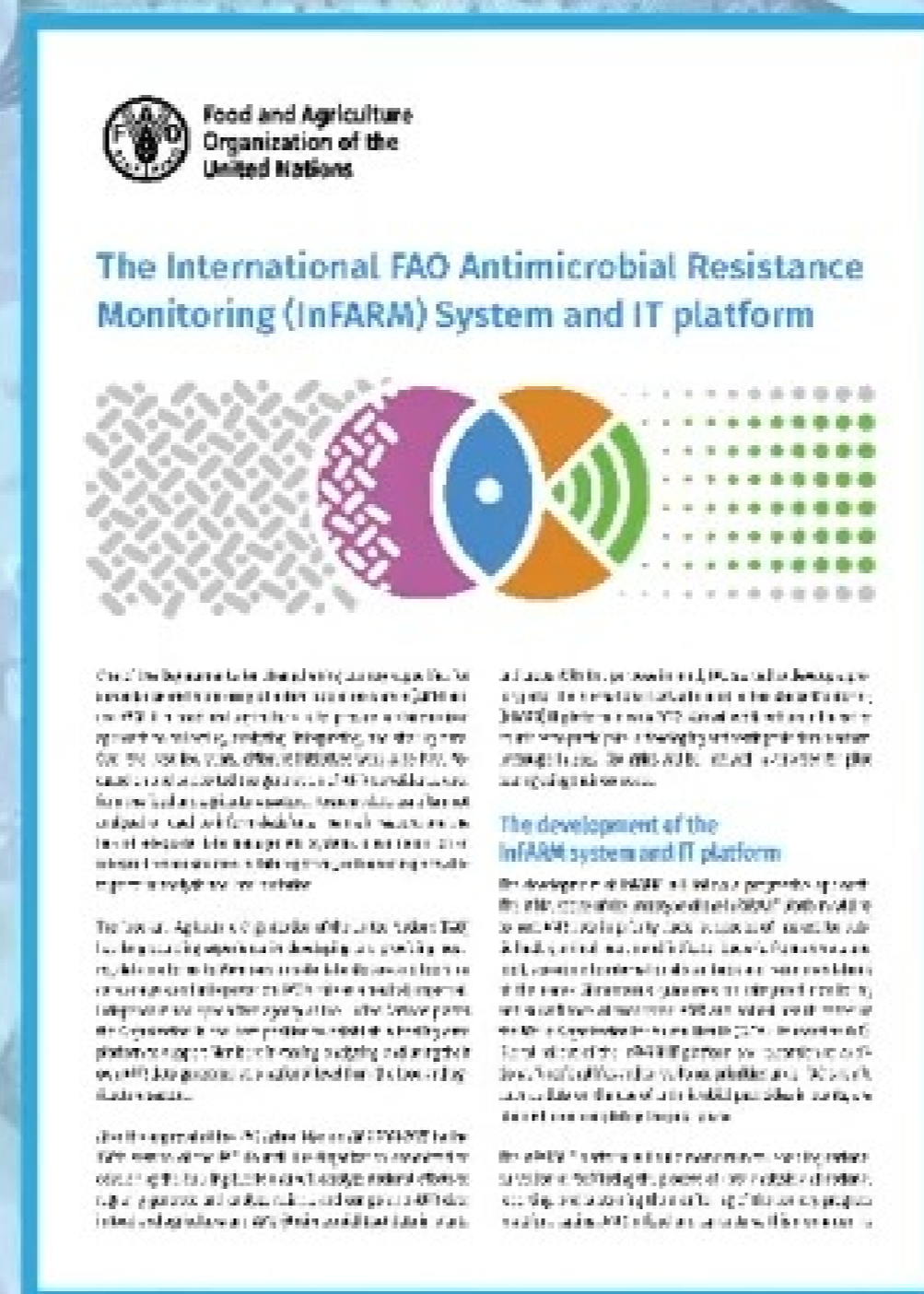
Venue:
"Federal Centre of Science and Technology" of the Federal Service on Customers' Rights Protection and Human Well-being Surveillance
Moscow (Russia), 27-30 August 2023

CONCEPT NOTE

Background and justification
Antimicrobial resistance (AMR) is broadly defined as the ability of bacteria, fungi, viruses, and parasites to become resistant to antimicrobials. However, the main AMR concerns are more specifically related to antibiotic resistance which is the ability of bacteria to develop mechanisms to resist to antibiotics. It has been estimated that if no prompt action is taken toward to reduce the development and the spread of AMR, 10 million lives per year globally with an associated enormous cumulative economic cost will be at risk due to AMR by 2050 (WHO et al., 2016).

As for all infectious diseases, surveillance is considered one of the cornerstones for AMR management, and can provide information for action to support national and international strategies for AMR. The Food and Agriculture Organization of the United Nations (FAO), following the adoption of FAO resolutions in 2005 and the publication of the FAO Action Plan in 2016, has developed the "FAO Assessment Tool for Laboratories and Antimicrobial Resistance Surveillance Systems" (FAO-ATLASS) in order to support countries in assessing and improving their national AMR surveillance systems in the food and agriculture sectors. FAO-ATLASS aims to collect descriptive data and assess the performance of national AMR surveillance-related activities by 8 measuring laboratory analytical capabilities and networks, and 10 assessing activities on data collection and analysis, governance, communication, and sustainability. Based on FAO-ATLASS assessment, a Progressive Management Pathway design is assigned for each laboratory, each pillar (laboratory network, epidemiology unit, governance, communication, and sustainability), and the national AMR surveillance systems as a whole. These results help assessors to provide recommendations to prioritize actions for improvement.

To date, FAO-ATLASS has been used to assess a total of 14 national AMR surveillance systems in Africa (Ethiopia, Kenya, Senegal, Tanzania, Zambia, and Zimbabwe) and Asia (Cambodia, Indonesia, Lao PDR, Myanmar, Philippines, Singapore, Thailand, and Vietnam). During the next years, it is foreseen an increase in the use of FAO-ATLASS.



Food and Agriculture Organization of the United Nations

The International FAO Antimicrobial Resistance Monitoring (InFARM) System and IT platform

CONTEXT
The development of the InFARM system and IT platform is a key milestone in the implementation of the FAO Action Plan on AMR. The system is designed to monitor and track antimicrobial resistance in food and agriculture sectors across different regions and countries.

The development of the InFARM system and IT platform
The development of the InFARM system and IT platform is a key milestone in the implementation of the FAO Action Plan on AMR. The system is designed to monitor and track antimicrobial resistance in food and agriculture sectors across different regions and countries.



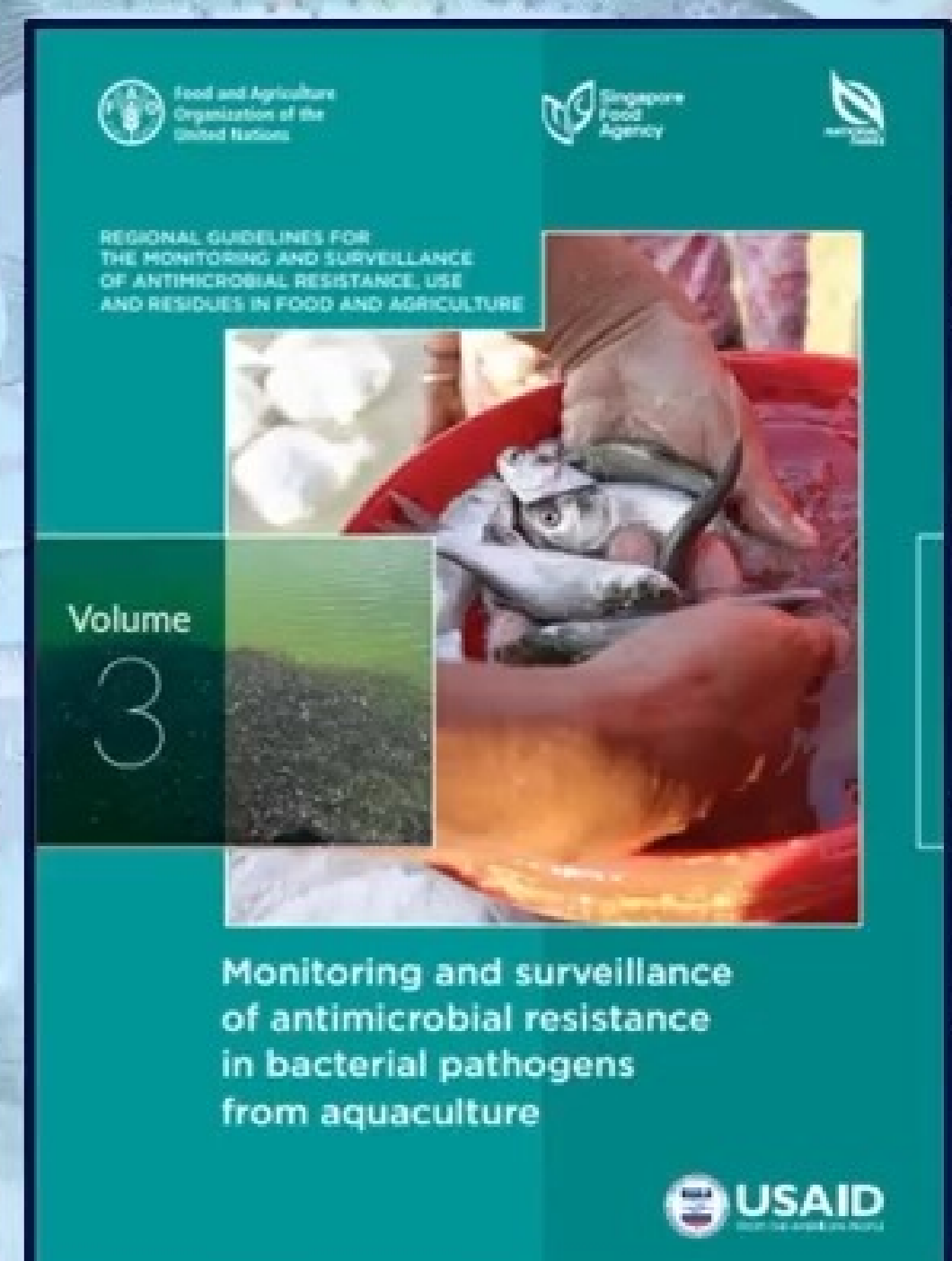
Food and Agriculture Organization of the United Nations

FAO tools to promote sustainable livestock transformation by reducing the need for antimicrobials on farms

CONTEXT
Antimicrobial resistance (AMR) is a global health and development challenge. AMR is a leading cause of death and disability worldwide, and its impact is expected to increase significantly in the coming years.

IN NUMBERS
The AMR crisis is a global health and development challenge. AMR is a leading cause of death and disability worldwide, and its impact is expected to increase significantly in the coming years.

CONCLUSION
The AMR crisis is a global health and development challenge. AMR is a leading cause of death and disability worldwide, and its impact is expected to increase significantly in the coming years.



Food and Agriculture Organization of the United Nations

Singapore Food Agency

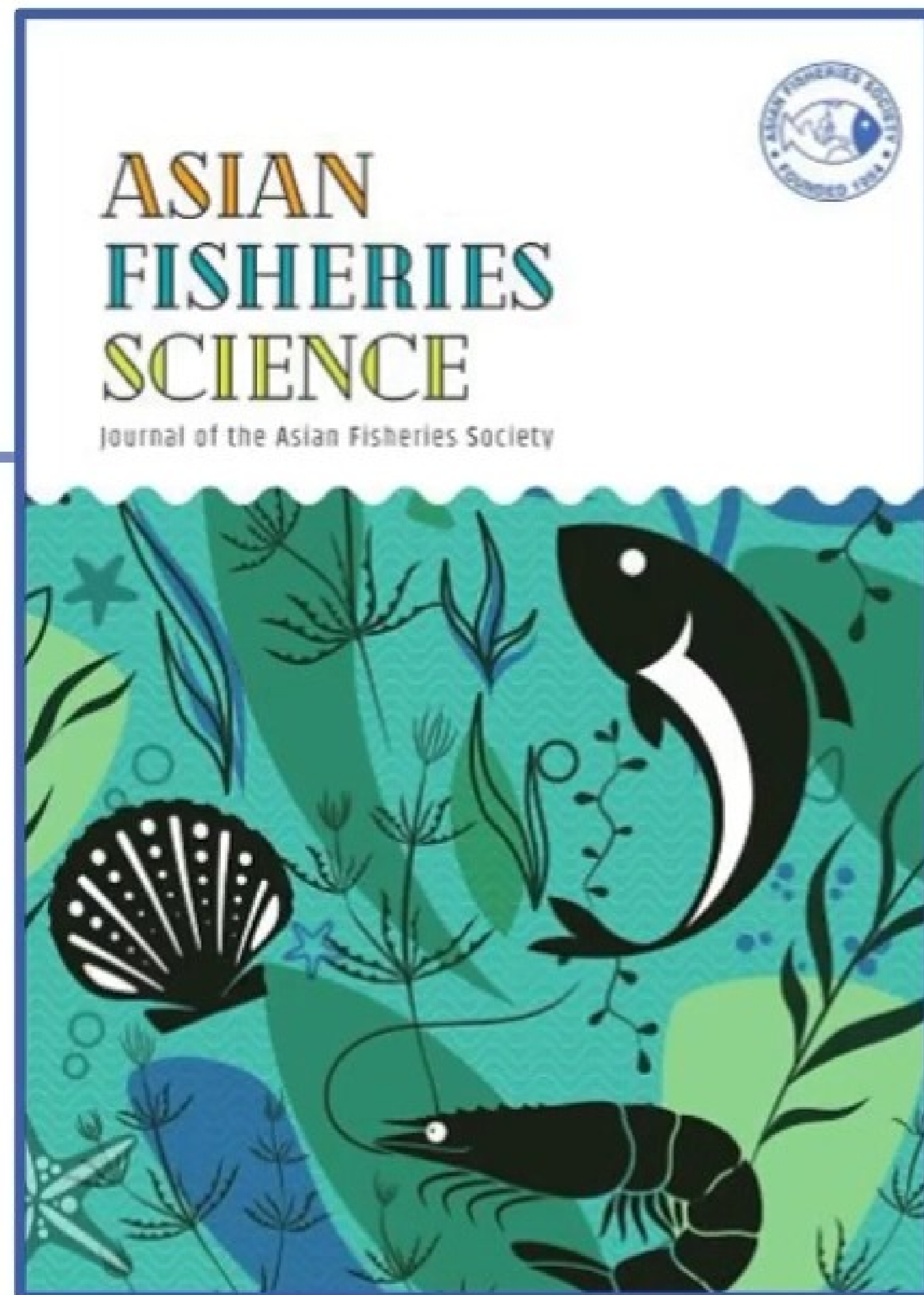
REGIONAL GUIDELINES FOR THE MONITORING AND SURVEILLANCE OF ANTIMICROBIAL RESISTANCE, USE AND RESIDUES IN FOOD AND AGRICULTURE

Volume 3

Monitoring and surveillance of antimicrobial resistance in bacterial pathogens from aquaculture

USAID

Examples of National Action Plans (NAPs)



Guidance in Development of Aquaculture Component of a National Action Plan on Antimicrobial Resistance, Melba Bondad-Reantaso, Celia Lavilla-Pitogo, Ma. Michelle Lopez, Bin Hao, 2020

- **Antimicrobial Use and Antimicrobial Resistance in Aquaculture in the People's Republic of China**, Deng Yuting, Tan Aiping, Zhao Fei, Jiang Lan*, 2020
- **European Union's Action Plan on Antimicrobial Resistance and Implications for Trading Partners with Example of National Action Plan for Croatia**, Snjezana Zrncic, 2020

Examples of National Action Plans (NAPs)

- **Aquaculture Component of National Action Plan on Antimicrobial Resistance in Malaysia**, Wan Norhana Md Noordin*, Gerald Misol Jr., Rozana Johari, 2020
- **Status of Aquaculture Component of the Philippine National Action Plan on Antimicrobial Resistance**, Simeona E. Regidor*, Sonia S. Somga, Jose O. Paclibare, 2020
- **Singapore's National Action Plan on Antimicrobial Resistance**, Kelvin Lim*, Diana Chee, Shawn Ting, Edmund Choo, Wei Ling Tan, Yueh Nuo Lin, 2020
- **Status of Viet Nam's National Action Plan on Antimicrobial Resistance in Aquaculture**, Lua T. Dang*, Lan-huong T. Nguyen, Chuong D. Vo, Viet-hang T. Bui, Long V. Nguyen, Van T. Phan, 2020

Understanding AMR in Aquaculture

16–18 May 2024 | Qingdao, China









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Progressive
Management
Pathway for
Aquaculture
Biosecurity

Fish-Vet+ Dialogue II: One Health and Biosecurity

18–19 June 2024 | FAO Headquarters, Rome
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Fish-Vet+ Dialogue II: One Health and Biosecurity 18-19 June 2024

Foodborne AMR – Optimising use of genomic data

Dr. Iddya Karunasagar

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In collaboration
with



Fish-Vet+ Dialogue II: One Health and Biosecurity 18-19 June 2024

Aquatic zoonoses

Olga L.M. Haenen

Olga Haenen Consultancy, LELYSTAD, The Netherlands



In collaboration
with



What to expect before the end of 2024

In collaboration with the FAO Reference Centres for AMR and Aquaculture Biosecurity:

- An academic paper that will cover Antimicrobial usage (AMU), AMR in Aquaculture, Biosecurity and One Health, tentative title: "**Can we link antimicrobial resistance genes (ARGs) in fish with AMU in the aquatic environment?**" This paper would cover ARGs in pristine and aquaculture environments to see any link between AMU and ARGs in the aquatic environment.
- Organize a 5-day capacity building Workshop for Asian and African countries on the topic **Utilizing microbiome and genomic resources for understanding and mitigating AMR in the One Health context** to be led by Nitte University in November 2024
- Launch of the book *Responsible Management of Bacterial Diseases in Aquaculture* in November

FAO Strategic Framework: Four Betters Fisheries and Aquaculture BLUE TRANSFORMATION Thematic Areas

- Sustainable fisheries
- Sustainable aquaculture
- Sustainable trade and value chain

Better Production
Ensure sustainable consumption and production patterns, through efficient and inclusive food supply chains, ensuring resilient and sustainable food systems.

Better Life
Promote inclusive economic growth by reducing inequalities.

Better Nutrition
End hunger, achieve food security and improve nutrition, including promoting nutritious food and increasing access to healthy diets.

Better Environment
Protect, restore and promote sustainable use of aquatic ecosystems and combat climate change.

Sustainable Trade and Value Chains

Sustainable Aquaculture

Sustainable Fisheries

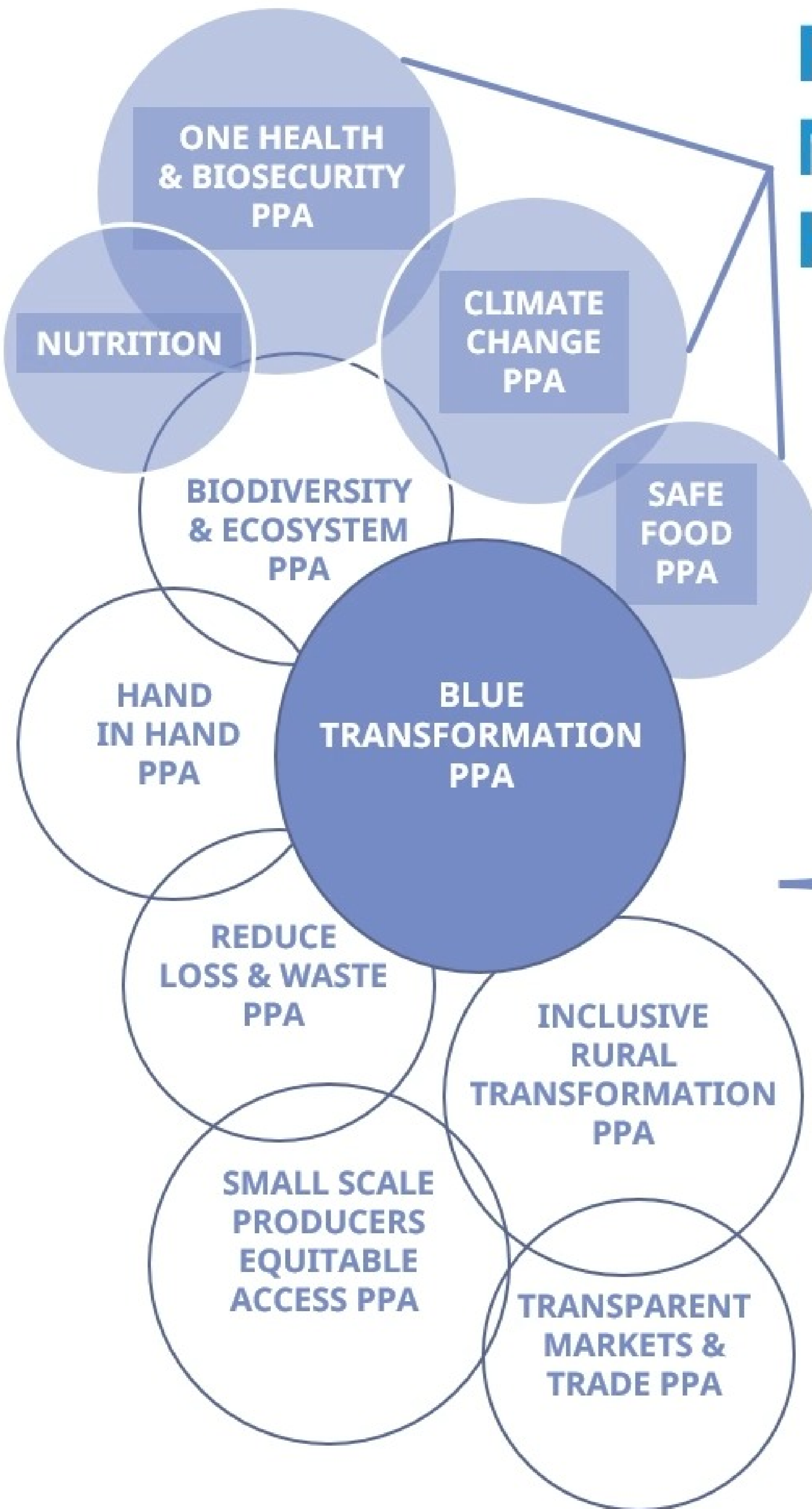
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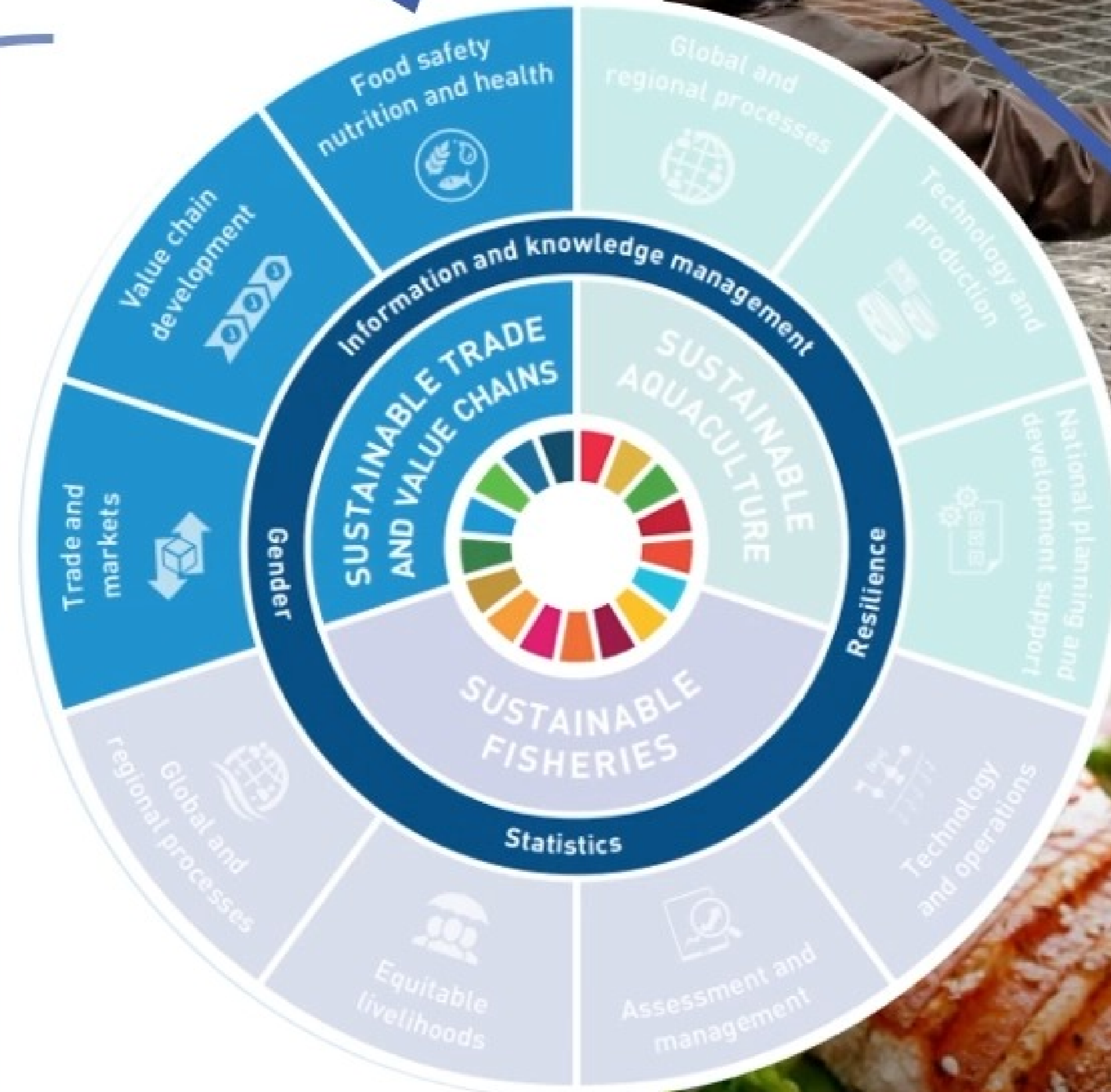
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Priority Programme Areas



- Embedded in FAO SF
- SF linked to budget allocations
- SF reporting and monitoring
- SF PPAs Specific goals and outcomes

Better Production
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**Thank you for your kind
attention.**



Melba Reantaso

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*Progressive Management Pathway
for Aquaculture Biosecurity*