Food and Agriculture Organization of the United Nations

FMM/RAS/298: Strengthening capacities, policies and national action plans on prudent and responsible use of antimicrobials in fisheries Final Workshop in cooperation with AVA Singapore and INFOFISH

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AMR, Aquaculture and One Health

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What is Antimicrobial Resistance (AMR)?

- **AMR** refers to a condition whereby microorganisms (e.g. bacteria, fungi, viruses and parasites affecting humans, terrestrial & aquatic animals and plants) become resistant to antimicrobial agents, thus making infections or diseases caused by such microorganisms more difficult or impossible to treat.
- An **ANTIMICROBIAL** is any substance of natural, semisynthetic or synthetic origin that kills or inhibits the growth of microorganisms but causes little or no damage to the host.
- All antibiotics are **antimicrobials**, but not all **antimicrobials** are antibiotics.
- Antimicrobials play a critical role for ensuring health and productivity.
- However, their misuse and the associated emergence and spread of antimicrobial resistant microorganisms place everyone at great risk.

How is resistance developed?

- Antimicrobial resistance happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when they are exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintics).
- Microorganisms that develop antimicrobial resistance are sometimes referred to as “superbugs”.

What accelerates the emergence and spread of antimicrobial resistance?

- Antimicrobial resistance occurs naturally over time, usually through genetic changes.
- However, the misuse and overuse of antimicrobials is accelerating this process.

What accelerates the emergence and spread of antimicrobial resistance?

- In many places, antibiotics are overused and misused in people and animals, and often given without professional oversight.
- Examples of misuse include when they are taken by people with viral infections like colds and flu, and when they are given as growth promoters in animals (and fish).

What accelerates the emergence and spread of antimicrobial resistance?

- Antimicrobial resistant-microbes are found in people, animals, food, and the environment (in water, soil and air).
- They can spread between people and animals, and from person to person.
- Poor infection control, inadequate sanitary conditions and inappropriate food-handling encourage the spread of antimicrobial resistance.

Benefits of the use of antimicrobials in aquaculture

(i) improved on-farm biosecurity and husbandry (e.g. use of vaccines and disinfectants)

Vaccines, for instance, are recognised as important tools for the prevention of diseases in fish and a measure for reducing the unregulated use of antimicrobials in aquaculture

(ii) treatment of chronic diseases that cause reduced growth, low food conversion rate and poor survival thus leading to reduced production, and

(iii) treatment of epizootic diseases that can cause mass mortalities.

Benefits of the use of antimicrobials in aquaculture

- **New species culture development**:
  - there is often a lag phase between the identification and characterization of pathogens and the development of disease control procedures.
  - In such cases, the use of veterinary medicines may be necessary to ensure viability of the new species until alternative control methods can be incorporated into production and health management programmes.
- **Failure of preventive therapy**:
  - The use of preventive measures such as good husbandry and vaccination does not always ensure the success of an aquaculture enterprise.
  - Cultured aquatic animals subjected to stresses above what they are capable of enduring may develop depressed immune systems and compromised nonspecific barriers (e.g. skin), enhancing susceptibility to infections by pathogens that can only be resolved by the use of antimicrobials.

Benefits of the use of antimicrobials in aquaculture

- **Emerging and re-emerging infectious disease**:
  - The number and occurrence of transboundary aquatic animal diseases have increased and the use of veterinary medicines to treat such infections supports other biosecurity measures to restrict the geographical spread of infections.
- **Developing culture technologies**:
  - Use of recirculation technologies, elevated growing temperatures, higher densities, chronic antimicrobial usage to control diseases and higher concentration of farms in limited geographical areas - may all change the manner in which pathogens and cultured species interact.
  - In such instances, diseases may manifest themselves in novel ways, requiring rapid diagnosis and treatment with antimicrobials.

AMR in bacteria associated with aquaculture

- Antimicrobial resistance in pathogens of aquatic animals has been reported from different systems
- In shrimp hatcheries, mass mortalities due to antibiotic resistant luminous bacteria (*Vibrio spp.*) can be a problem (Karunasagar *et al.*, 1994).
- Acquired resistance in *Aeromonas salmonicida* causing furunculosis in temperate waters has been reported from a number of countries (FAO/OIE/WHO, 2006).
- Several mobile genetic elements like plasmids, transposons, integrons carrying AMR genes have been detected in *Aeromonas* spp. from aquaculture sites in different parts of the world (Piotrowska and Popowska, 2015).
- Over 80 percent of *Vibrio harveyi* from finfish aquaculture systems in Italy showed resistance to amoxicillin, ampicillin and erythromycin, while 76 percent of strains showed resistance to sulphadiazine (Scarano *et al.*, 2014).

Thus, AMR in bacterial pathogens of aquatic animals could impact disease management in these systems and the resistance determinants could be transferred to human pathogens from aquatic systems.

AMR in bacteria associated with aquaculture

- Though AMR is observed in aquatic bacteria associated with aquaculture systems, it is difficult to find a direct link between the resistance profile and AMU.
- Culture-independent studies in the Baltic Sea show presence of resistance genes encoding resistance to sulphonamides, trimethoprim, tetracycline, aminoglycoside, chloramphenicol and also genes encoding multidrug efflux pumps in sediments of fish farms, though some antibiotics like tetracyclines, aminoglycosides and chloramphenicol are not used in this area (Muziasari *et al.*, 2017).
- Some of these might represent a natural reservoir of resistance genes in the aquatic environment. Antibiotic resistant marine bacteria have been found as far as 522 km offshore and in deep sea at depths of 8 200 m (Aminov, 2011).
  - Source attribution of AMR in aquaculture associated bacteria is very complex and caution needs to be exercised in interpretation of data.
  - AMR may be naturally present in the aquatic environment or derived from AMU in other sectors or derived from AMU in aquaculture.

Therefore, mere detection of AMR in aquaculture systems does not imply misuse of antimicrobials in aquaculture.

Need for coordinated action

- Antimicrobial resistance is a complex problem that affects all of society and is driven by many interconnected factors.
- Single, isolated interventions have limited impact.
- Coordinated action is required to minimize the emergence and spread of antimicrobial resistance.
- All countries need national action plans on AMR.
- Greater innovation and investment are required in research and development of new antimicrobial medicines, vaccines, and diagnostic tools.

WHO's response

- WHO is providing technical assistance to help countries develop their national action plans, and strengthen their health and surveillance systems so that they can prevent and manage AMR. It is collaborating with partners to strengthen the evidence base and develop new responses to this global threat.
- WHO is working closely with FAO and OIE in a ‘One Health’ approach to promote best practices to avoid the emergence and spread of antibacterial resistance, including optimal use of antibiotics in both humans and animals.

WHO's response

- A global action plan on AMR was adopted by Member States at the Sixty-eighth World Health Assembly and supported by the governing bodies of OIE and FAO, in May and June 2015, respectively.
- The goal of the global action plan is to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them.

AMR is 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 Delegates (May 2015)
  - Adoption of the 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)
  - Political Declaration
- WHO/FAO/OIE Tripartite Actions

One Health collaboration

UNGA called upon the Tripartite (and other intergovernmental organizations), to support the development and implementation of national action plans and AMR activities at the national, regional and global levels

Food and Agriculture Organization of the United Nations

Global leader for food and agriculture

WORLD ORGANISATION FOR ANIMAL HEALTH

Global leader for animal health and welfare standards

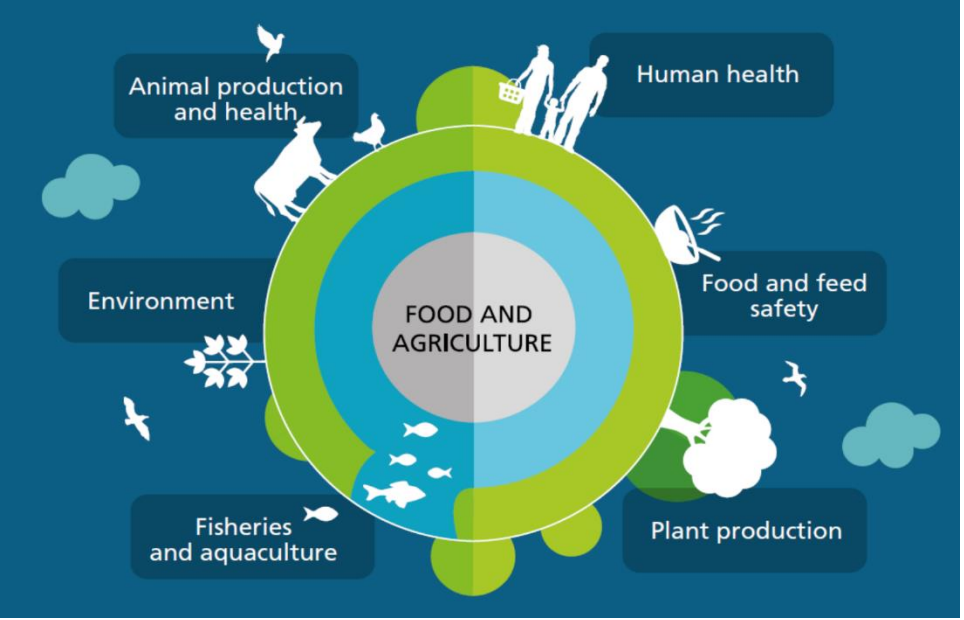
World Health Organization

Global leader for human health

ASEAN and AMR

- ASEAN Leaders' Declaration on AMR on 10-11 May 2017
- The next steps would involve the endorsement of the Declaration to the Seniors Official Meeting on Health Development (SOMHD) which shall be elevated to the ASEAN Health Ministers Meeting (AHMM). The Declaration is planned to be adopted on the 31st ASEAN Summit in November 2017.

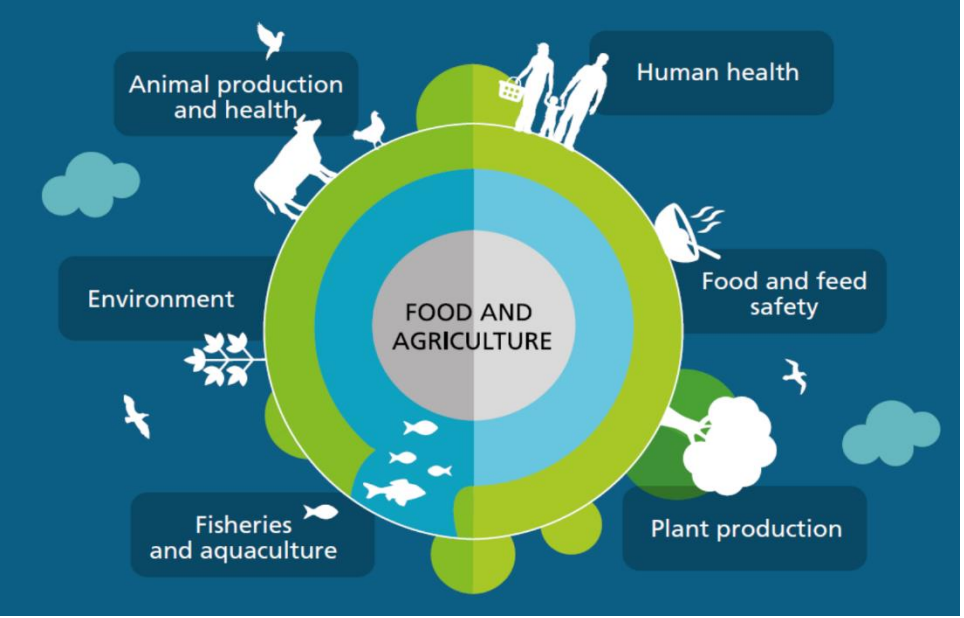
- http://www.asean2017.ph/ams-gathered-finalize-asean-leaders-declaration-amr/



Very complex interface: different productions systems and sectors involved: Aquatic, Terrestrial, Environment.

Lack of regulation and oversight of AMU: easy access leads to overuse, misuse, self-medication, or production and availability of sub-standard medications.

Allowing food animal producers to import large quantities of unapproved drugs enables addition of these medicines to feed or to be used without compliance to good veterinary or food hygiene practices.



Lack of awareness in best practices: lead to:
excessive or inappropriate use of AM drugs promotes the spread of AMR; increased incidence of severe and prolonged illnesses, and more deaths.

Very complex interface: different productions systems and sectors involved: Aquatic, Terrestrial, Environment.

Use of antibiotics as growth promoters in animals – terrestrial (and aquatic) - increases AMR.

One Health at FAO

Inter-departmental Working Group chaired by FAO Chief Veterinary Officer

Multidisciplinary expertise: animal health, livestock and production, food and feed safety, plant health and production, **fisheries and aquaculture**, legislative contexts, etc.) - needed to address a cross-sectoral issue such as AMR.

Each of these aspects were considered in developing the FAO Action Plan (in support of Global Action Plan on AMR) and implementation at national and regional levels

Issues pertaining to the use of antimicrobials

- Threats posed by abuse, overuse, misuse
- Human and animal health issues
- Environmental and ecological issues
- Antimicrobial residues
- Antimicrobial resistance

Issues pertaining to the use of antimicrobials

- **Threats posed by abuse, overuse, misuse**
- Imprudent use of antimicrobials in aquaculture is a contributing factor in the development of antimicrobial resistance (AMR).
- For example, antibiotics should only be used in a confirmed bacterial infection case. It should not be used in diseases caused by viral infection. The use of antimicrobials should be based on correct diagnosis.
- Only antimicrobials that are labelled to treat the condition diagnosed and licensed for use of the species affected should be used.
- Such drugs should also be properly handled (and disposed), stored and expiry dates should be closely monitored; and they should be administered by a recognized and/or licenced aquatic animal health professional.

Human and animal health issues

- For animal health, the main issue is treatment failure due to increase in resistance.
- For human health, the main concern is adverse health effects associated with the presence of residues in the food produced or resistance in bacteria associated with human disease.
- Resistance in bacteria causing human disease may arise either directly via enrichment of these bacteria in the aquaculture environment or indirectly via enrichment of the genes that encode such resistance and which may subsequently be transferred to bacteria associated with human disease.

Environmental and ecological issues

- The release of the medicines into the aquatic environment through leaching from unconsumed feeds, intentional or unintentional release of effluent water from aquaculture facilities and presence of residues in faecal materials are some of the environmental issues.
- The impacts on local ecosystem are, in general, poorly studied. The ecological concerns include accumulation of residues in the sediments, impacts of drugs and chemicals on natural biota, and possible development of antimicrobial resistance in aquatic bacteria.

Antimicrobial residues

- The Joint FAO/OIE/WHO Expert Meeting on Antimicrobial Use and Antimicrobial Resistance in Aquaculture identified that the two hazards to be considered are **antimicrobial residues** and development and **spread of antimicrobial resistant bacteria.**
- While residues found in animal tissues may be directly related to the use of antimicrobials in the respective sector, the issue with AMR is more complicated in the case of aquaculture.
- This is because the aquatic environment receives effluents from hospitals, animal farms and agricultural field.
- Hence, bacteria carrying AMR determinants that are selected in other sectors find their way into the aquatic environment and may eventually reach aquaculture systems.
- Further antimicrobial resistance genes (ARGs) respect neither phylogenetic nor geographical borders; hence ARG selected in one sector may impact another.

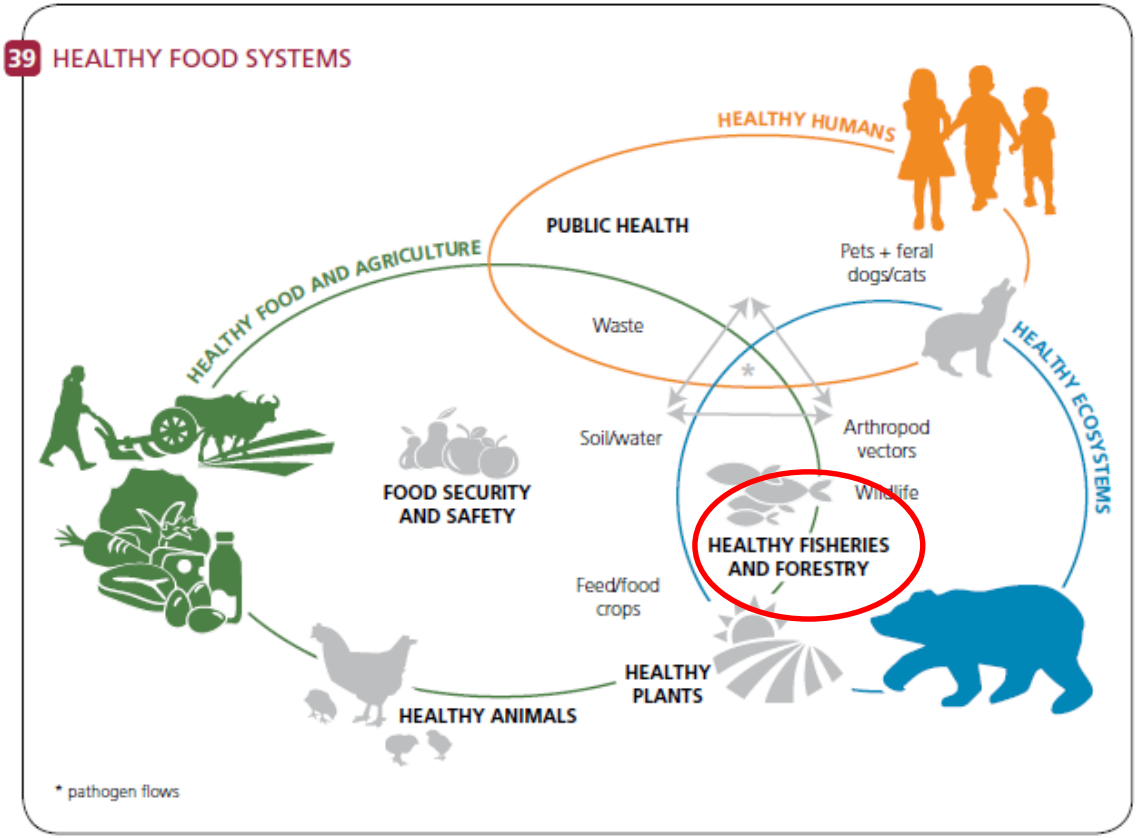
Aquaculture AMR

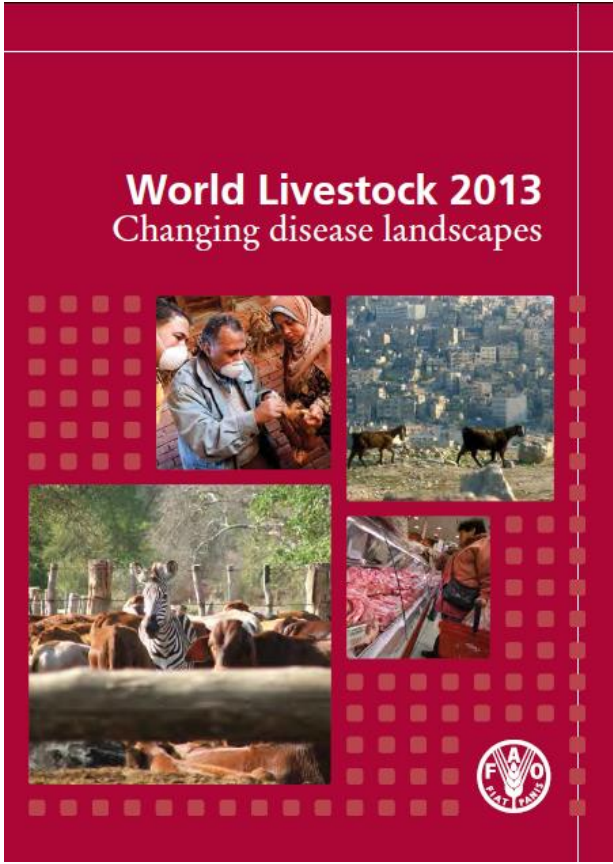
- 2015: 8th Session of the FAO Committee on Fisheries (COFI) Sub-Committee on Aquaculture (Brasilia) agreed on biosecurity as a priority and highlighted AMR
- 2016-2017:
  - Management of Bacterial Diseases in Aquaculture
  - Code of Conduct for Responsibe Fisheries (CCRF) Technical Guidelines in Prudent and Responsible Use of Veterinary Medicines
  - FMM/RAS/298/MUL (ongoing project)
  - Continue resource mobilisation to support AMR work

Aquaculture AMR

- 2018:
  - Highlight AMR @ next session of FAO COFI
  - Working document to be prepared jointly by COFI SCA and COFI SubCommittee on Trade
  - Risk analysis of pathways to antibiotic residues and AMR
  - Funds permitting continue developing and implementing AMR projects

AMR in aquaculture is now a new area of emphasis and high work priority of FAO's Department of Fisheries and Aquaculture





Addressing AMR within the One Health Platform

Healthy people, healthy environment, healthy animals


THANK
YOU