Food and Agriculture Organization of the United Nations

Antimicrobial Resistance (AMR) in Aquaculture

Melba.Reantaso@fao.org

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http://www.fao.org/cofi/aq/90408/en/

Antimicrobial use in Aquaculture

Benefits on the use of antimicrobials	Concerns on the use of antimicrobials
New species culture development: lag phase between the identification and characterization of pathogens and the development of disease control procedures; use of veterinary medicines to ensure viability of the new species until alternative control methods can be incorporated into production and health management programmes.	**Abuse, overuse, misuse:** Antibiotics should only be used in a confirmed bacterial infection case; not for viral infection; thus based on correct diagnosis. Only antimicrobials 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.
Failure of preventive therapy: good husbandry and vaccination not always ensure successful aquaculture. When exposed to stress above what they are capable of enduring aquatic animals 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	**Human and animal health issues:** Animal health issue is treatment failure due to increase in resistance. Human health issue 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.
Emerging and re-emerging infectious disease: 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.	**Environmental and ecological issues:** These include 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. 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.
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.	Joint FAO/OIE/WHO Expert Meeting on Antimicrobial Use and Antimicrobial Resistance in Aquaculture: two main hazards Antimicrobial **residues** Antimicrobial **resistance**

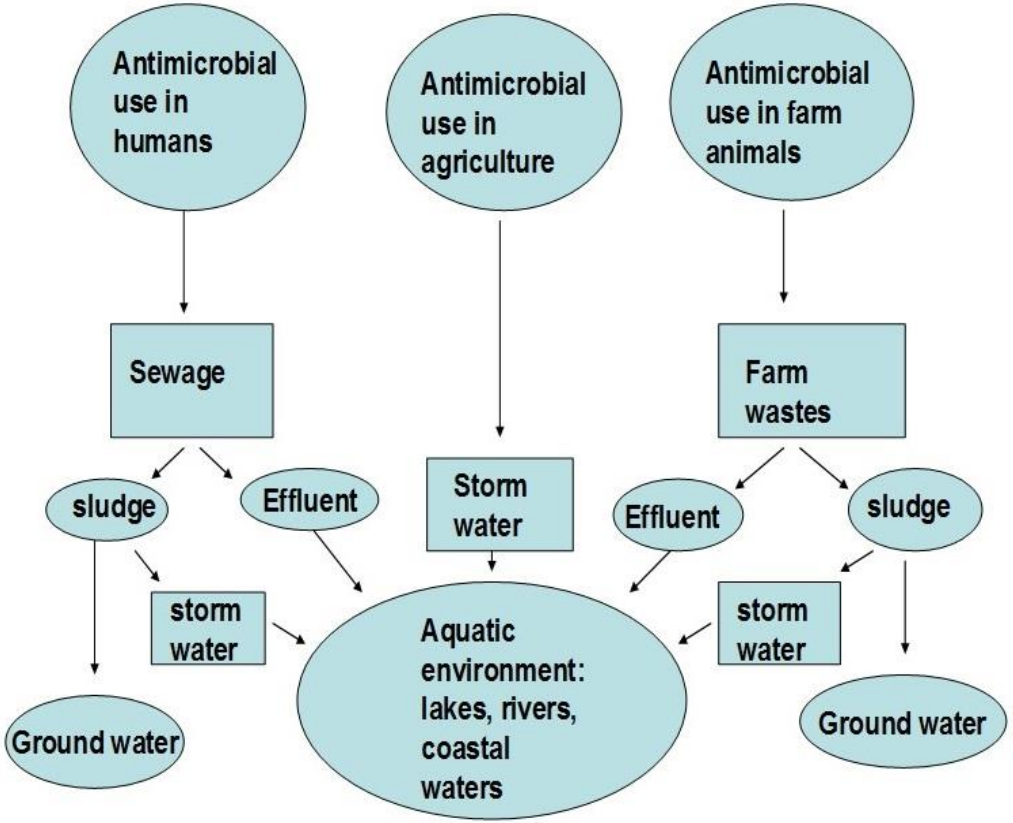
Most Important Bacterial Diseases in Aquaculture (Dec 2016)

In red (28): considered important for tropical regions

Gram-negative bacteria (6)	Gram-positive bacteria (4)
Vibriosis (***V. anguillarum***, *V. harveyi* clade, *V. parahaemolyticus*, *Aliivibrio salmonicida* (***V. salmonicida***), *V. vulnificus* , ***Photobacterium damselae***)	Mycobacteriosis (*Mycobacterium fortuitum*, *M. marinum*, *Nocardia asteroides*, *N. crassostreae (ostreae)*, *N. seriolae*)
Aeromonasis (Motile *Aeromonas* spp.:*Aeromonas caviae*, *A. hydropila*, *A. sobria*, *A. veronii*, *A. jandaei*; ***A. salmonicida***)	Streptococcosis (*Streptococcus agalactiae*, ***S. iniae***, ***Lactococcus garvieae***, *Aerococcus viridans*)
Edwardsiellosis (*Edwardsiella anguillarum*, ***E. ictaluri***, *E. piscicida*, *E. tarda*, ***Yersinia ruckeri***)	Renibacteriosis (***Renibacterium salmoninarum***)
Pseudomonasis (*Pseudomonas anguilliseptica*, *P. fluorescens*)	Infection with Anaerobic Bacteria (*Clostridium botulinum*, *Enterobacterium catenabacterium*)
Flavobacteriosis (*Flavobacterium branchiophilum*, ***F. columnare***, ***F. psychrophilum***, *Tenacibaculum maritinum*)	

Infection with Intracellular Bacteria (***Piscirickettsia salmonis***, *Hepatobacter penaei*, *Francisella noatunensis*, *Chlamydia* spp.)

In bold/underline: vaccines are available



Possible sources of ARGs entering the aquatic environment and eventually the aquaculture environment

Antimicrobial resistance genes (ARGs) may have evolved naturally, indiscriminate use of antibiotics in human and animal sectors has led to selection and spread of resistant bacteria.

But ARGs found in aquatic systems may be derived from multiple sources.

Hospital effluents carry significant pool of ARGs.

There are also evidence using metagenomics approach that the abundance of ARGs in effluents entering a river catchment area is higher than that in the receiving environment.

Understanding and avoiding the threat

Understanding the threat	Avoiding the threat
Which bacterial pathogens for which cultured species?	**If we wish to avoid re-entering the pre-antibiotic age we must learn how to use antibiotics wisely**
How are these bacterial diseases being prevented/managed? Good husbandry, vaccines, antibiotics, other alternatives?	**Although we have very little idea about how much we use in aquaculture we do know that we must use less.**
Source attribution of AMR in aquaculture associated bacteria is very complex and caution needs to be exercised in interpretation of data. Mere detection of AMR in aquaculture systems does not imply misuse of antimicrobials in aquaculture.	**We need antibiotics but we must learn to use antibiotics only when that use is necessary, prudent and rational.**
Is there a direct link between the resistance profile and AMU. AMR may be naturally present in the aquatic environment or derived from AMU in other sectors or derived from AMU in aquaculture.	**When we use antibiotics we must learn the most effective and efficient methods to administer them**

Atypical *Aeromonas salmonicida*

Photobacterium damselae

Streptococcus

Aeromonas

Mycobacterium

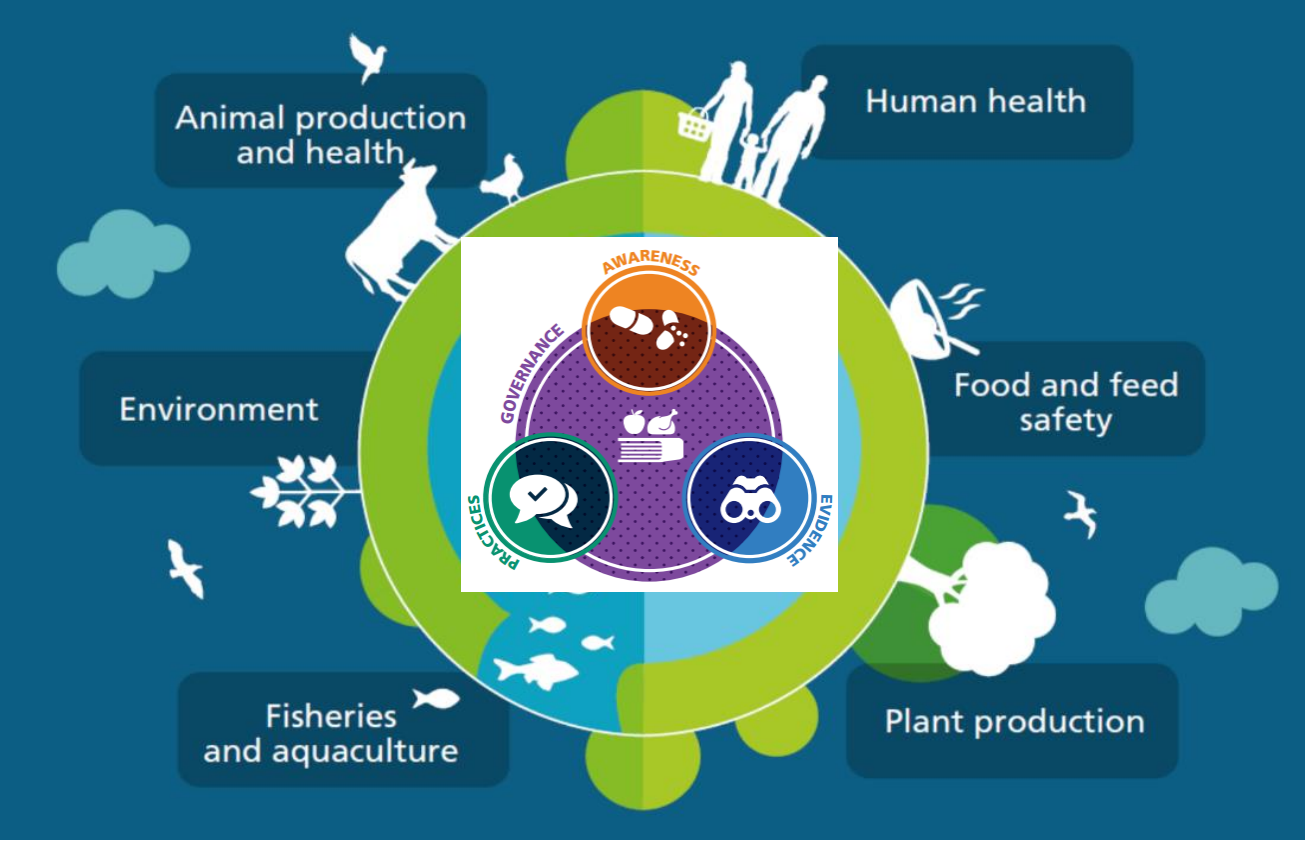
Yersinia ruckeri

Fasciitis necroticans

Vibrio vulnificus

Mycobacterium marinum

Swimmer granuloma



Very complex interface: different productions systems and sectors involved: aquatic, terrestrial, environment

What FAO/FI does

FAO Action Plan on AMR: 2016-2020

- **Awareness**
  - National/regional/international fora
  - Book: Responsible management of bacterial diseases in aquaculture
  - CCRF Technical Guidelines on Prudent and Responsible Use of Drugs
  - World Antibiotic Awareness Week (13-19 November 2017)
- **Evidence**: Surveillance (AMU and AMR)
- **Practices:** Best practice guidance (shrimp, tilapia and carp)
- **Governance**: assistance to the development of the aquaculture component (within food and agriculture) of NAP on AMR


THANK
YOU