# AMFORA: Applying a One Health systems modelling approach to formulate strategies for mitigating the risk to human health of ABR in aquaculture

**Lucy Brunton, Maria Garza, Andrew Desbois, Barbara Haesler, Barbara Wieland, Mohan Chadag & Javier Guitian**

**Contact: lbrunton@rvc.ac.uk**

**Aim** To use a 'systems-thinking' approach to map aquaculture systems and identify potential hotspots for the emergence and selection of resistance and human exposure to antibiotics and antibiotic-resistant organisms

## Background:

Aquaculture systems are highly complex and influenced by environmental, biological, cultural, socio-economic and human behavioural factors. The growing importance of aquaculture is fuelling a transition of small-scale farming to industrial intensification in LMICs.

## Challenge:

This transition is likely to be driving the extensive and often indiscriminate use of antibiotics in these systems to treat or prevent disease and increase productivity, often to compensate for management and husbandry deficiencies. But enforcement of regulations for the responsible use of antibiotics is often inefficient and surveillance or monitoring of antibiotic usage (ABU) and antibiotic resistance (ABR) in these countries is lacking or absent.

## Systems-thinking workshops

Two interdisciplinary workshops were held in 2018, in Vietnam and Egypt. As well as addressing the aim above, both workshops were designed to develop systems thinking and experience in mapping systems, to build collaborations and understanding of different expertise. The range of disciplines among attendees included epidemiology, veterinary sciences, microbiology, environmental science, anthropology, economics, public health, pathology, aquatic science and biotechnology.

The workshop in Vietnam focused on three systems: white-leg shrimp production and striped catfish production in Vietnam, and tilapia production in Bangladesh, while the workshop in Egypt focused on local tilapia production.


Hanoi, Vietnam – January 2018

**AMFORA partners:**

- Royal Veterinary College, UK
- University of Stirling, UK
- London School of Hygiene and Tropical Medicine, UK
- International Livestock Research Institute
- WorldFish
- Chittagong Veterinary and Animal Sciences University, Bangladesh
- Research Institute for Aquaculture No.1, Vietnam
- Kafrelsheikh University, Egypt

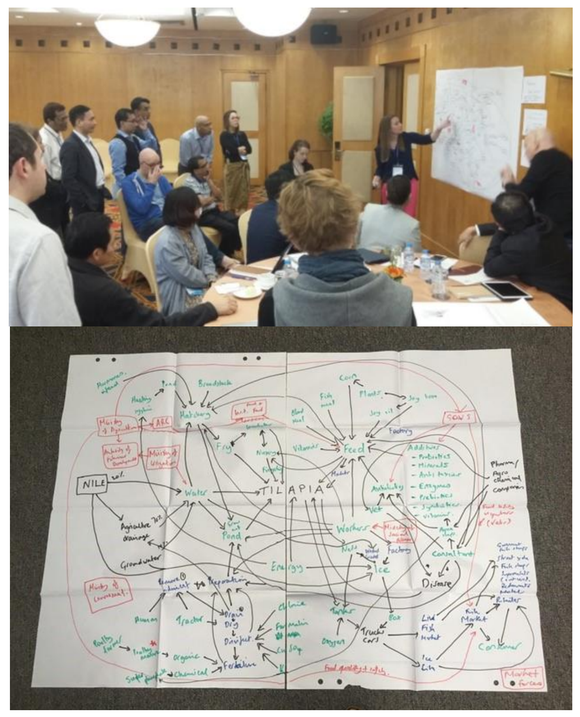
Kafrelsheikh, Egypt – May 2018

## Mapping aquaculture systems

In each system, the grow-out ponds were identified as the most likely **hotspot for emergence of resistance** due to direct and indirect ABU, the possibility of contamination of water with sewage and longer productive periods (in the three species assessed).

A number of **hotspots for potential human exposure** to resistance genes and/or residues and for antibiotic use were identified. The main pathways for exposure included: occupational (at the farm and different handling points along the value chain), through consumption (bacterial cross-contamination and residues) and from different environmental routes.

A number of **drivers of ABU and ABR** were identified. Drivers of ABU included a lack of alternatives to antibiotics such as vaccines, lack of knowledge and awareness of ABR, insufficient regulation and the potential role of antibiotics as growth promoters. Drivers of ABR included the use of antibiotics directly, or indirectly, through the use of manure from poultry and other species to enrich the ponds, and pollution of water and other resources with antibiotics or resistance genes.




**These workshops have identified potential interventions as well as key knowledge gaps, and provide a template for more detailed characterisation of the systems. The next step will be to build on the information captured at these workshops using system dynamics modelling to deepen understanding of how a complex system, such as intensive aquaculture in LMICs, behaves.**