Understanding AMU/R in Bangladesh's Aquaculture: challenges, approaches and lessons learned

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Background

- Fifth-largest inland aquaculture producer in the world
- Impressive average annual growth of 8.59%
- Major contributors to the social, political, and economic fabric
    - 60% of human intake of animal food
    - workplace for 17.8 million people

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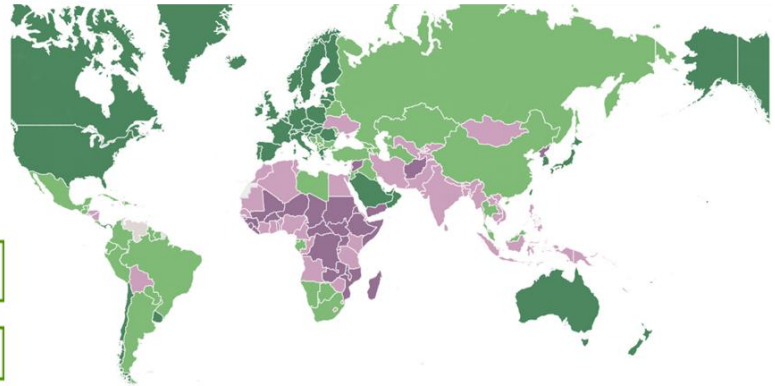
Background

AMR is particularly of concern to low-and middle-income countries

- Limited public health care facilities
- Insufficient environmental protection
- Increasing demand for food production
- Weak disease surveillance and diagnostics
- Weak control of antimicrobial sale and use
- knowledge and awareness gaps on AMU/AMR



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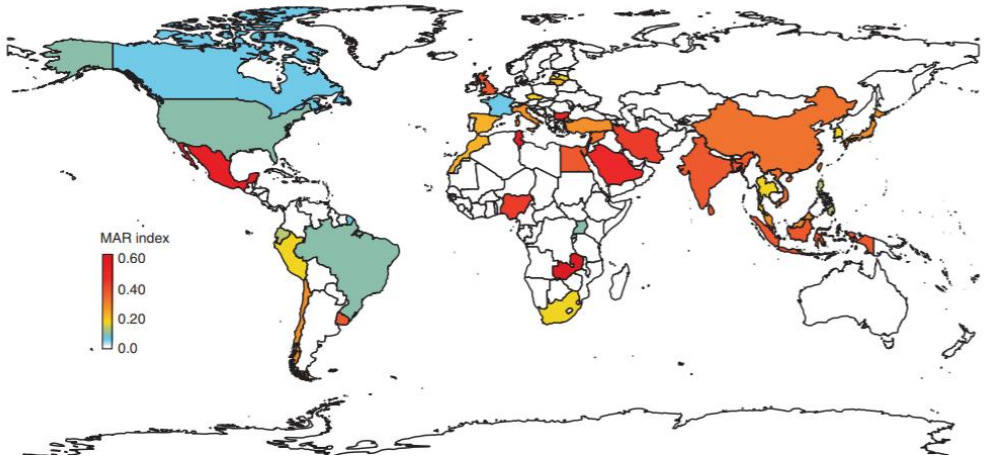
Background

Global Multi-antibiotic Resistance (MAR) index for aquaculture



MAR indices > 0.2, considered as high-risk antibiotic contamination

https://doi.org/10.1038/s41467-020-15735-6

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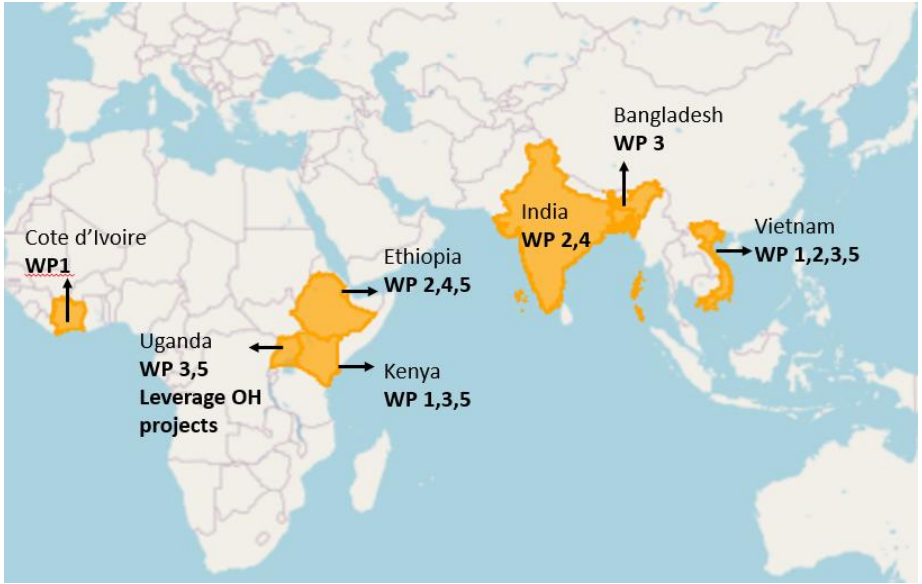
Objectives

Better understand AMU/R and One Health Issues and develop intervention strategies in aquatic food systems of Bangladesh



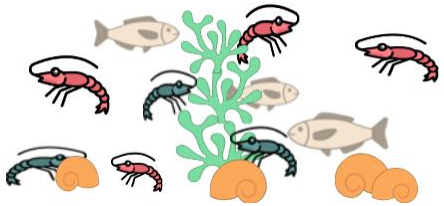
Country	Key Work Package
Vietnam	**WP1, WP2, WP5*** WP3, WP4
Bangladesh	**WP3**
India	**WP4** WP2
Kenya	**WP1, WP3, WP5** WP2
Ethiopia	**WP2, WP4, WP5**
Cote d'Ivoire	**WP1** WP2
Uganda	Leverage from other One Health projects in Uganda

Situation analysis

- **Diversified farmed fish species:**

260 freshwater and 475 marine

12 exotic species fish species



- **Many production systems:**

Pond, gher, cages, tank, raceway, RAS

- **Multitudes of production techniques:**

Homestead, extensive, improved-extensive, semi-intensive, intensive, monoculture, polyculture

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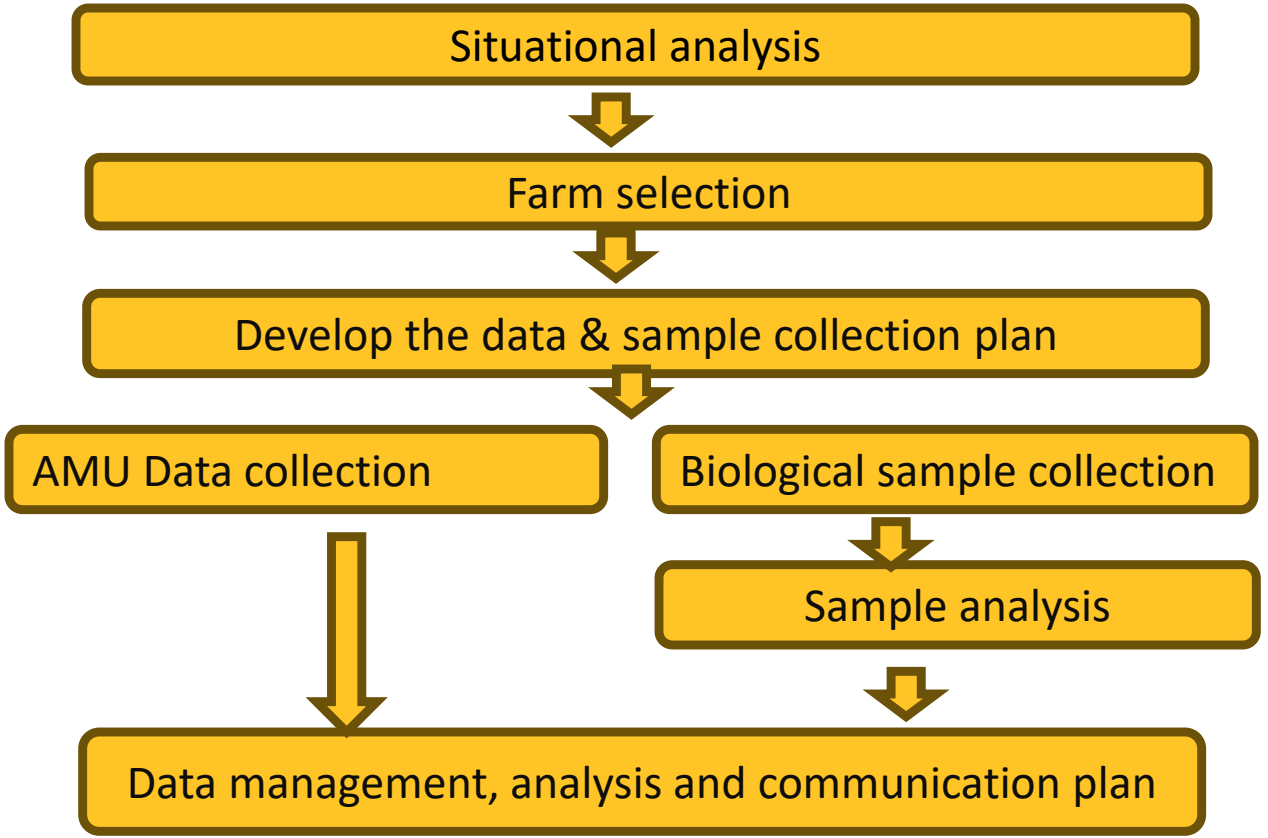
Steps to initiate and implement farm-level AMU/R tracking



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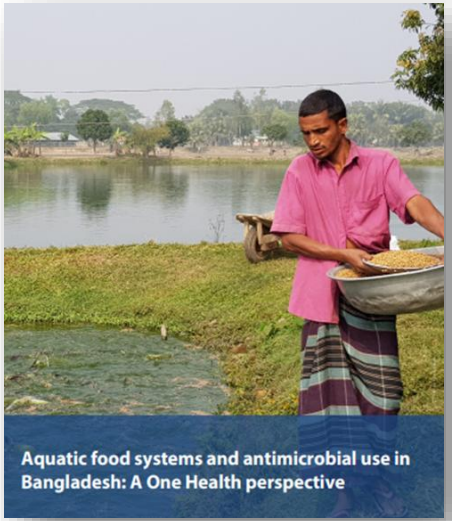
Situation analysis

Context: Diversified farmed fish species. Many production systems and techniques. Multitudes of inputs entering the systems. Fragmented data. No historical data

How do we start?
Where to concentrate?

- Major aquaculture species and production systems
- Common inputs in commercial aquaculture farms
- Prevalent fish diseases and AMU
- AMR and aquaculture
- System assessment through One Health metrics
- AMR research trends and gaps
- Initiatives to reduce AMU and AMR



https://hdl.handle.net/10568/131046

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Situation analysis

Challenges	Selection criteria
Which fish species, production types, production systems?	Commercial significance Species production data National priorities
Study location?	Main fish producing hub Intensification growing
Which Inputs to include?	Inputs regarding potential impacts on AMU/AMR
Pathogen selection for AMR	One Health significance National AMR monitoring strategy Laboratory capacity and capability

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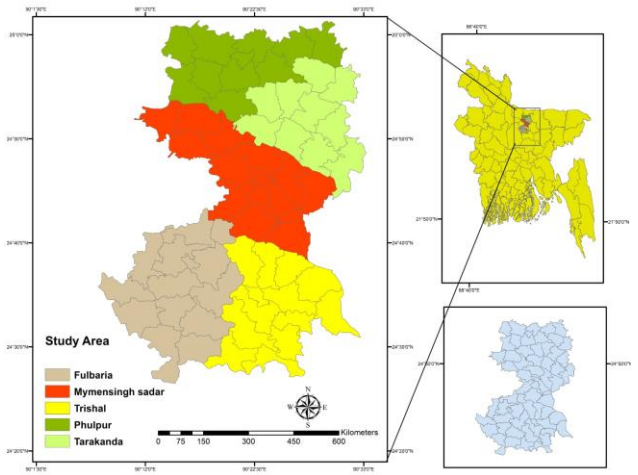
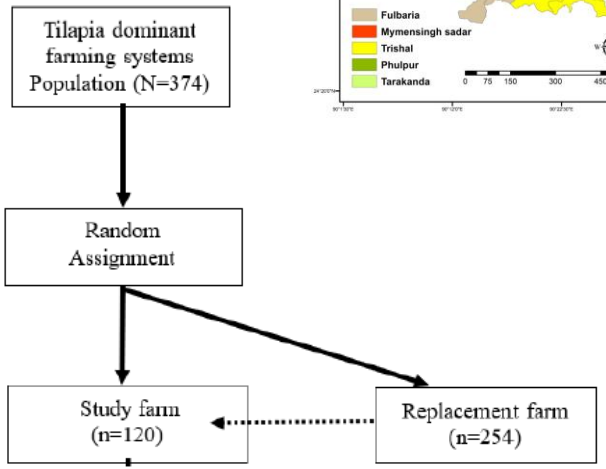
Data collection plan: Study area and farm selection

Context: Around 112,000 fish farmers in the in the division. Distribution of farms is not known. No updated records of registered fish farms and current species farming

- KIIs: Local fisheries officers & fish farmer cooperatives leaders
- FGDs: community farmers
- Field survey and phone survey: confirmatory survey





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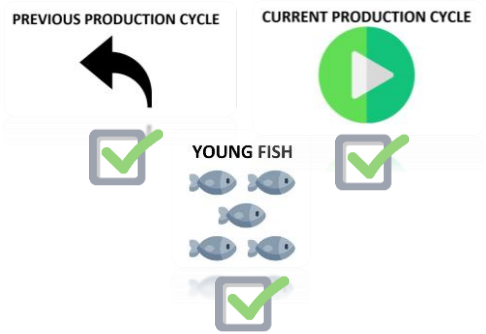
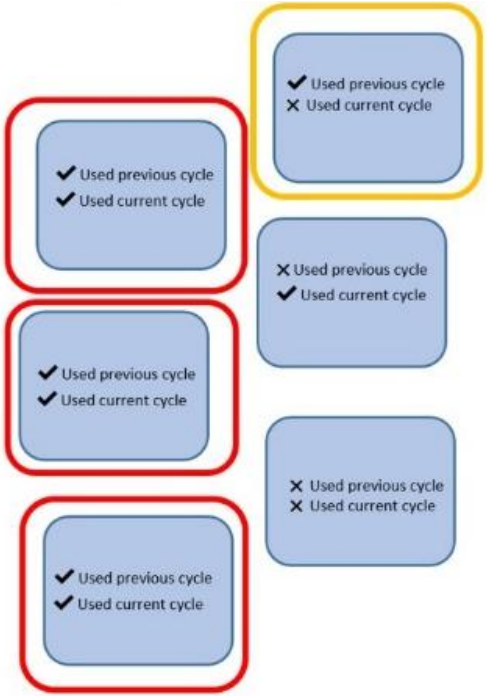
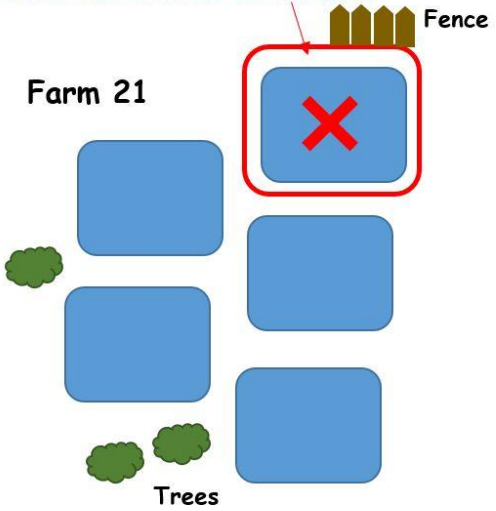
Data collection plan: Pond selection for AMU/R

Take a photo of the selected pond & its landmarks



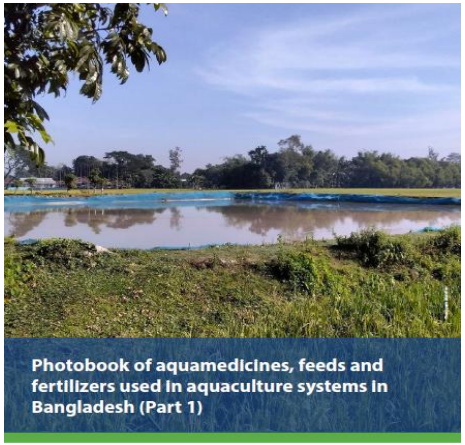


Mark the selected survey pond in your notebook sketch of the farm layout



AMU/R data collection plan

Context: Farm-level AMU data is nonexistent. Prescription records is poorly documented or nonexistent. Farmers not be able to distinguish different treatment products. Treatment packaging not conserved. Purchase orders and inventory reports are often incomplete or inaccessible.



No.	Develop tools	Description
1	Cross-sectional survey	Collect farm-level & pond-level information from previous completed production cycle for each farm
2.	Longitudinal survey	Collect ongoing farming practices from the same selected pond covering one production cycle

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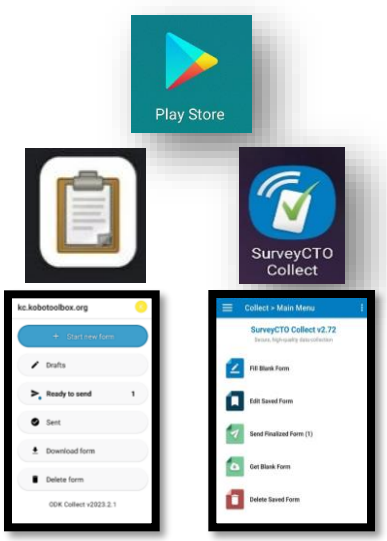
AMU Data collection plan



Training content:

- Types of questions
- Navigation
- Saving, accessing & deleting survey forms
- Submitting data

Installation of data collection app on mobile devices

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Connect to the project server

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Download the survey tool/ questionnaire tool to mobile devices

↓

Upload mock submissions

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AMU Data collection: Retrospective cross-sectional Survey

- Respondent information
- Perceived AMU benefits & downside
- General farm information
- Farm biosecurity practices
- 4 Pond-level production practices (Stocking/Feeding/Fertilizers/Harvesting)
- Signs of disease and health issues
- Farmer response to mortalities (reporting/health services/treatments)
- Economics of production
- Fertilizer use

Section A-C: Enumerator & respondent information

- ▶ Section A: General survey information
- ▶ Section B: Enumerator information
- ▶ Section C: Respondent information
- ▶ Section D: Awareness

Section D-J: Farm-level questions

- ▶ Section E: Farm layout & worker information
- ▶ Section F: General farming system information
- ▶ Section G: Farm practices: Water source & management
- ▶ Section H: Farm practices: Biosecurity
- ▶ Section I: Farm practices: Effluent discharge
- ▶ Section J: Farm practices: Pond sludge removal

Section K-W: Pond-level questions

- ▶ Section K: Farm practices: Fish stocking
- ▶ Section L: Farm practices: Feeding
- ▶ Section M: Farm practices: Fertilizers
- ▶ Section N: Farm practices: Harvesting
- ▶ Section O: Clinical signs
- ▶ Section P: Mortality
- ▶ Section Q: Response to mortality: Reporting
- ▶ Section R: Response to mortality: Animal health services
- ▶ Section S: Treatments (for prevention & treatment of disease)
- ▶ Section T: Administering treatments
- ▶ Section U: Economics: Production

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AMU Data collection: Longitudinal Survey

- Pond-level practices
- Signs of mortality or health issues
- Input costs

Final section: Longitudinal survey (Day Zero)

- Pond preparation
- Fish stocking
- Feeding
- Fertilizers
- Harvesting
- Clinical signs
- Mortality
- Treatments (for prevention & treatment of disease)
- Economics: Production

Follow-up longitudinal survey tool

- Pond preparation
- Water exchange
- Effluent release
- Pond sludge removal
- Fish stocking
- Feeding
- Fertilizers
- Harvesting
- Clinical signs
- Mortality
- Treatments (for prevention & treatment of disease)
- Economics: Production

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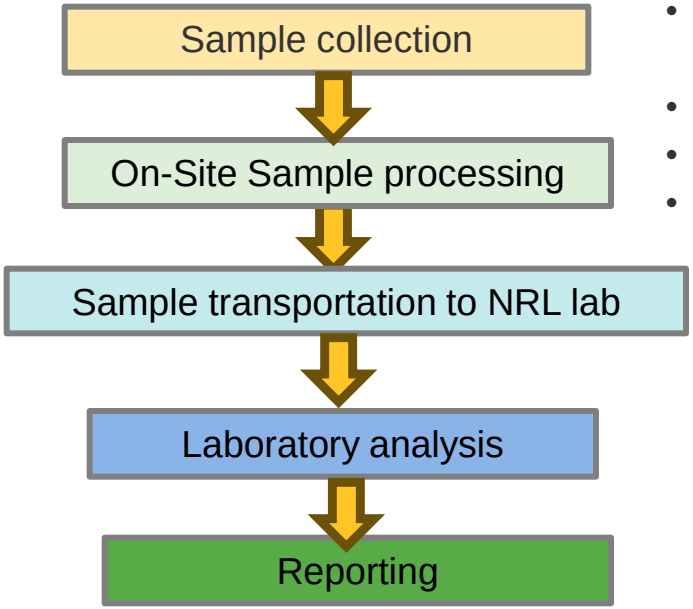
AMR sample collection plan



Training content AMR:

- Biological and environmental sample collection
- Initial sample processing at field
- Sample transportation
- Laboratory testing: processing, isolation, identification, QC, AST and preservation

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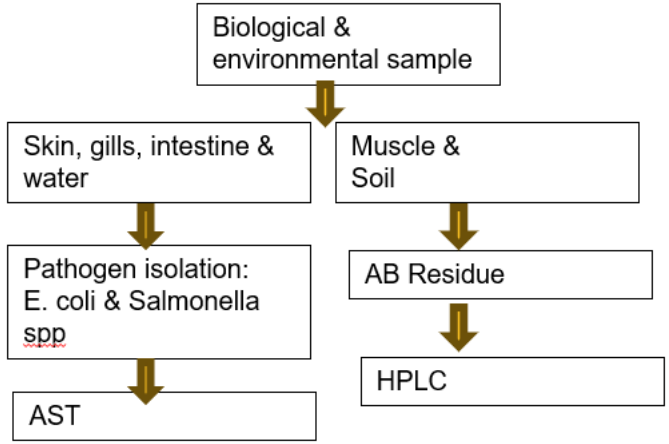
Overview: Biological & Environmental sample collection

Target population	Same setting Commercial tilapia farms
Target Pathogen	*E.coli* & *Salmonella*
Sampling approach	Active surveillance
Collection schedule	Twice: Beginning & End of production cycle
AST and AB residue testing	Data analysis and reporting



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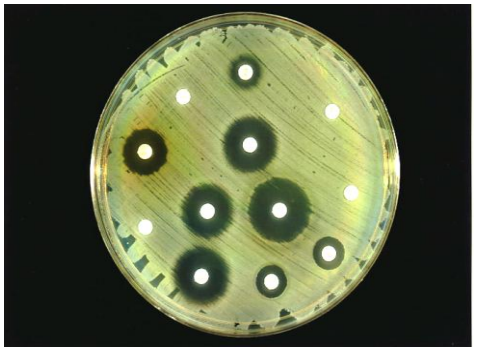
Antimicrobial susceptibility and residue testing

Disk diffusion test for a panel of antimicrobials

- **Penicillin:** ampicillin (AMP, 10 µg)
- **Tetracyclines:** oxytetracycline (OT, 10 µg)
- **Aminoglycosides:** gentamycin (GEN, 10 µg)
- **Quinolones:** nalidixic acid (NAL, 30 µg), ciprofloxacin (CIP, 5 µg), levofloxacin (LVX, 5 µg), norfloxacin (NOR, 100 µg)
- **Carbapenems:** meropenem (MEM, 10 µg)
- **Cephalosporins:** cefuroxime (CXM, 30 µg), cefepime (FEP, 30 µg)
- **Others:** trimethoprim-sulfamethoxazole (STX, 25 µg), chloramphenicol (CHL, 30 µg), azithromycin (AZM, 15 µg), nitrofurantoin (NIT, 100 µg)



Disk diffusion test according CLSI

AB residue

amoxicillin, oxytetracycline, ciprofloxacin, tetracycline, and trimethoprim-sulfamethoxazole

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Communication

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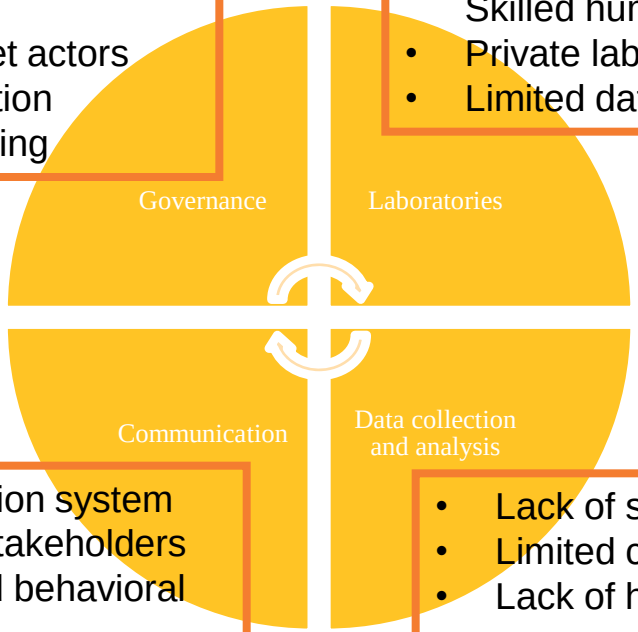
AMU/R surveillance in Bangladesh's aquaculture: gaps and challenges

- Weak regulatory framework
- Inadequate enforcement
- Limited surveillance activities
- No data collection from market actors
- Weak multi-sectoral coordination
- Dependency on external funding

- Only one designated NRL for aquaculture
- Very limited fish disease diagnostic services
  Skilled human resource constraints
- Private laboratories are not integrated
- Limited data transmission from laboratories



- Weak surveillance communication system
- Limited engagement with key stakeholders
- Limited initiative for cultural and behavioral shift
- Surveillance results are never circulated

- Lack of standardize protocol
- Limited coverage
- Lack of historical data, fragmented data

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Thank You

CGIAR INITIATIVE ON One Health

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The Fleming Fund

UKaid from the British people

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