

# Transmission and Spread of AMR from Aquatic Environments

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The “One Health” approach in aquatic animals: how to prevent AMR

*Primer Webinar regional cuadripartito El enfoque “Una Salud” en animales acuáticos: cómo prevenir la RAM*

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# Environmental Dimensions of Antimicrobial Resistance

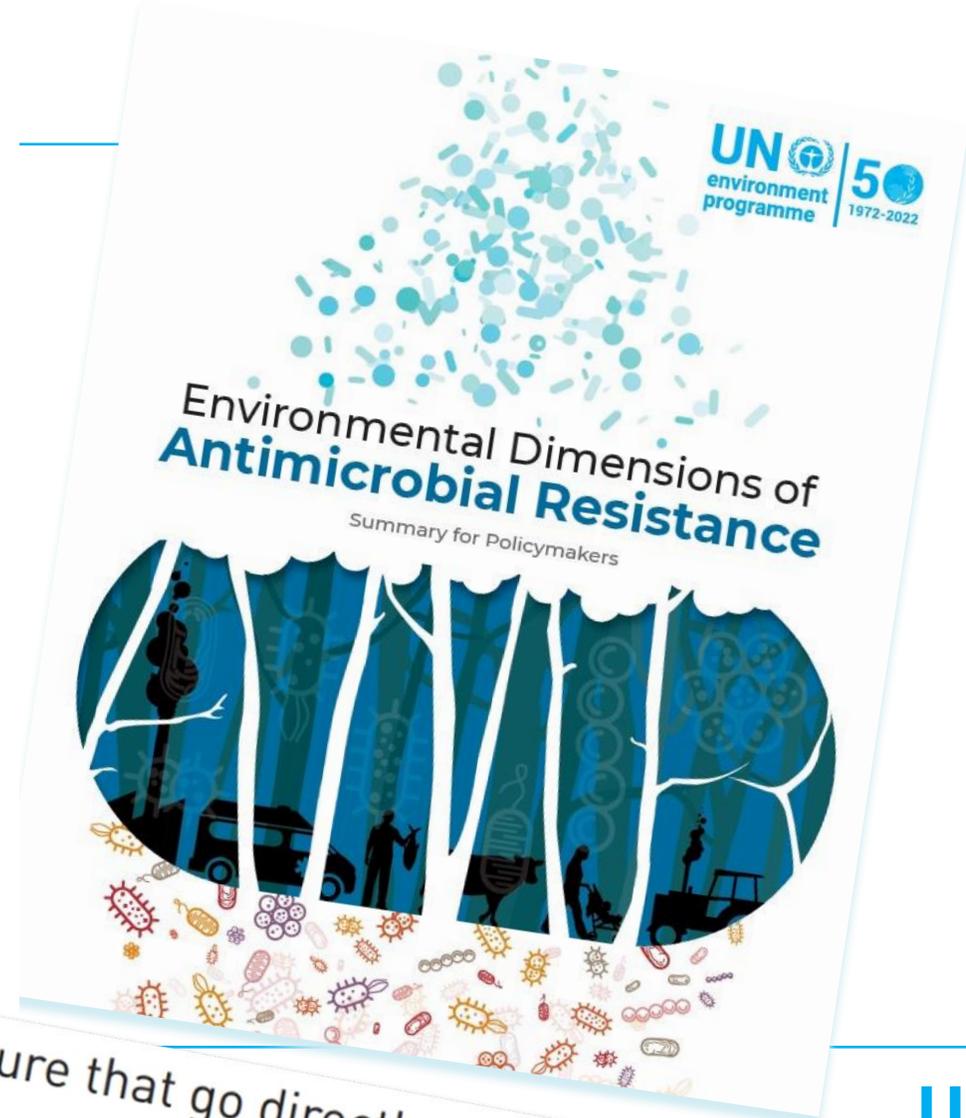
## Summary for Policymakers

Table 1

Summary of the major pollution sources affecting AMR in the environment

Major sources	Type and nature of potential environmental releases
Poor sanitation, sewage and waste effluent	<ul style="list-style-type: none"> <li>Preventable use of antimicrobials due to disease burden caused by poor WASH conditions</li> <li>Lack of sanitation or poorly functioning sanitation or fragmented systems (e.g. open defaecation, poorly contained pit latrines, septic tanks and sewers) that contaminate water sources and spread AMR</li> <li>Effluent from septic tanks and wastewater treatment plants</li> <li>Faecal sludge and wastewater biosolids</li> <li>Releases from unused drugs disposed of in toilets, bins or waste dumps</li> <li>Leaching from open waste dumps</li> <li>Urban runoff</li> </ul>
Effluent and waste from pharmaceutical manufacturing	<ul style="list-style-type: none"> <li>High concentrations of antimicrobials in untreated effluent</li> <li>Residual antimicrobials in solid wastes discharged from pharmaceutical fermentation processes</li> <li>Resistant microbes in effluent if biological treatment is applied</li> </ul>
Effluent and waste from hospitals	<ul style="list-style-type: none"> <li>Antimicrobial products and residues in hospital solid wastes</li> <li>Resistant microbes (including those with more abundant and diverse ARGs) and antimicrobial residues (particularly antimicrobial compounds of last resort) in wastewater/effluent</li> </ul>
Antimicrobials and parasiticides used in the production of food, and manure in crop production	<ul style="list-style-type: none"> <li>Antimicrobial residues, ARGs and resistant microbes in animal manure and effluent</li> <li>Inappropriate disposal of antimicrobials and parasiticides</li> </ul>
Releases, effluent and waste in animal production	<ul style="list-style-type: none"> <li>Manure and effluent from aquatic and terrestrial animal production containing antimicrobial residues, ARGs and resistant microbes</li> <li>Application of antibiotics and parasiticides in aquaculture that go directly into the environment</li> <li>Improper disposal of unused drugs</li> </ul>

Application of antibiotics and parasiticides in aquaculture that go directly into the environment



# Environmental – Aquaculture Interactions

## Inputs

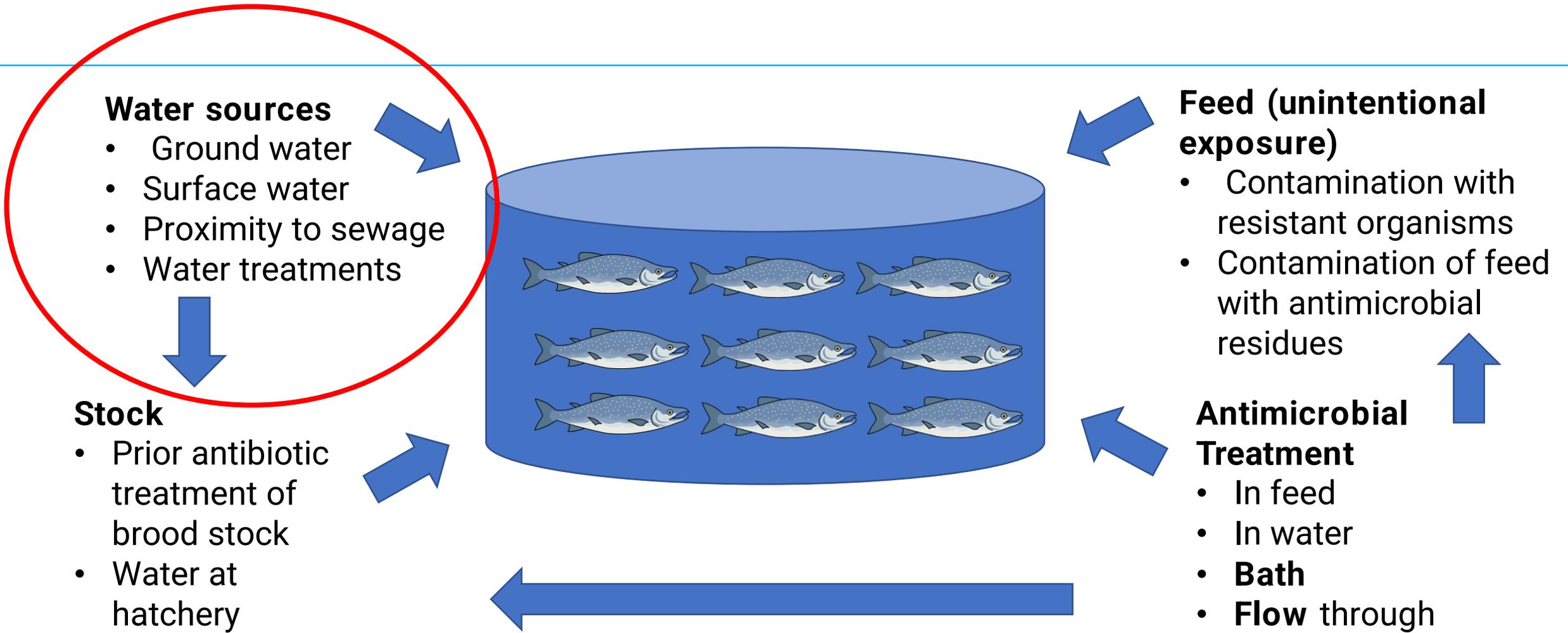
Stock/fry  
Water  
Feed  
Treatment



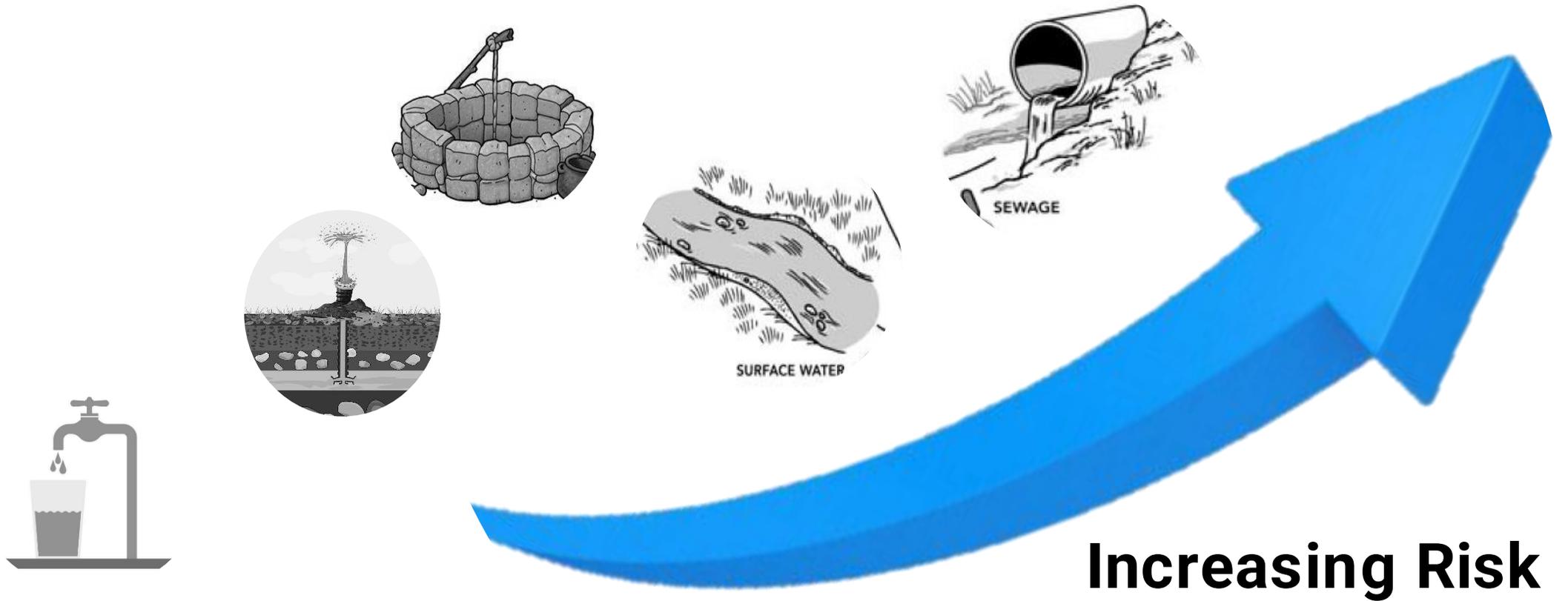
## Outputs

Water  
Fish  
Waste

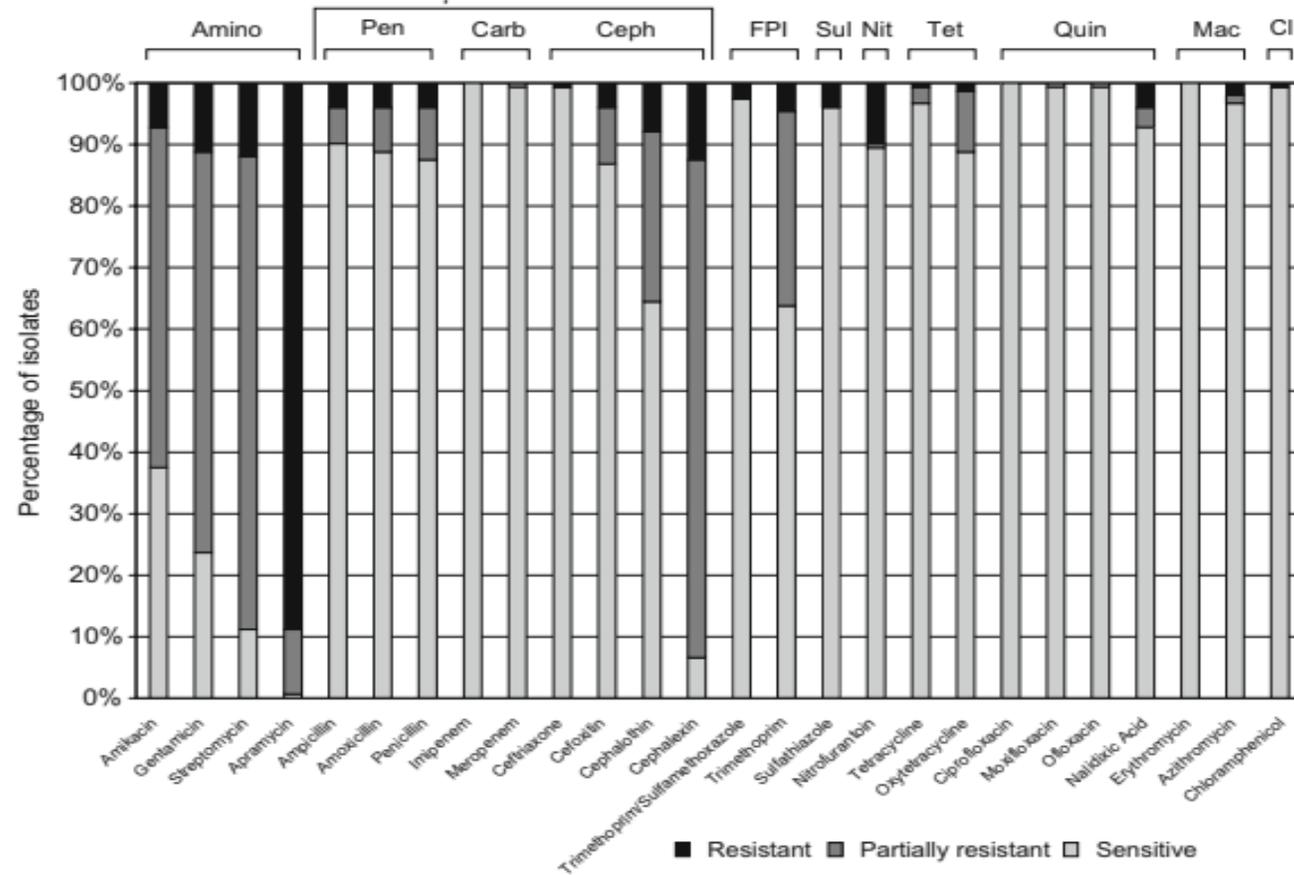
# Inputs to aquaculture



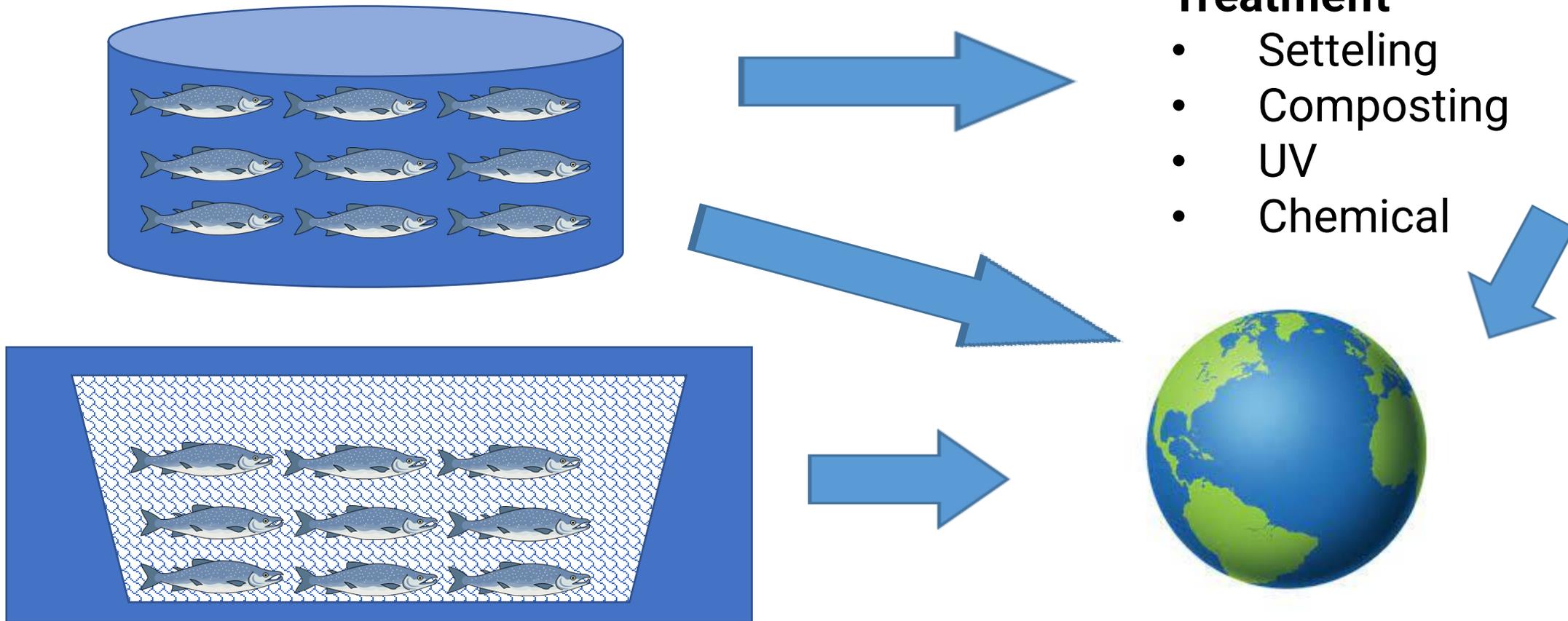
# Water sources for aquaculture



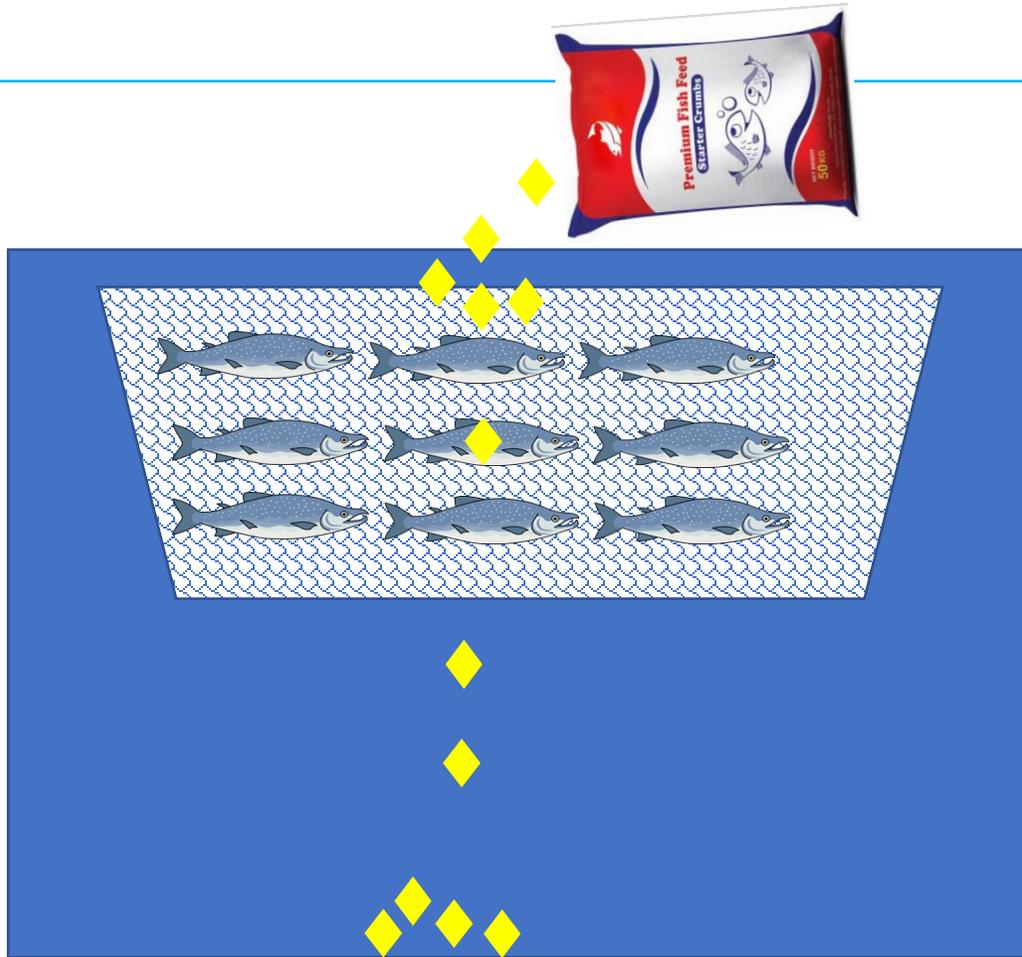
# Vibrio vulnificus in marine environment



# Outputs from aquaculture



## Example – antimicrobial treatment in feed



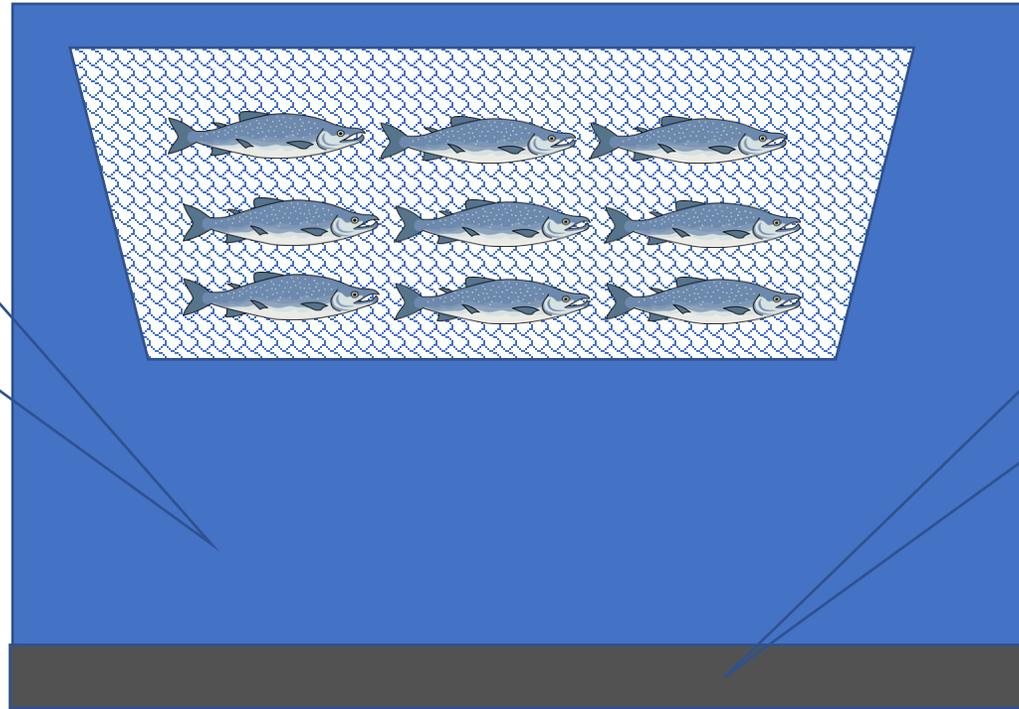
Medicated feed contaminates the environment when not consumed.

Active metabolites or antibiotic residues are also excreted in waste, and are dependent upon:

- Fish species
- Antimicrobial class
- Water temperature

# Environmental contamination surrounding aquaculture sites

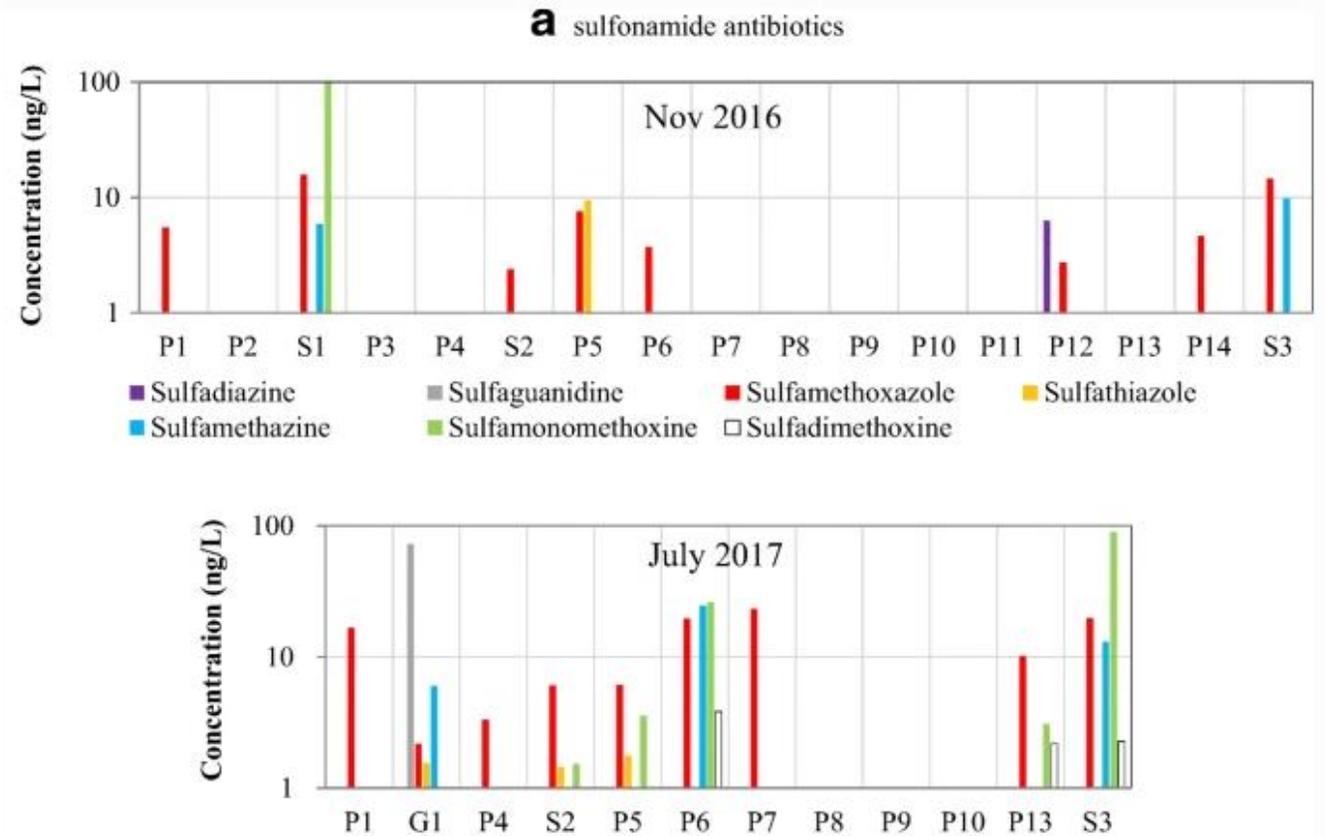
Prevalence reports of resistant microorganisms and antimicrobials in water



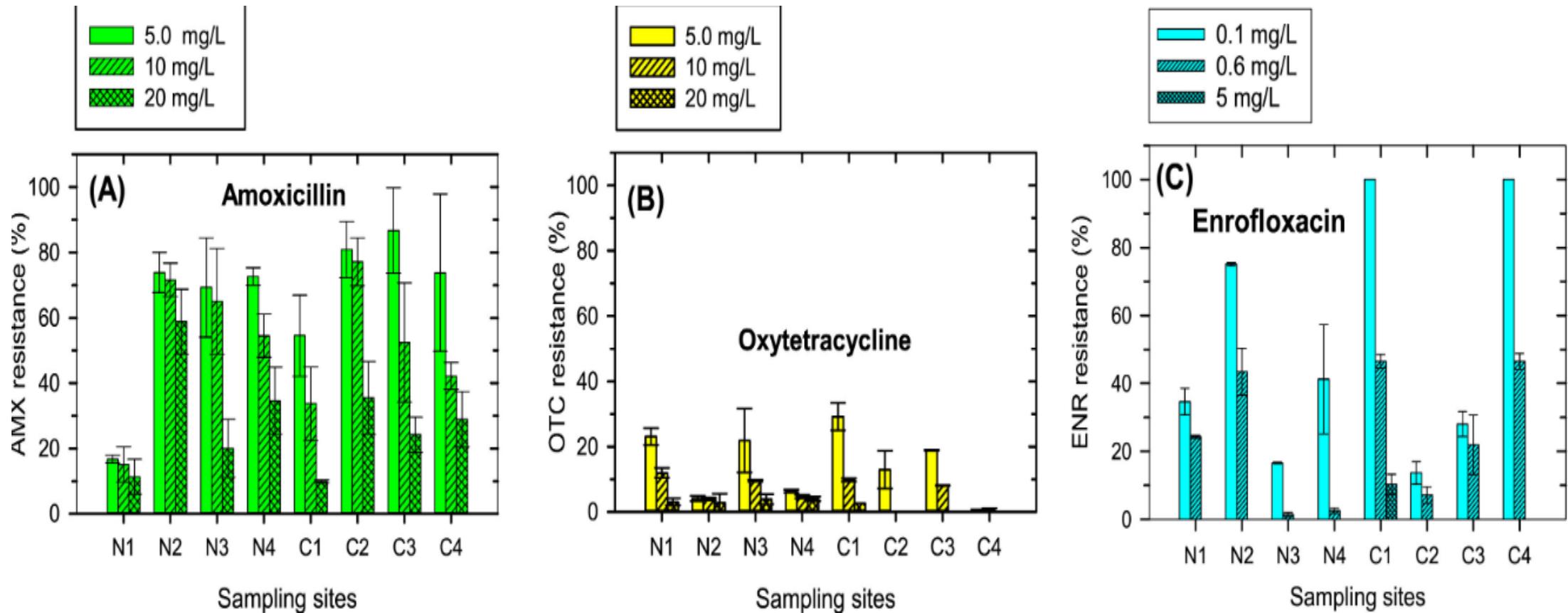
Prevalence reports of resistant microorganisms, and antimicrobials in sediments

# Antimicrobials (sulphonamides) in water

- November: **47%** (38 sites) positive
- July: **75%** (38 sites) positive
- Including ponds (P) and surrounding water (S)

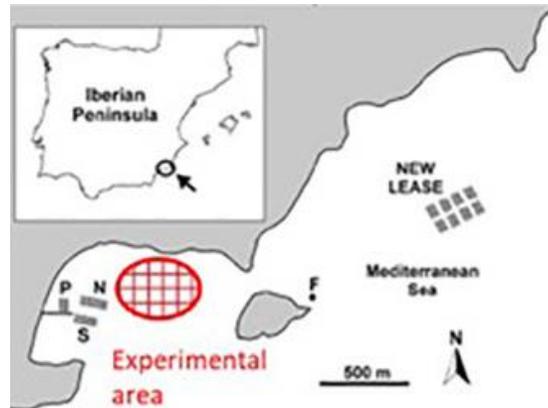


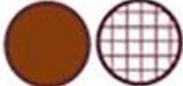
# Resistant microorganisms (bacteria) in water



<https://doi.org/10.1016/j.jhazmat.2021.126572>

# Medicated feeds – environmental impacts



-  1) **Control** (no trap)
-  2) **Control** (trap)
-  3) **Non medicated** feed
-  4) **Flumequine** medicated feed
-  5) **Florfenicol** medicated feed
-  6) **Oxytetracycline** medicated feed



## Sediments:

- Antibiotics accumulation
- Physicochemical parameters



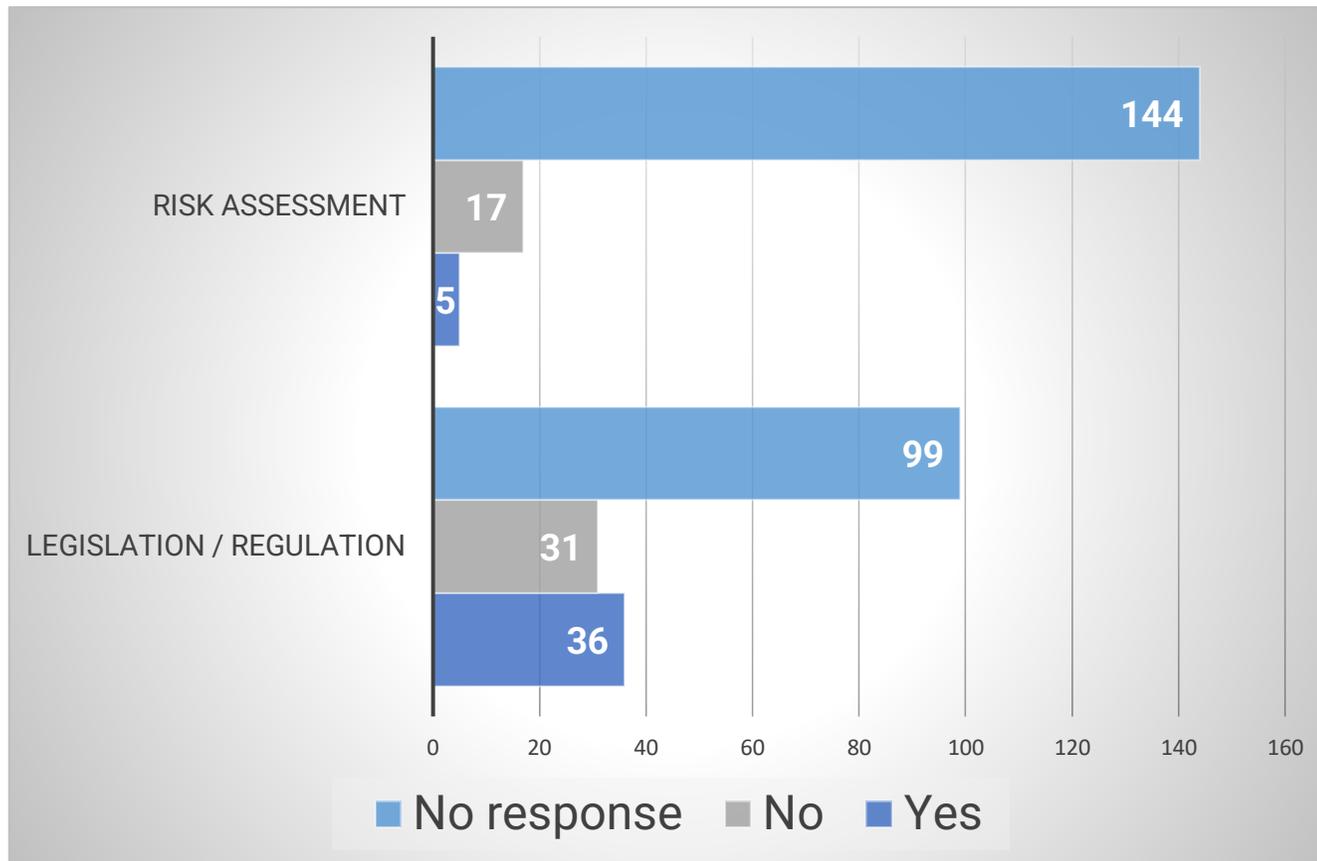
## Biota:

- Antibiotics accumulation
- Invertebrates
- Microbiota
- Resistome



# Tracking Antimicrobial Resistance Country Self Assessment Survey

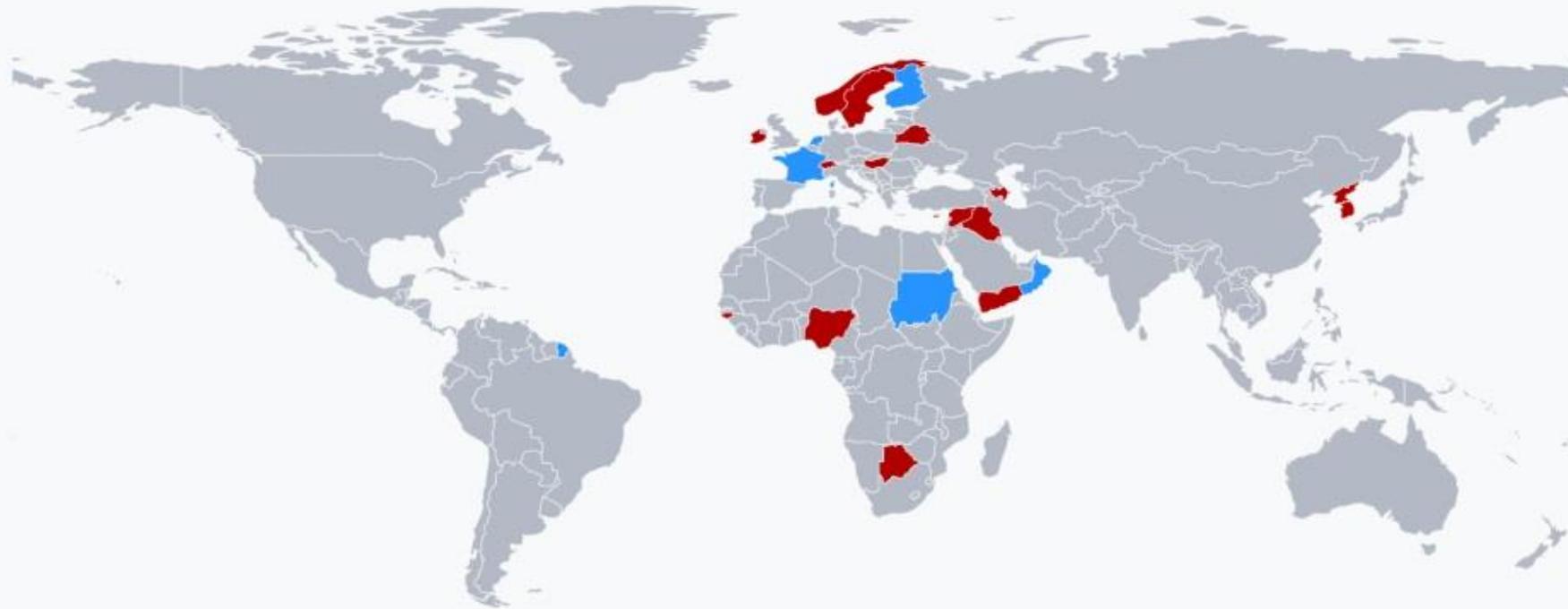
TrACSS 2022



6.1.7 Have risk assessments been conducted? **Discharges from intensive aquatic animal production (liquid and solid waste)**

6.2.7 Are there legislation and/or regulation and policies to mitigate risks? **Discharges from intensive aquatic animal production (liquid and solid waste)**

## TrACSS 2022, Environment Sector, Question 6.1.7

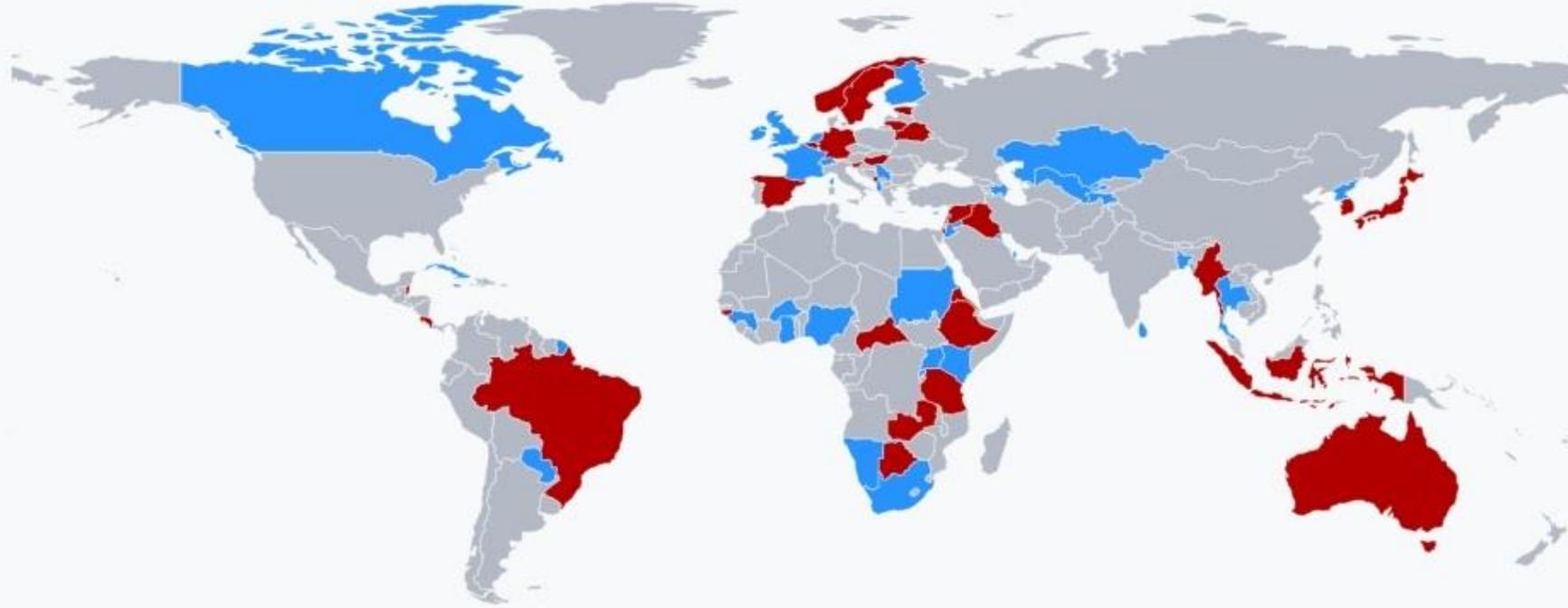


6.1.7 Have risk assessments been conducted? Discharges from intensive aquatic animal production (liquid and solid waste)

Yes

No

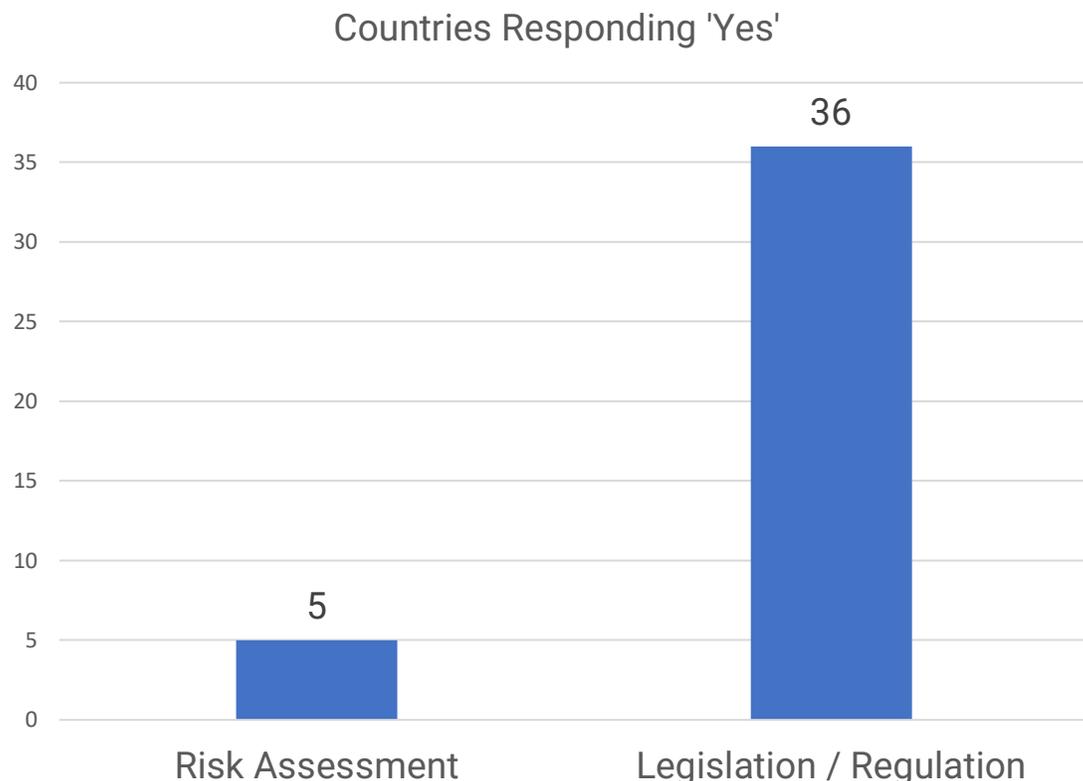
## TrACSS 2022, Environment Sector, Question 6.2.7



**6.2.7 Are there legislation and/or regulation and policies to mitigate risks? Discharges from intensive aquatic animal production (liquid and solid waste).**

- Yes
- No

## TrACSS 2022 Environment Section 6



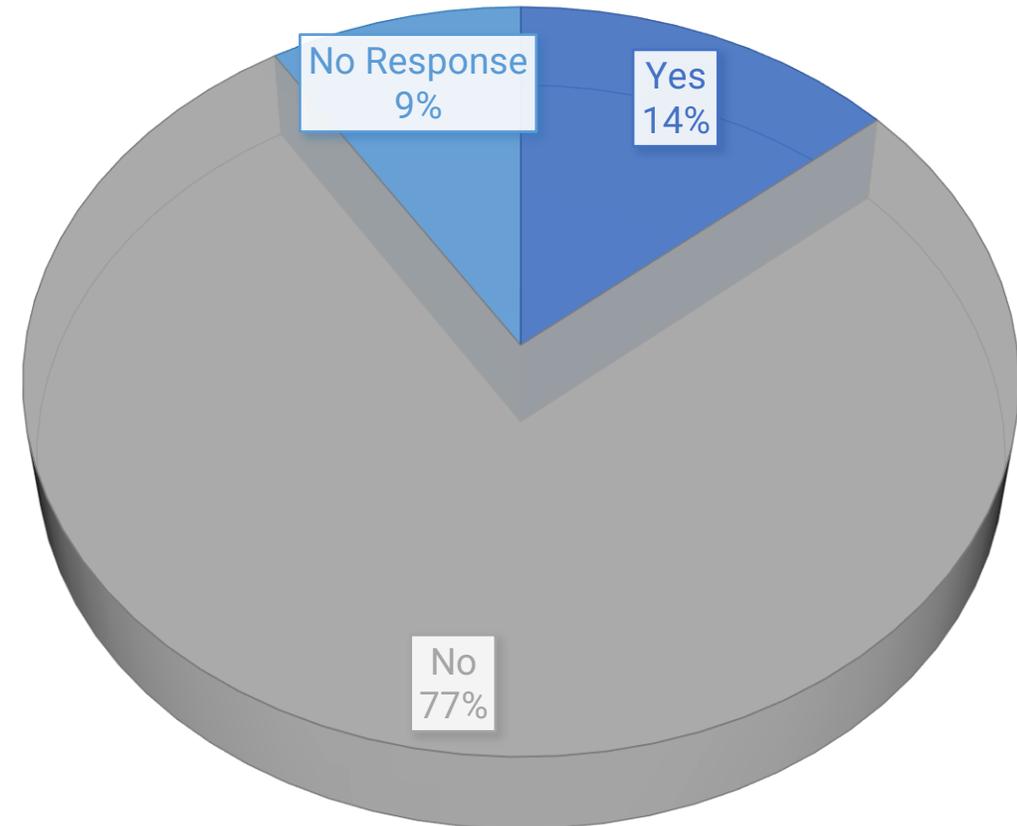
**Question 6.1.7** Have risk assessments been conducted? Discharges from intensive aquatic animal production (liquid and solid waste)

**Questions 6.2.7** Are there legislation and/or regulation and policies to mitigate risks? Discharges from intensive aquatic animal production (liquid and solid waste)

## TrACSS 2022 Environment Section 6

**Question 6.3** Is there a system for regular monitoring (passive surveillance) of antimicrobial compounds and their metabolites (or residues) and resistant bacteria or antimicrobial resistance genes (ARGs) in water quality?

### WATER QUALITY



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Antimicrobial Resistance is a Global Crisis.

There is no time to waste.

# Thank you



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