



UK Centre for  
Ecology & Hydrology



UNIVERSITY OF  
**BATH**



Natural  
Environment  
Research Council

# NERC PACIFIC project

**PA**thways of **Ch**emicals **I**nto  
Freshwaters and their  
ecological **Impa**Cts

Better Water Quality for Wales

27<sup>th</sup> June 2023



UNIVERSITY OF  
**OXFORD**



Environment  
Agency



# NERC PACIFIC project

Four organisations, four years (2022-2026)



UK Centre for  
Ecology & Hydrology

Dr Daniel Read (PI)



Dr Holly Tipper

Dr Issy Stanton

Tim Goodall

Dr Andrew Singer

Dr Virginie Keller

Dr John Redhead

Dr Emily Upcott



UNIVERSITY OF  
**BATH**

Prof. Barbara  
Kasprzyk-Hordern



Dr Kishore Jagadeesan



UNIVERSITY OF  
**OXFORD**

Dr Michelle  
Jackson



Dr Sam Macaulay



Environment  
Agency

Dr Kerry Walsh



Dr Helen Wilkinson





**PACIFIC objective:** To develop a predictive understanding of the risks of micropollutants (MPs) to the microbial health of freshwater ecosystems





# Micropollutants in freshwaters

## Point sources

- Wastewater treatment effluents (both treated and untreated)



## Diffuse sources

- Agricultural chemicals such as insecticides, fungicides, general biocides and herbicides



## Chemical mixtures in the environment

- 100s to 1000s of chemicals measurable in freshwaters
- Which are important and how do they interact?



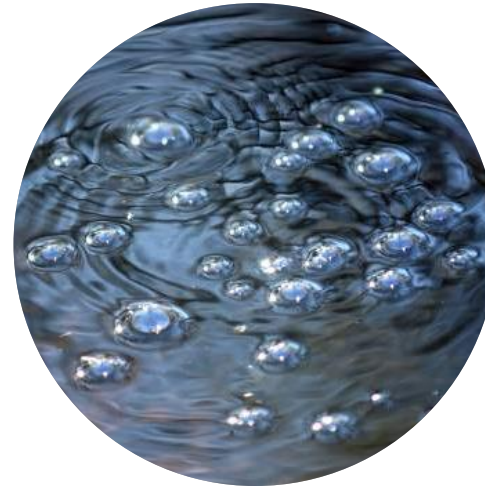
## Antimicrobial pollutants

- Antibiotics, antifungals, antiprotozoals, biocides etc.
- Widely used and frequently found in freshwater environments.



# Why freshwater microbes?

- Most abundant and taxonomically diverse biological component of freshwater ecosystems



- The freshwater '*biogeochemical engine*'
- Responsible for organic matter turnover, C, N and P cycling, river metabolism, greenhouse gas fluxes etc.

- Can be directly responsible for freshwater and human health (e.g., pathogens).

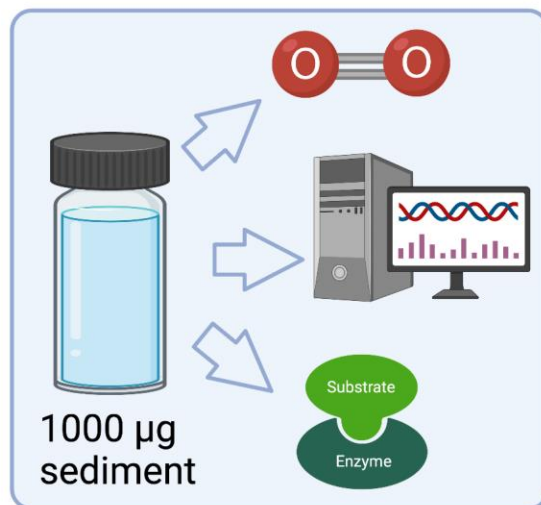


- Sensitive to a range of anthropogenically produced chemicals (e.g., antibiotics, antivirals, fungicides, biocides etc.).

## WP2



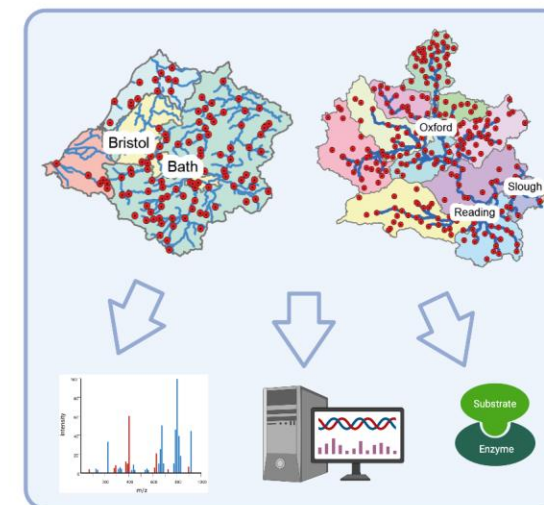
## WP2



## WP3

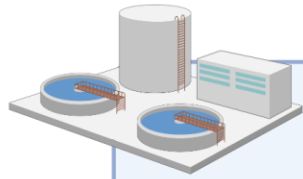


## WP1



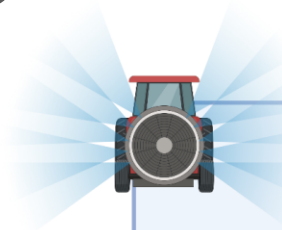
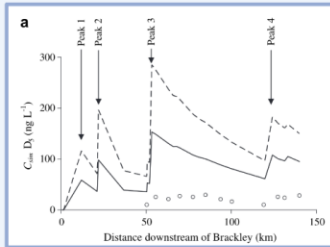


# Scaling up – modelling and data integration



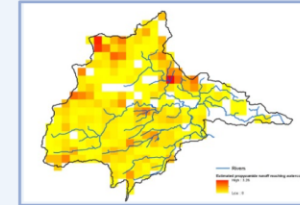
## Point source modelling - Qube WQX model

- Stochastic Model - probability distributions of predicted environmental concentrations (PECs)



## Diffuse source modelling - InVEST NDR model

- UKCEH Land Cover Map (LCM) predictions of agrochemical applications to land
- Hydrological routing and mass-balance equations to estimate pollutant run-off





# Mesocosms – ExStream





# Bristol Avon survey



Wessex Water  
YTL GROUP

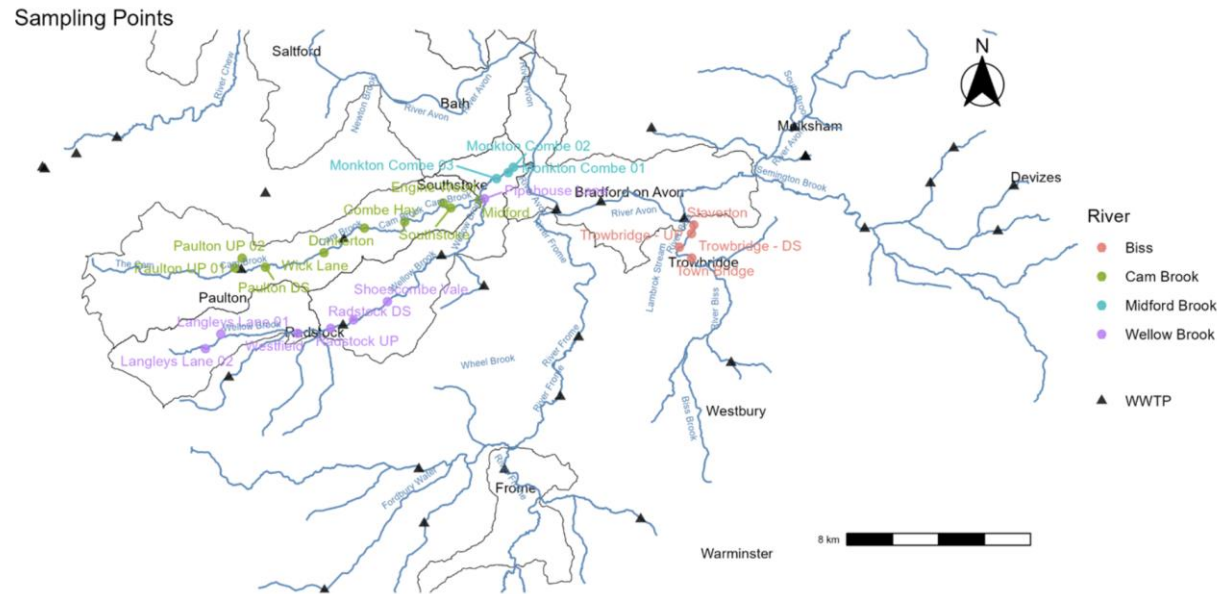
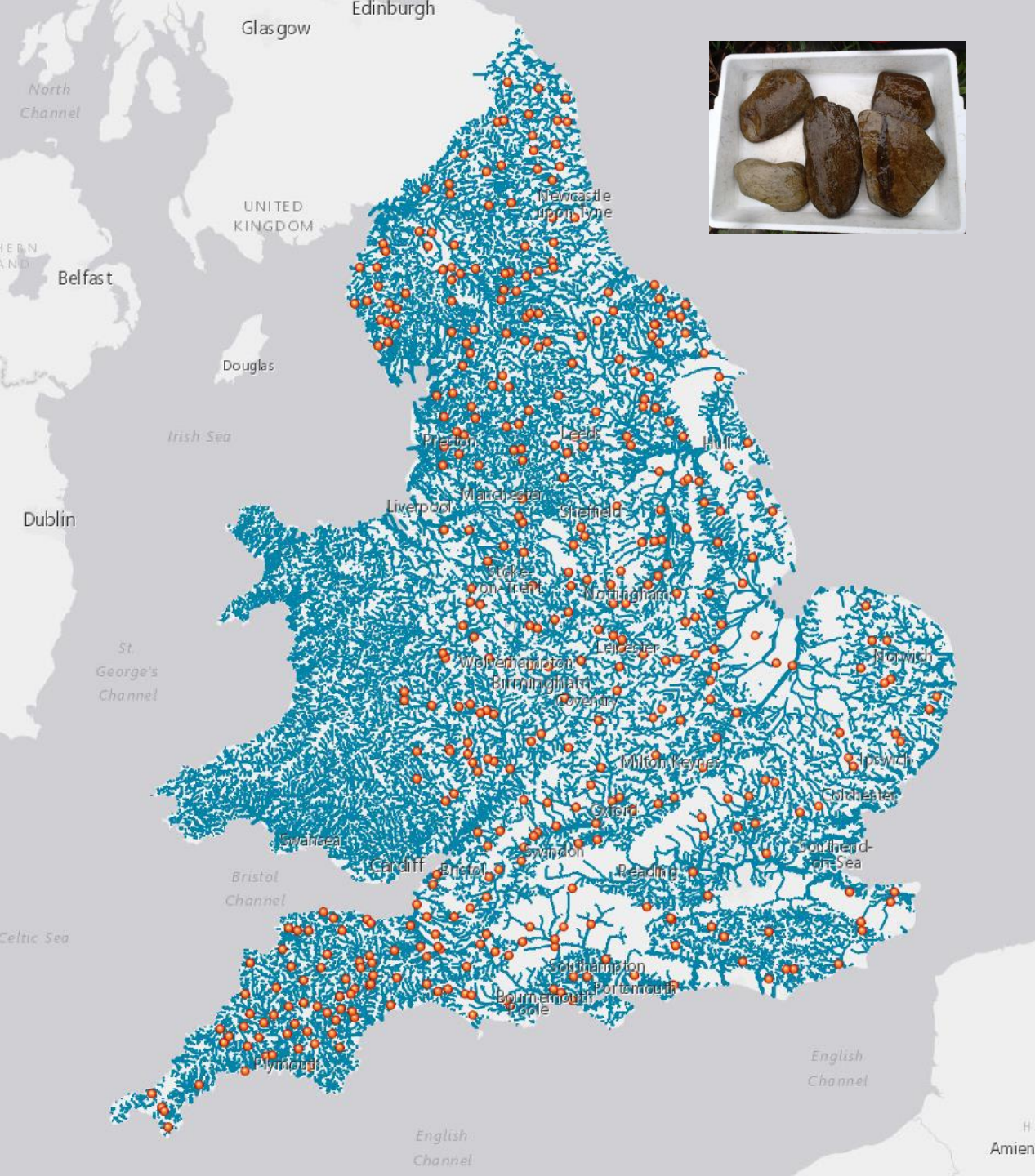


Figure 1. Sampling Points

- River monitoring linked to high resolution monitoring of raw and treated wastewater.
- Link between population consumption/use of chemicals and emissions from wastewater.
- Wastewater treatment transformations
- Impact on microbial ecosystems downstream.

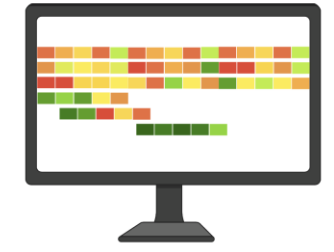
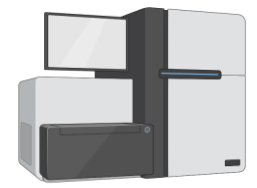
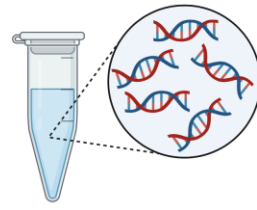






## Scaling-up to national (England) scale.

- National network of river biofilm sampling and analysis (River Surveillance Network).
- Harmonisation of methods with the PACIFIC project to allow upscaling of results.
- 2,400 samples, 1,600 metabarcoding, 200 metagenomes.







Natural  
Environment  
Research Council

Thank you for your attention  
Any questions?

[daniel.read@ceh.ac.uk](mailto:daniel.read@ceh.ac.uk)



UK Centre for  
Ecology & Hydrology

