Water Quality Monitoring

Benefits and challenges of citizen science data

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On behalf of Cardiff Wye team**

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PRIFYSGOL CAERDYDD

School of Earth and Environmental Sciences
Ysgol Gwyddorau'r Ddaear a'r Amgylchedd

UKRI

Natural Environment Research Council

What is water quality?

How do we determine Water Quality?

- Wikipedia: **Water quality** refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the condition of water *relative to the requirements of one or more biotic species and or to any human need or purpose*.

- Can measure chemical, biological or physical status of water body

It depends on who is asking!

We're asking predominantly about the *chemical* status

# Statutory monitoring of water quality

- Water Framework Directive
  - 16 specific pollutants in surface waters; phosphorus, oxygen conditions and acidity in rivers; nitrates and other pollutants in groundwater
- Agencies are responsible for *compliance*
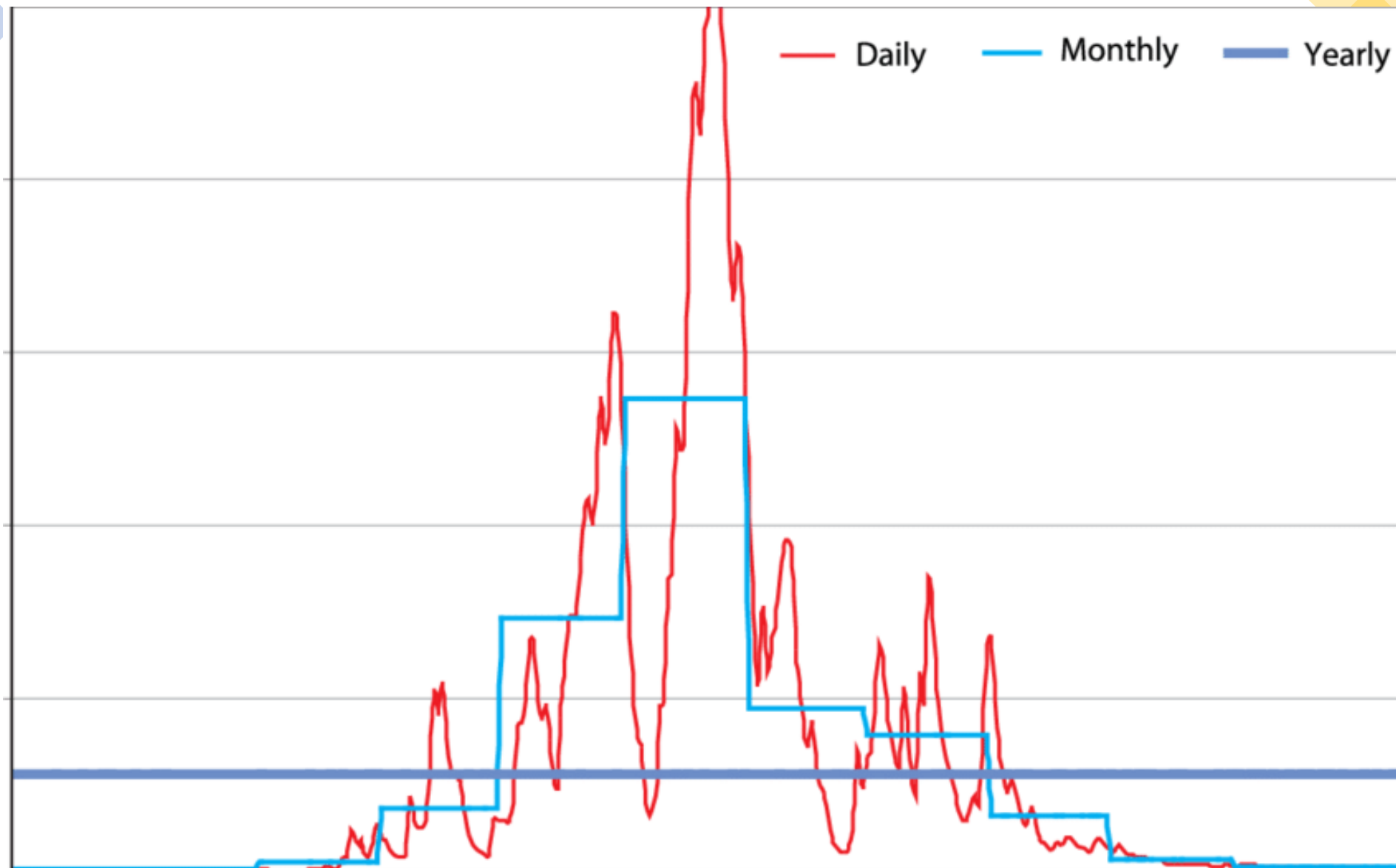 - Legally binding, accredited methods and laboratories

High quality, trustworthy data

Limits of statutory monitoring

- Expensive: logistically and resourcing
- → Spatial and temporal coverage is necessarily limited

Smakhtin et al. 2007
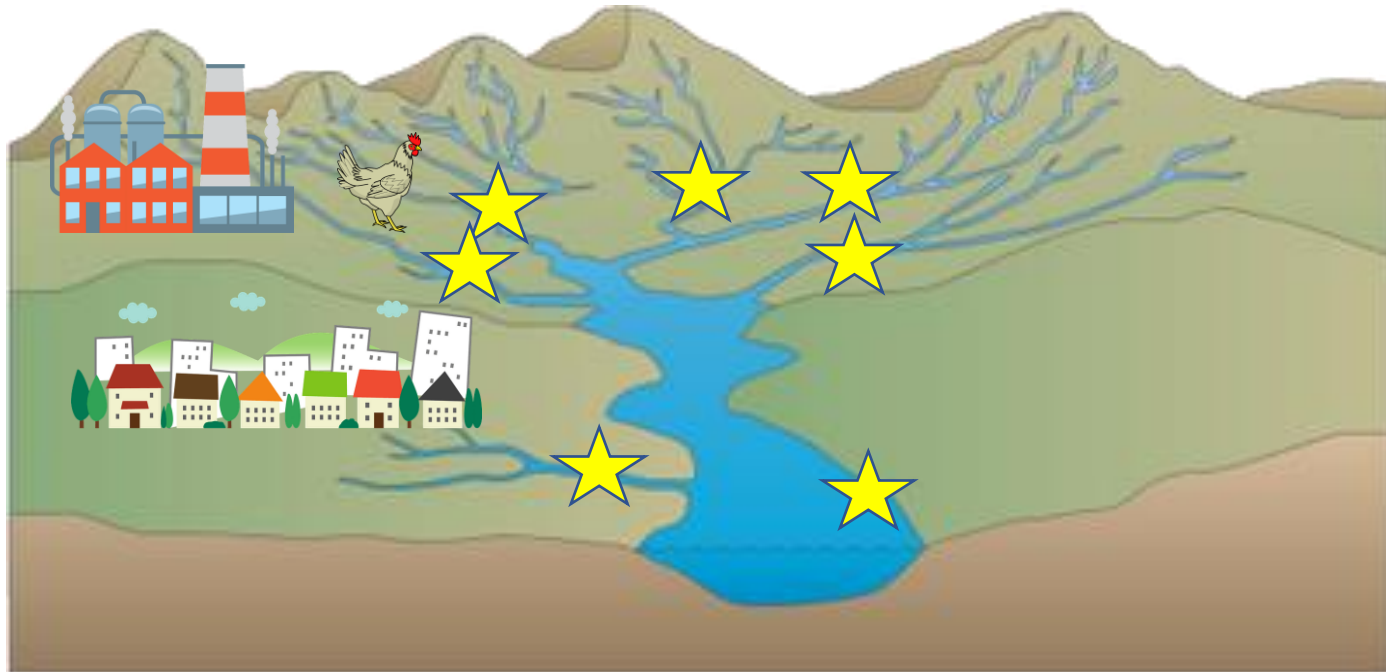
Potential of citizen science

Raise awareness and promote responsibility

Fill in the gaps

Identify problem areas

What can we NOT measure?

Statutory monitoring

- Requires accredited data

Nutrient fractions

- Different methods for different fractions

'Failures' of SAC targets

- Accuracy insufficient

Annual limits

- Concentration vs. loading

Citizen science data quality

Not standardised or governed

Resource-limited

Difficult to access

→ Viewed as 'untrustworthy'

| Accurate Precise | Not Accurate Precise | Accurate Not Precise | Not Accurate Not Precise |

Our aims

1
Understand precision and accuracy of citizen data methods

2
Improve reporting and accessibility of citizen science data

3
Promote understanding of water quality parameters

Jan 2021: funding obtained for NERC Engagement Project to put research into action

What can we measure?

Electrical conductivity
- Proxy for total dissolved solids: how much stuff is dissolved in the water

Temperature
- Driver of biological and geochemical processes

pH (potential hydrogen)
- Acid or alkali. Control of biological and geochemical processes

Dissolved oxygen
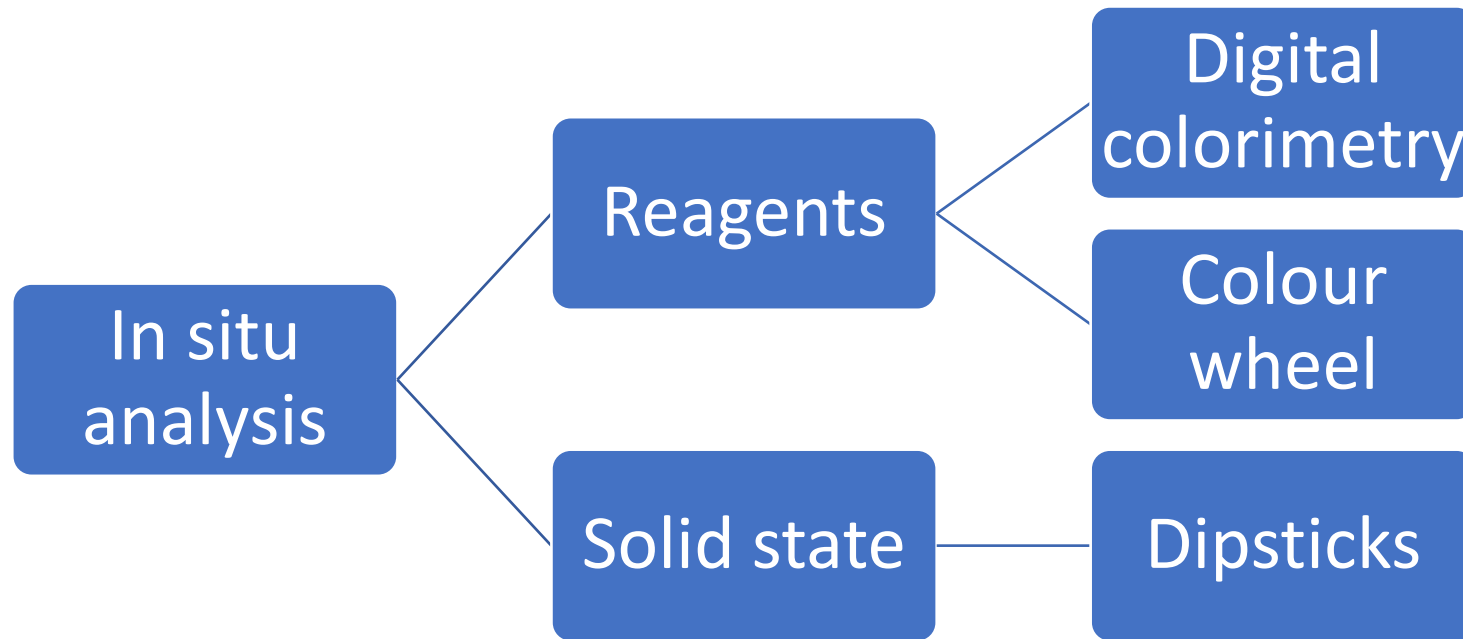- Control of biological processes, indicator of ecosystem health

Nutrients
- Control of biological processes, indicator of ecosystem health

Discharge
- Volume of water in river. Water level + speed.

Nutrient testing

In situ analysis
- Reagents
  - Digital colorimetry
  - Colour wheel
- Solid state
  - Dipsticks

The Wye catchment collaborative monitoring network

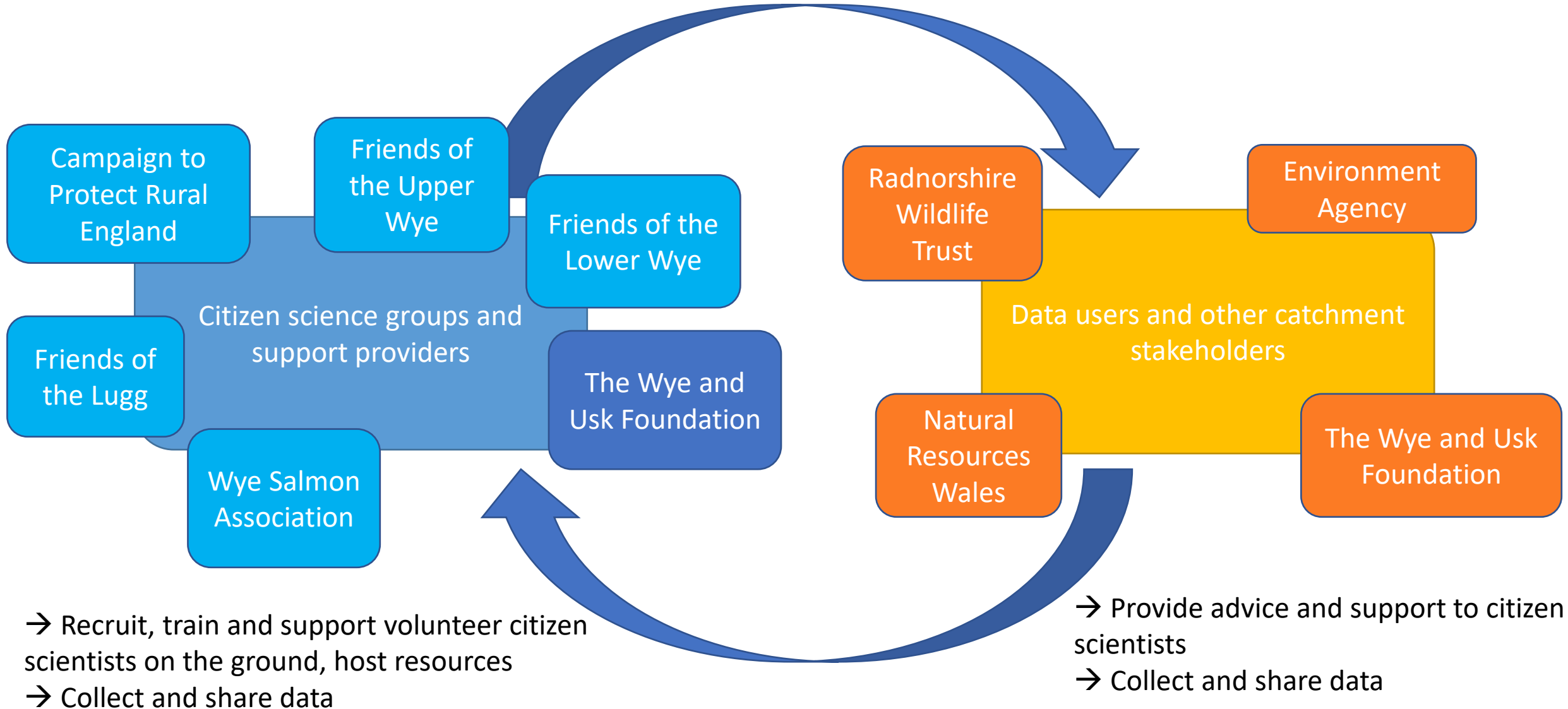Present a collaborative approach to citizen science monitoring

Share resources and learning

Make standardized citizen science data available to those who can use it to influence change

The network structure

Campaign to Protect Rural England

Friends of the Upper Wye

Friends of the Lower Wye

Citizen science groups and support providers

Friends of the Lugg

The Wye and Usk Foundation

Wye Salmon Association

Radnorshire Wildlife Trust

Environment Agency

Data users and other catchment stakeholders

Natural Resources Wales

The Wye and Usk Foundation

→ Recruit, train and support volunteer citizen scientists on the ground, host resources
→ Collect and share data

→ Provide advice and support to citizen scientists
→ Collect and share data

Cardiff's role in the network this year

Facilitated the development of the network

Helped standardize citizen science monitoring equipment, methods and approach to data collection
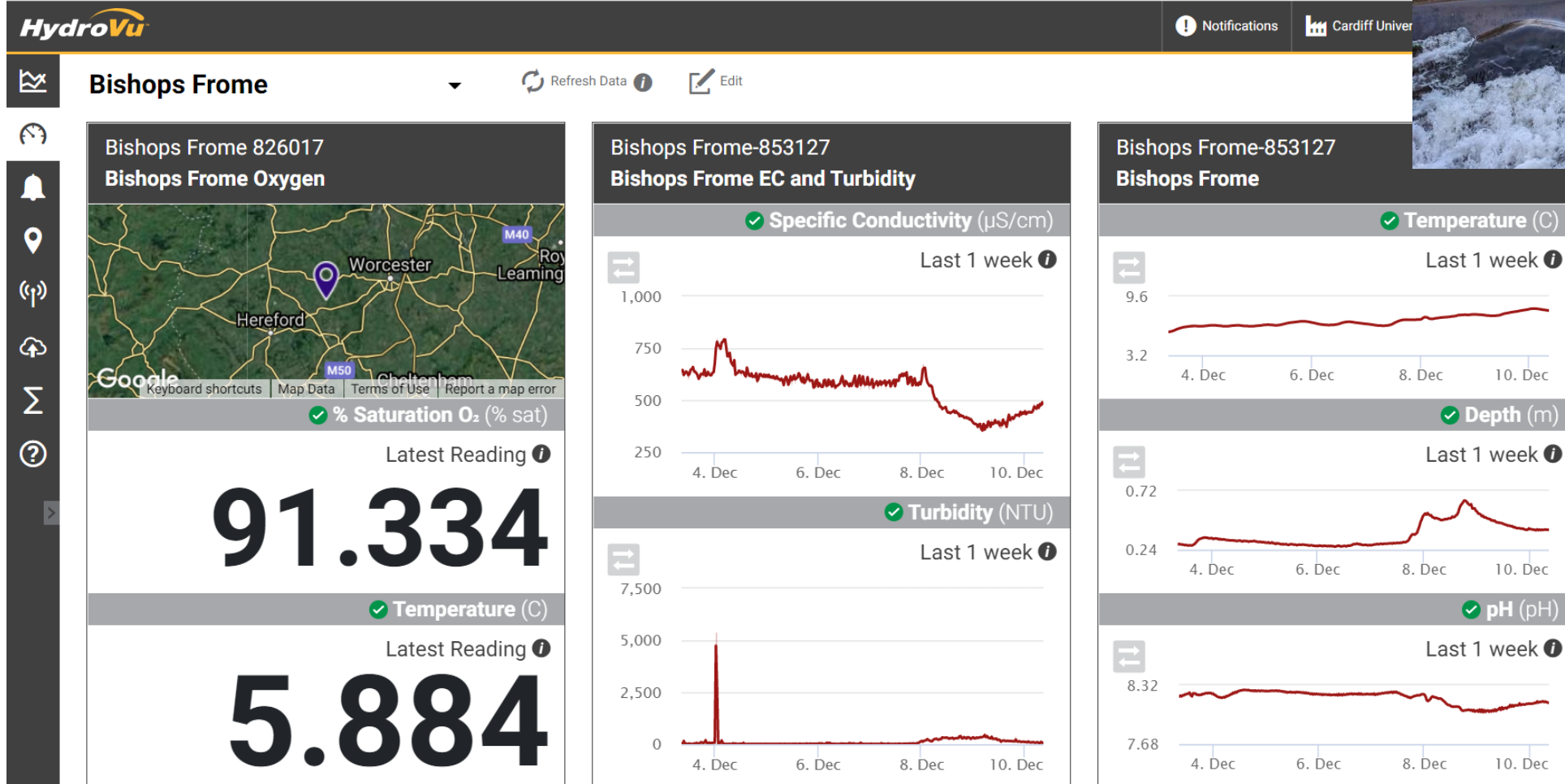
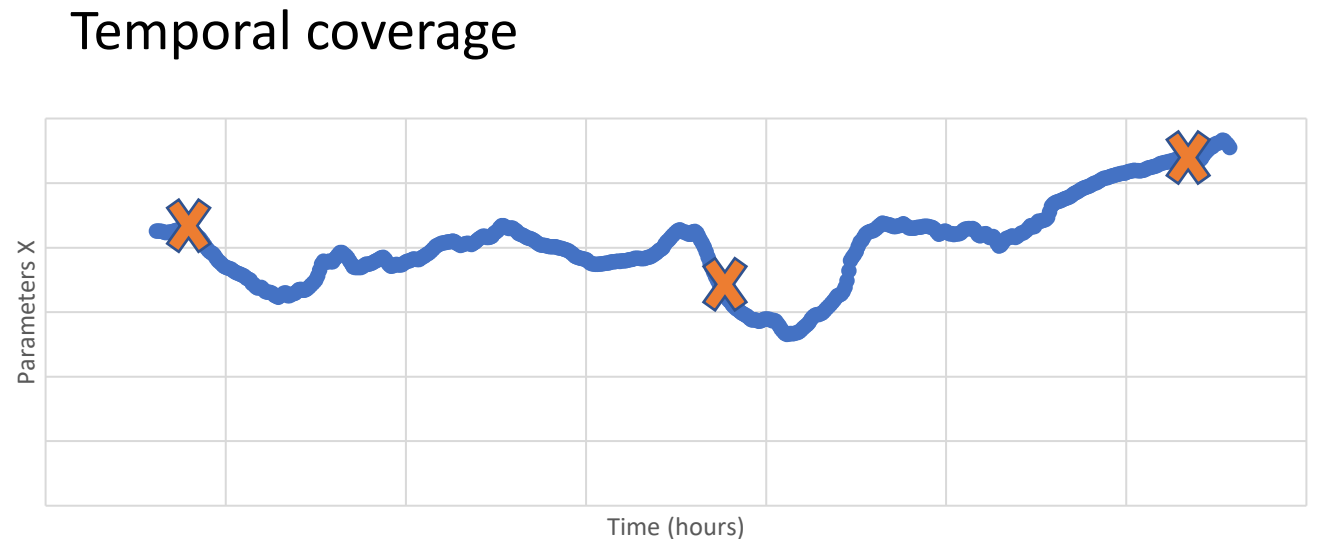Provided technical training, guidance and support to volunteer coordinators

Provided guidance to help data users and citizen scientists understand the data

Live data collection in catchment

Empower citizen scientists to deliver benefits for decision makers and agencies

Spatial coverage

Temporal coverage

Provide information to improve the quality of our environment