

Inspiring environmental monitoring in Scotland; a review of innovative approaches to monitoring the aquatic environment

KEY FINDINGS

- Regulatory objectives are driving innovation within aquatic monitoring, resulting in diverse methodologies delivering to national and regional strategies.
- The specific monitoring objective – such as informing short-term interventions, or determining cause of failure – often determines the method employed.
- Broad areas of innovation are identified. Notably increased use of satellite and radar data with methodologies capable of increasing spatial and temporal data density, such as that seen in Estonia and Norway.
- The use of tiered assessment methods and involvement of citizens in gathering low cost data is becoming commonplace, as are eDNA methods.
- More attention is being paid to risk assessment of emerging contaminants (or substances of high concern) through effect based monitoring and innovative screening methods such as the non-target analytical method used in Norway.
- These approaches should be considered in the specific context of the Scottish and UK requirement.
- Alongside 'added value' of the new methods, added value of current methods must also be considered.
- Interdisciplinary, interdepartmental collaboration and co-construction of monitoring programmes is evident from data, literature and conversations with actors.
- Changing data collection methods for data used in trend monitoring may impact data continuity.



BACKGROUND

Regulatory and management decisions made by the Scottish Environment Protection Agency (SEPA) are based on evidence from a variety of sources, including environmental monitoring data. SEPA's aquatic monitoring has evolved in response to changes in the environment, policy priorities and financial constraints. Previous strategic reviews have considered aquatic monitoring; however existing networks had a strong influence on the outputs of these. With the start of monitoring for the second cycle of the River Basin Management Plan in 2016, there is an opportunity thoroughly reflect

on why and how SEPA monitors. To inform this, CREW commissioned an international review of monitoring networks, to identify and summarise innovative and radical approaches. The focus was on nation-wide monitoring networks, ideally those with similar objectives to the WFD monitoring carried out in Scotland, the UK and across Europe.

The need for innovation appears greatest for investigative monitoring because traditional monitoring methods cannot always reveal why water bodies fail to reach quality standards.

RESEARCH UNDERTAKEN

In parallel to a literature review, we sought information from networks of contacts across the EU, supplemented by interviews with those leading monitoring strategy development and implementation. The approach was that of an invitation for interviewees to share experiences. It is recognised that the number of interviews is limited meaning that the list of monitoring activities identified is not exhaustive. The qualification of 'innovative' was

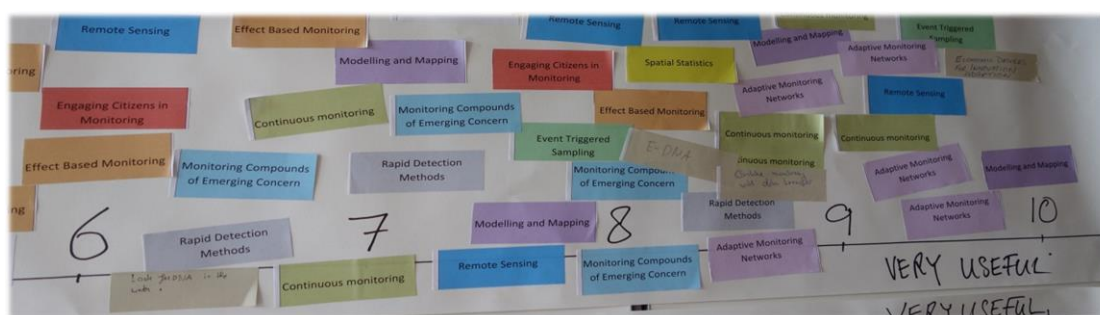
largely left with the respondents. Certain areas, such as biological scoring systems, were mentioned by a few respondents but have not been covered in detail; this may be a topic area for further investigation. The focus of the project is on surface waters and to a lesser extent coastal and transitional waters; only one response about groundwater was received.

The information gathered from the interviews informed the design of a workshop, held at Glasgow Caledonian University's offices in London. Here, representatives from eight countries including the USA came together to discuss innovative monitoring and exchange expertise. The outputs from the research activities (literature review, interviews and workshop) informed the detailed project report.

THE FUTURE OF MONITORING

Interviewees and workshop attendees were asked their vision for the future of aquatic monitoring:

- More attention for mixture toxicities, effect-based sampling tools and ecosystem functioning.
- Incorporating biomarker technology in biological quality elements.
- Integrated monitoring of chemical, biological and hydro-morphological data to enable measures towards improved ecological quality.
- Further application of remote sensing technologies, including (aerial) drone technologies and higher resolution satellite data.
- Use of combined datasets from image data, automated measurements and classic sampling; combining radar systems with ground based data.
- A network of fixed automated analysers, satellite and drone systems, delivering data (almost) in real time.
- Data mining of existing datasets, advances in mapping, increased data sharing, including cross-disciplinary.
- Accurate and cost-efficient monitoring using eDNA techniques; further research to deal with issues of transport, quantification and intellectual property issues associated with the method.
- Increased engagement of citizens in water policy.



RESEARCH TEAM AND CONTACTS

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