Written evidence from the UK Centre for Ecology & Hydrology

Introduction

1. The UK Centre for Ecology & Hydrology (UKCEH) is grateful for the opportunity to provide evidence to the EAC's inquiry into water quality in rivers.

2. UKCEH is an independent, not-for-profit research institute carrying out excellent environmental science with impact. Our 500 scientists work to understand the environment, how it sustains life, and the human impact on it. We are a world-leading centre for water science and specialise in investigating, monitoring and modelling environmental change. For the last 50 years, we have provided the data that industry, government and regulators need to manage the UK's freshwater environment.

3. Our science is independent and impartial. We are members of the UK Water Partnership, an affiliate of Scotland's Centre of Expertise for Water, and contribute to Dŵr Cymru / Welsh Water's Independent Environmental Advisory Panel. We carry out research for a wide range of clients, including Defra, the Environment Agency, UK Water Industry Research, as well as for individual water companies and water quality campaigning groups.

4. UKCEH has decades of experience in monitoring the water quality of rivers. We have considerable expertise in the monitoring of nutrients and algae, emerging contaminants, microplastics, pathogens and organic pollutants. We have studied a wide range of chemicals and substances discharged in wastewater including engineered nanoparticles, metals, POPs, pharmaceuticals, personal care products and antimicrobials. We develop innovative tools for identifying, monitoring and modelling the sources and fate of pollution, which help to understand how freshwater bodies and ecosystems are likely to be impacted.

5. We hope that this response is helpful, and we would be happy to discuss any of the evidence with the Committee.

Questions

- **What are the best indicators for river water quality that could be used as targets being developed under the Environment Bill?**

A. Nutrients and general water quality

The Environment Agency (EA) measure a huge array of chemical pollutants in UK rivers. Their focus on dissolved phosphate, dissolved oxygen, pH and ammonium is sensible and should continue. The EA's monthly monitoring regime has been reduced to seasonal sampling at many sites in recent years, and this is not adequate to capture storm events and sporadic pollution incidents. Dissolved oxygen concentrations in particular vary greatly over the daily cycle, especially during algal blooms. Low oxygen concentrations can cause fish kills tend to occur overnight, and are therefore missed by routine EA manual sampling (Skeffington et al. 2015). Dissolved oxygen, pH and ammonium can now be reliably monitored on an hourly basis using water quality probes, and this technology could deliver accurate pollution and DO concentration data, and provide early warnings of pollution incidents.

B. Hazardous and emerging contaminants

Chemical monitoring remains valuable but should include AMR-driving chemicals such as antimicrobials, metals and biocides. For some metals and persistent organic pollutants such as brominated flame retardants, biomonitoring is most useful – for example, measuring the concentration of chemicals in fish tissue – as these are often difficult to measure in the water but they slowly build up over time in the tissue of relatively long-lived creatures. There are very sound reasons for wanting to reduce plastic and microplastic pollution of the environment (see below), but the toxic risks of these substances still appear to be generally low.

C. Biological indicators

It is vital to maintain consistent, long-term monitoring of populations of freshwater biota (including algae, invertebrates and fish), both at sites exposed to pollution and sites less exposed to pollution along British rivers. Monitoring the resident wildlife over time is essential to gauge the impacts both of urban populations and agriculture on the health of our freshwater environment, and to ensure there is no deterioration in ecological status. This monitoring illustrates whether we are achieving a healthy and biodiverse ecosystem.

D. Human pathogenic microorganisms

Increased use of our waterways for recreational use has seen recently increased scrutiny of the biological risk associated with waterborne pathogens. To minimise the risk of the spread of harmful

microbes, it would be valuable to monitor pathogenic, enteric and antimicrobial resistant (AMR) microorganisms in rivers, especially in areas of high use by human populations. These microorganisms can indicate the nature, source, and frequency of pollution, and provide evidence of risk to humans through exposure from recreational activities (Leonard et al., 2018).

E. Discharges and runoff

The management and responsibility of road runoff discharges needs more research into the effects of this form of pollution (see below for further information and for further information on water company discharges).

F. Development of novel approaches

We encourage the use of novel approaches to increase the quality, scope and cost-effectiveness of water quality monitoring programmes. Such approaches include the use of environmental DNA for biological monitoring, passive sampling for chemical monitoring, and the use of citizen scientists to supplement national monitoring by environmental regulators. Citizen scientist approaches can engage the public in protecting their local areas of the freshwater environment. Exemplars upon which to build such a network are being drafted and developed by the Rivers Trust with guidance from UKCEH https://catchmentbasedapproach.org/

- **How could drainage and sewage management plans, introduced by the Environment Bill, play a role in reduced sewer discharges?**

A priority needs to be placed on ensuring planning permission is contingent on capacity existing in the sewage network, or on such capacity being built prior to new developments being completed. Sustainable drainage schemes are a critical factor that can help to alleviate the pressure sewage systems experience from rainfall runoff. Leakages from sewerage and mains water pipes (Gooddy et al., 2017) both can result in significant phosphorus inputs to rivers, with potential impacts on aquatic ecology.

- **How adequate are the monitoring and reporting requirements around water company discharges? How can technology improve and assist with transparency and enforcement?**

We have seen major improvements in the water quality of UK rivers since the late 1990s. Phosphorus concentrations in particular have seen large decreases in many rivers, primarily due to Water Company investment in upgrading sewage treatment works. However, current research indicates that, in many major UK rivers, the majority of phosphorus pollution during the ecologically-sensitive spring to summer period is still derived from point source discharges (Bowes et al., 2014). Therefore, further targeting of Sewage Treatment Work (STW) inputs is a sensible policy in many catchments.

The routine regulatory testing of STW effluents is very intermittent, and a monthly sampling interval is very unlikely to detect STW failures. The sampling of combined sewer overflows is even less frequent. The use of multi-probe Sondes with telemetry to detect ammonium, turbidity and dissolved oxygen concentrations in effluents at hourly frequencies, alongside flow gauging, could provide an accurate estimate of pollution loadings coming from STWs, an early warning system to detect STW failures and provide the key data for researchers to evaluate the impact of CSOs on downstream river water quality and ecology.

- **What is the impact of plastic pollution and other materials on drainage and water quality in rivers and what should be done to mitigate it?**

The field of microplastic toxicity remains in its infancy, but the limited research carried out to date does not imply great toxicity, nor that levels are exceeding what may be considered toxic thresholds in freshwater (Connors et al., 2017). However, macroplastics are a problem for individual creatures and can lead to strangulation or starvation. Even if their long-term harmful consequences are as yet unclear, their extraordinary persistence, predicted to be over 500 years, is an important consideration in looking for greater control. Reducing uncontrolled waste loss is a societal challenge, but it should be noted that UK wastewater treatment prevents 99% of microplastics from reaching rivers (Horton et al., 2021). However, by retaining it in the sludge fraction, most if which is then applied to agricultural land as fertiliser, there is a risk of it eventually returning to freshwater bodies. More research is needed to be done to understand other pathways of plastics entering rivers, including from land treated with sewage sludge and agricultural practices that generate plastic waste in the environment.

- **What is the required investment level needed to minimise storm overflows vs the scope for sustainable drainage and nature-based solutions?**

No comment.

- **How effective are the planning policy and standards around sustainable drainage systems to reduce urban diffuse pollution in England?**

No comment.

- **Should local authorities and highways agencies be given a duty to prevent pollution to watercourses without prior treatment?**

The ownership, management and regulation of road runoff to waters is unclear. In particular, the impacts of the mix of toxic chemicals and microplastics associated with road runoff remains unknown and is an oversight in our understanding of the health of the UK freshwater environment. A clearer partnership between local authorities, highways agencies and the EA is needed to manage the situation effectively. There is a need for further research into the impacts of road runoff on local freshwater biodiversity, as no significant UK public research has occurred over the past 30 years to our knowledge. However, recent evidence in America has shown highly toxic chemicals originating from tyres are responsible for the loss of salmon in key rivers in the northwest (Tian et al. 2020).

- **How effective is Ofwat's remit and regulation of water companies? Does it facilitate sufficient investment in improvements to water quality, including sustainable drainage systems and nature-based solutions such as constructed wetlands?**

From the research point of view, Ofwat continues to support the water industry in funding the chemical investigation programme (currently CIP3). We welcome the recently launched Ofwat innovation fund which will hopefully support research in these areas.

- **How could the designation of inland bathing waters by water companies affect the costs of achieving the associated water quality standards?**

Achieving bathing water standards for enteric and pathogenic organisms in rivers would be a major challenge, due to the high population density in many parts of the UK. The composition, sources and distribution of pathogenic microbes in rivers are not well understood. Although the water industry contributes to microbiological water quality (primarily through treated and untreated wastewater

discharges), other sources of pathogenic microbes include diffuse urban run-off, livestock and wildlife. We urge that more research is done to better understand the relative contribution of the water industry to microbiological water quality, to guide appropriate interventions to be made if necessary.

References

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