Water Quality Research in the Arctic

Researchers at the University of Brighton are using Aquaread equipment to monitor river water quality in the extreme environments of the Arctic, including one of Europe's best salmon rivers, in a bid to understand the contrasting water quality requirements of different freshwater ecosystems. The ECOFORS project, which is funded by the European Union's INTERACT funding scheme, builds on an existing collaboration between Aquaread and researchers at the University of Brighton, led by Dr Gary Bilotta and Magdalena Grove of the School of Environment and Technology.

"The Arctic research project will be supported by state-of-the-art monitoring equipment provided by Aquaread Ltd, an award-winning designer and manufacturer of water quality monitoring equipment"

The researchers will be monitoring the water quality of pristine rivers in northern Iceland and northern Finland. The project will add to existing water quality research, by Dr Bilotta and PhD student Magdalena Grove, in pristine rivers in the more temperate climate of the UK. These pristine rivers are being used as models of the water quality required to support different freshwater communities in catchments with contrasting environmental characteristics, including climate and geology.

The research will feed into the development of improved water quality guidelines to support healthy freshwater ecosystems – a requirement of the European Union's Water Framework Directive legislation.

Dr Bilotta said "Freshwater ecosystems are incredibly valuable, providing humans with ecosystem services worth more than $1.7 trillion per annum, but these ecosystems are currently threatened by water pollution. One of the most common forms of water pollution is excessive levels of particulate matter, from nano-particles to sand-sized sediments. The transport of particulate matter by rivers to the oceans represents an important process of the global erosion process, an important component of global biogeochemical cycles, and is an essential constituent of freshwater ecosystems, critical to habitat heterogeneity and ecological functioning. However, when human activity causes a significant deviation in the dynamics of particulate matter from 'natural' or 'reference condition' dynamics, this can cause ecological degradation. Ultimately, this can lead to a significant decline in the associated ecosystem services. It is therefore essential that particulate matter is managed in order to minimise these impacts. However, at the moment we have a poor understanding of what the 'natural' or 'reference condition' dynamics of particulate matter should be in a given environment. Current water quality guidelines, which are designed to manage this pollutant and protect a whole range of different freshwater communities, are often blanket guideline values with limited ecological basis. Our research aims to address this and improve current water quality guidelines so that firstly they reflect the natural variation in water quality that should be expected in different types of environments, and secondly they are more closely aligned to what is needed to sustain different communities of freshwater organisms".

According to existing water quality guidelines for particulate matter in Europe, concentrations should not exceed 25 mg per litre in waters suitable for salmonid and cyprinid fish. However, recent research led by Dr Gary Bilotta, in which the team examined background concentrations of particulate matter in 638 reference condition stream and river sites in the UK (representing 42 different freshwater ecosystem types), demonstrated that levels of particulate matter vary significantly among different ecosystem types. For instance, in one ecosystem type, which is home to the Atlantic salmon, the particulate matter levels were 15 times lower than the current guideline, but in another ecosystem type the levels exceeded the guideline level, despite the ecosystem being in a healthy state.

The researchers believe that this initial study shows that specific quality guidelines are needed for different ecosystems because in some ecosystems the particulate matter provides organisms with a food source and the habitat that the organisms need to live and breed in, whilst in other ecosystems particulate matter can harm organisms, even when at relatively low concentrations.

This previous research has already attracted the attention of European policymakers. It has big implications for those involved in managing land use and water quality across Europe because under European legislation land owners and water users who are perceived to be contributing to the failure of a waterbody to meet water quality guidelines, may face fines and have to contribute to clean-up costs.

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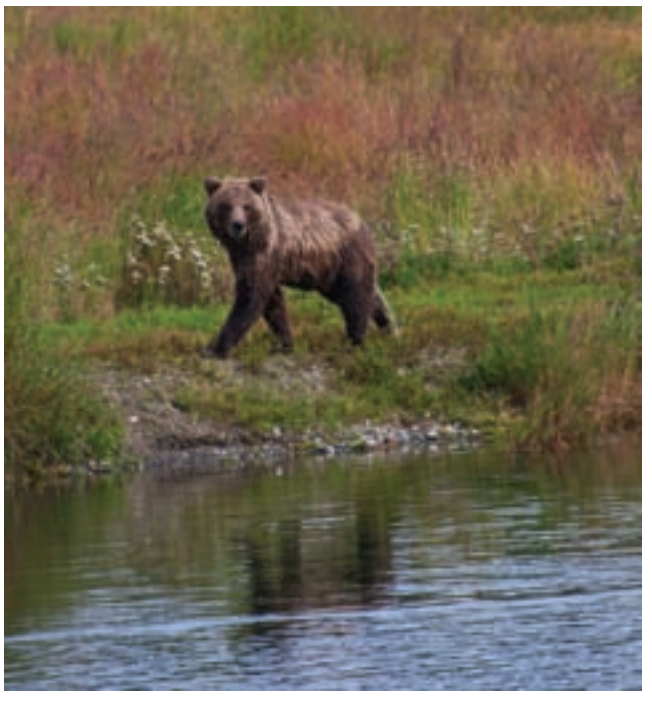

Example of wildlife common at some planned testing sites

The researchers are now developing a tool for setting ecosystem-specific water quality guidelines. This will only be achieved through high-resolution monitoring of particulate matter in natural or reference-condition rivers, in a range of environments/climates, including the colder climates of the Arctic.

The Arctic research project will be supported by state-of-the-art monitoring equipment provided by Aquaread Ltd, an award-winning designer and manufacturer of water quality monitoring equipment. The team will be using Aquaread's AP-2000 multi-parameter water quality testing probe, which will be installed in-situ within the water column of each river. The Aquaprobe will be recording turbidity (a surrogate measure of particulate matter), dissolved oxygen, pH, total dissolved solids, and temperature on a 15 minute resolution. The data will be logged with Aquaread's Aqualogger that will be installed streamside with thermal insulation to protect the electronic device from the extreme Arctic climate where mean annual temperatures at the sites are around just 2°C and winter temperatures can get as low as -30°C. Each reference site will be monitored continuously for at least one year to capture temporal variations in water quality. The Aquaprobe and Aqualogger will connected by cables that will be fixed in place and protected from Arctic wildlife such as bears and reindeer.

Dr Bilotta was asked how Aquaread's water testing equipment was best suited for the research project "Aquaread's equipment has proven to be rugged and reliable in the range of environments that we have used them within for our previous research and teaching. The design of the Aqualoggers and Aquaprobes also allow us to be flexible in terms of our installation for in-situ monitoring, which is really important given the contrasting nature of our rivers".

To find out more about the research see: Developing environment-specific water quality guidelines for suspended particulate matter, Water Research Volume 46 Issue 7 May 2012.

You can also follow Dr Bilotta on Twitter @GaryBilotta.