An urgent need for standardised monitoring of Arctic freshwaters

Heino et al.'s recent Policy Direction **provides an approach to freshwater biomonitoring that could equip us to manage the effects of climate change in the Arctic. Associate Editor, Robert Britton highlights the work as our latest *Journal of Applied Ecology* Editor's Choice.**

Anthropogenic climate change is not resulting in uniform warming rates across the world, with some regions increasing in temperature faster than others. This is exemplified by the accelerated warming of Arctic regions – the 'Arctic amplification' – where climate feedback mechanisms are resulting in relatively high temperature increases. In highlighting the biological implications of this warming for Arctic freshwaters, Heino et al. identify that the current freshwater biomonitoring approaches are inadequate for measuring responses to this warming, and require urgent change if appropriate ecological and socio-economic management approaches are to be developed.

The cold-water habitats of the Arctic are naturally oligotrophic and can support surprisingly diverse biota. The uniqueness of the region is emphasised by it having some of the largest remaining undammed rivers in the world. This is coupled with both its river and lake ecosystems supporting novel flora and fauna that is only maintained through ecological connectivity and the prevailing environmental conditions. These systems are not only imperilled by accelerated warming, but also from multiple anthropogenic stressors including land-use alterations, permafrost thaw, and eutrophication and brownification.

Warming is also resulting in the replacement of northern species with more southern species that are expanding their ranges. This is rapidly altering the biota of these freshwater systems and the ecosystem services they support. This includes the loss of fish species that are traditionally harvested by Indigenous Peoples, with suggestions of radical changes in the near future to their livelihoods, and physical and cultural well-being. While Heino et al. suggest that reversing this trend will be difficult, monitoring data on freshwater biodiversity and ecosystem services can model predicted changes and socio-economic impacts, both of which are important to plan for, and adapt to, these environmental changes.

However, the authors emphasise that, while regional monitoring exists at small scales, this is applied inconsistently between countries, resulting in a shortage of standardised monitoring data. A lack of baseline data then makes it close to impossible to predict changes in ecosystem services. To overcome this, Heino et al. propose a new three-step monitoring approach for measuring rapid ecological changes in Arctic freshwater ecosystems. Their first step is to establish a network of monitoring sites across all Arctic countries which are surveyed using standardised methods to establish broad-scale baseline data that are then used in the second step that enhances predictive modelling approaches to incorporate ecological change and socio-economic development, and predict the species, ecosystems and geographical areas that will respond most quickly to change. Underpinning these efforts is the third step, where scientists forge stronger collaborations with policymakers, and engage with different stakeholder groups, especially Indigenous Peoples.

The article by Heino et al. thus proposes a freshwater biomonitoring approach that, if adopted, will better enable the effects of climate change on the Arctic freshwaters to be detected and, in the long-

term, better managed. It highlights that routine monitoring using standardised methods should focus on generating data capable of predicting the impact of change that, when coupled with increased collaboration, should deliver enhanced environmental management. Indeed, these principles on effective monitoring and climate change management arguably have high global relevance too.

***Originally posted on** The Applied Ecologist*

Metadata

Summary author: Robert Britton

Heino, J, Culp, JM, Erkinaro, J, et al. Abruptly and irreversibly changing Arctic freshwaters urgently require standardized monitoring. *J Appl Ecol*. 2020; 57: 1192– 1198. https://doi.org/10.1111/1365-2664.13645