Novel tool for the assessment of salinity in fresh-water habitats

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The salinisation of fresh-water habitats is a growing threat to biotic communities. To protect the biodiversity and ecosystem services and goods associated with these systems, effective monitoring is essential. Here, researchers present the Salinity Association Group Index (SAGI), a novel tool for the assessment of salinity in fresh-water habitats. Three case studies demonstrate how SAGI can enhance our understanding of salinity-mediated ecological impacts on aquatic macroinvertebrate communities.

Salinisation is a global threat to fresh-water habitats that is predicted to intensify with climate change. Increases in salinity can result in substantial modification of fresh-water biotic communities through both direct effects (such as toxicity) and indirect effects (such as altering prey resources, competitive interactions, predator abundances, and facilitating the spread of invasive species). The monitoring and management of at-risk habitats is, therefore, essential. Salinity can be inexpensively and effectively determined using traditional monitoring techniques, such as point-sampling chemical assessment. However, these techniques are typically periodic, meaning intermittent changes in salinity concentrations may be missed. Moreover, such methods do not show the ecological consequences of salinity increases in fresh-water habitats. Complementing traditional techniques with biological assessments may help to resolve these issues. This study introduces the Salinity Association Group Index (SAGI), a novel index for the assessment of salinity increases on fresh-water macroinvertebrate communities. The tool uses the presence and abundance of different macroinvertebrate taxa in a fresh-water biological pond-net sample to determine the ecological effect resulting from changes in salinity. First, individual taxa are assigned to one of five salinity association groups (SAGs) based on their known association with salinity. A SAGI score is then calculated for the sample that accounts for the SAGs and abundance of all taxa present. The researchers illustrate the application of SAGI using three case studies, carried out in England at different temporal resolutions. The researchers collected data where salinity was considered to be the greatest stress on the ecological communities. The case studies were chosen because they were known to be affected by saline ingress. The results show that SAGI is an effective and robust metric in reflecting changes in the macroinvertebrate community structure resulting from changing salinity in natural conditions, such as tidal waters. The researchers demonstrated SAGI's efficiency as an effective evidencegathering tool under different scenarios - including across multiple sites along a river length and salinity gradient, and for a single site subject to saline ingress over multiple decades. The researchers also found that the index was highly effective in comparison to alternative salinityspecific biotic indices adapted for use with this dataset. Based on these findings, the researchers propose SAGI as an effective tool for application in future monitoring programmes and investigations, applicable in areas of coastal water inflow. They note that the index is compatible with data derived from established survey techniques employed by regulatory bodies and for Water Framework Directive assessments, amongst others.

By assessing the response of macroinvertebrates to changes in water salinity, relevant decisionmaking institutions can identify sites of risk and take appropriate steps towards conservation and management of fresh-water habitats more accurately and quickly.

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