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Optimising complex decision-making under uncertainty: application of a novel multi-agent decision support tool to inform climate resilience of finfish freshwater aquaculture in Scotland.

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Abstract

Decision support tools can be applied to enhance collaborative decision-making in complex systems (Wagener et al., 2022) such as freshwater administration on islands (Karnauskas et al., 2016). Despite the prevalence of decision support tools, existing solutions often fall short in adequately incorporating multiple stakeholders' perspectives and addressing uncertainties. We developed a novel multi-agent decision support tool to address this gap. The SEAD (Stakeholder interaction, Elicitation, Analysis, Dialogue) method uses a Multi-agent Influence Diagram (MAID) framework to enable the quantification of different stakeholder perspectives and values while accommodating various scenarios, such as climate change.

We applied the SEAD method to the freshwater finfish aquaculture industry in Scotland to understand climate vulnerability, adaptation and resilience pathways for different climate futures. In total, 6 stakeholders participated in the study, which included representatives from insurance, regulation, and industry bodies. The SEAD tool explicated how stakeholder values differed, and interactions between and implications of different stakeholder decisions. Through exploration of different climate risk scenarios, cooperative decision pathways were identified, including key focal points for climate adaptation and resilience measures. Our findings highlight the additionality of collaboration among stakeholders involved in freshwater-reliant industries on islands, and the value of innovation in freshwater administration processes, both in terms of technological advancements and conceptual approaches to better capture the value of freshwater resources on islands.

The SEAD method could be used for a range of contexts and applications, such as to enhance innovation within collaboration, governance and stewardship of water.

References:

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