

## **Integrating governance with quantitative evaluation of resource management strategies to improve social and ecological outcomes**

Managing a fishery involves a complex suite of interacting ecological, political, and social factors. Accounting for each of them when making decisions can be difficult. Consider the broad concept of governance. Governance, write Derek Armitage and his Ocean Modeling Forum (OMF) co-authors in new work, refers to the ways institutions and social interactions shape cultural preferences, inform who can make decisions about natural resources, and influence what will be considered acceptable politically, economically, and environmentally. But despite being an integral factor in natural resource management, governance is rarely incorporated in the quantitative tools used to evaluate fisheries management actions.

Overlooking governance can have substantial consequences, including diminishing the usefulness and accuracy of stock assessments, as well as leading to unanticipated outcomes. Using the Pacific herring as a test case, Armitage et al. set out to show the benefits of including governance in quantitative evaluation and simulation modeling. Because governance as an idea is somewhat diffuse, even as it has known, measurable attributes, the authors used two surrogate terms in its place: compliance and inertia. *Compliance* is the degree to which resource harvesters are willing to follow the rules set out for them. *Inertia*, on the other hand, is the failure of resource managers to adapt their rules in response to new information or changing conditions.

Armitage et al. then built a heuristic model of governance, compliance, and inertia in a fishery management scenario based on the herring fishery at Haida Gwaii, British Columbia. They evaluated scenarios in which compliance was high and inertia was low (i.e., most fishers complied with the rules, and managers were responsive to changing conditions), and also the reverse.

Although the model was simplified, the authors demonstrated that making even a casual attempt to incorporate governance went a long way to highlighting areas of potential friction, which in turn could lead to, they write, “undesirable or unanticipated ecological and social trade-offs.” Both compliance and inertia significantly altered the frequency of fishery closures, for example. The simulated fishery closed about 10% of the time in a high-compliance / low-inertia scenario; decreasing compliance and increasing inertia markedly increased closure frequency. The effects were similar for the collapse of the fishery. “This demonstrates that excluding governance from management strategy evaluation has the potential to lead to biased estimates of risk and returns,” the authors write.

Compliance and inertia are not the only attributes of governance that have the potential to influence outcomes of quantitative evaluations or management strategy evaluations. Armitage et al. point out that legitimacy of the decision process is another important consideration, though it was not modeled explicitly in this exercise. “The credibility of quantitative evaluation approaches hinges on the extent to which decisions are considered legitimate,” they write. “Outcomes that are perceived as ‘illegitimate’, or that undermine trust among harvesters, Indigenous peoples and coastal communities, scientists and decision makers, are far more likely to limit opportunities to identify desired outcomes (i.e., increased compliance and less inertia, less conflict, increased stock health).” Armitage and co-authors demonstrate that governance attributes can affect fisheries management outcomes, and that they can be explicitly included in quantitative fisheries approaches.