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TITLE: Mechanisms and risk of cumulative impacts to coastal ecosystem services: An expert elicitation approach

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ABSTRACT:

Coastal environments are some of the most populated on Earth, with greater pressures projected in the future. Managing coastal systems requires the consideration of multiple uses, which both benefit from and threaten multiple ecosystem services. Thus understanding the cumulative impacts of human activities on coastal ecosystem services would seem fundamental to management, yet there is no widely accepted approach for assessing these. This study trials an approach for understanding the cumulative impacts of anthropogenic change, focusing on Tasman and Golden Bays, New Zealand. Using an expert elicitation procedure, we collected information on three aspects of cumulative impacts: the importance and magnitude of impacts by various activities and stressors on ecosystem services, and the causal processes of impact on ecosystem services. We assessed impacts to four ecosystem service benefits ? fisheries, shellfish aquaculture, marine recreation and existence value of biodiversity?addressing three main research questions: (1) how severe are cumulative impacts on ecosystem services (correspondingly, what potential is there for restoration)?; (2) are threats evenly distributed across activities and stressors, or do a few threats dominate?; (3) do prominent activities mainly operate through direct stressors, or do they often exacerbate other impacts? We found (1) that despite high uncertainty in the threat posed by individual stressors and impacts, total cumulative impact is consistently severe for all four ecosystem services. (2) A subset of drivers and stressors pose important threats across the ecosystem services explored, including climate change, commercial fishing, sedimentation and pollution. (3) Climate change and commercial fishing contribute to prominent indirect impacts across ecosystem services by exacerbating regional impacts, namely sedimentation and pollution. The prevalence and magnitude of these indirect, networked impacts highlights the need for approaches like this to understand mechanisms of impact, in order to develop strategies to manage them.

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