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TITLE: Effects of model assumptions and data quality on spatial cumulative human impact assessments

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ABSTRACT:

Abstract Aim Many studies have quantified and mapped cumulative human impacts on marine ecosystems. These maps are intended to inform management and planning, but uncertainty in them has not been studied in depth. This paper aims to: (1) quantify the uncertainty in cumulative impact maps and related spatial modelling results; (2) attribute this uncertainty to specific model assumptions and problems with data quality; (3) identify and test sound approaches to such analyses. **Location** We used the Baltic Sea and the Mediterranean and Black Seas as example regions. The methods and conclusions are relevant for human impact mapping anywhere. **Methods** We conducted computational experiments to test the effects of nine model assumptions and data quality problems (factors) on maps of human impact and related modelling results. The factors were implemented on the basis of a literature review. We quantified aggregate uncertainty using Monte Carlo simulations, and ranked the factors by their influence on modelling results using the elementary effects method. Both methods are well established and theoretically suitable for complex models, but had to be modified for application to spatial human impact models. **Results** Some, but not all, modelling results were robust. This contradicts previous studies that found only minor effects of the factors they tested. Of the nine factors tested here, eight had a considerable influence on at least one modelling result in at least one of the two study regions. **Main conclusions** Model assumptions and data quality have larger aggregate effects on maps of human impact than found in previous analyses. These effects depend on the study region and the data that describe it. Future human impact mapping studies should thus include comprehensive uncertainty analyses. Computational experiments allow us to distinguish robust from less reliable modelling results and to prioritize improvements in models and data.

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