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Identifying robust approaches for projecting North Pacific groundfish population dynamics using multiple models for linkages between recruitment and the environment

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A variety of links between climate and groundfish recruitment in the North Pacific have been identified, including positive correlation of recruitment with an environmental index related to sea surface height for five commercially important species. How to incorporate environmental linkages within stock assessments is an open area of research, and the ability of model selection tools to identify these relationships has not been explored. In addition, the robustness of harvest policies that incorporate recruitment-environmental linkages to future climate scenarios is unknown. To determine an appropriate set of models for conducting population projections under climate change, we evaluate the ability of model selection tools (Deviance Information Criterion, Mohn's retrospective statistics, and hold-out cross validation) for choosing among sets of stock assessment models that differ in the modeled linkages between recruitment and the environment. We compare the estimation performance of models identified by the model selection tools with that of models where the recruitment-environment linkages are specified currently, and determine the consequences for forecasts under currently used fishery control rules. Incorrect use of environmental linkages within stock assessment models could lead to biased estimates of population parameters, and consequently incorrect management advice, particularly when faced with uncertainty related to recruitment-environmental linkages and a suite of possible futures for environmental conditions. Our study improves upon tools for including environmental linkages within stock assessment by first assessing the tools to select a set of fishery forecasting models, and secondly assessing the sensitivity and robustness of fisheries forecasts under climate change to model uncertainty.

Keywords: Gulf of Alaska, climate change, fisheries management, stock assessment, model selection

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