ICES CM 2016/E The emerging science of ecological multimodel inference for informing fisheries management

Performance of catch-only models and ensembles at providing management guidance for unassessed data-limited fish stocks

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The majority of the world's fisheries, particularly in developing countries, are unassessed with little information about fish population status. Several methods based only on fisheries catch data along with basic assumptions about population resilience and fishing effort dynamics have been developed to assess stock status (biomass relative to biomass at maximum sustainable yield: B/B_{MSY}). Research has shown that a super-ensemble of these methods provides more accurate status estimates than individual models. Rather than simply averaging the estimates, this super-ensemble uses the B/B_{MSY} estimates of each model as covariates in a new random forest model. It is trained using stocks with known status, and then used to predict status of unknown stocks. We do not know if these catch-only models or the super-ensemble can provide reliable and robust management advice to fisheries, nor how well they perform after management strategies that control catch or fishing effort have been implemented. We use management strategy evaluation to determine whether the super-ensemble can reliably inform harvest control rules to deliver management objectives. We also investigate the value of collecting additional data sources: more accurate catch data, fish length composition data, and fishing effort data. To contrast stocks with different life histories, management histories and data constraints, we focus on six species from the west coast of the U.S., Canada, and the Eastern Tropical Pacific Seascape. Our work outlines important trade-offs when using ensembles of catch-only models to inform management and provides recommendations on which monitoring programmes to improve or develop given limited resources.

Keywords: super-ensemble, catch-only model, management strategy evaluation, data-limited, value of information

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