Impact of the environmental drivers of condition on Biomass Prediction for sea scallop (*Placopecten magellanicus*) on Georges Bank, Canada

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Abstract

Oceanographic conditions are known to influence natural fluctuations in fish stocks, however disentangling environmental variability from fishing effects remains challenging despite significant efforts to improve science advice through an ecosystem approach to fisheries management (EAFM). For the world's largest wild scallop fisheries, the sea scallop (*Placopecten magellanicus*) found off the northeastern United States and eastern Canada annual variations in growth underlie major fluctuations in catch rate and yield. Inter-annual variability in the relative size of the harvested meat is measured using an allometric relationship between scallop meat-weight and shell height, known as scallop condition (SC), which is used to estimate the population biomass. When estimating the biomass for the current fishing year SC is an unknown parameter which is predicted based on a biological-only model. The purpose of this study was to investigate how using a recently developed model to predict SC using winter sea surface temperature (SST) impacts the prediction of current year biomass. A retrospective analysis was undertaken in which the current year biomass estimates from the stock assessment model were compared using the currently implemented bioloigical-only model and two SC-SST models. The results of this retrospective analysis indicated that there is a small positive bias of approximately 2% in the model biomass predictions using the biological-only model. The biological-only model tends to predict that SC will be lower than the SC-SST model, thus the use of the SC-SST model results in a slight statistically insignificant increase in the bias of the model biomass predictions. The underestiamte of SC in the biological model helps to offset the tendency for the assessment model to overestimate biomass in the current fishing year. These results highlight the challenges of attempting to incorporate environmental information into existing stock assessment frameworks and suggests that the development of next generation integrated stock assessment frameworks are needed to quantiatively develop science advice that can operationlize EAFM into the science advice.

SUPPLEMENT 1

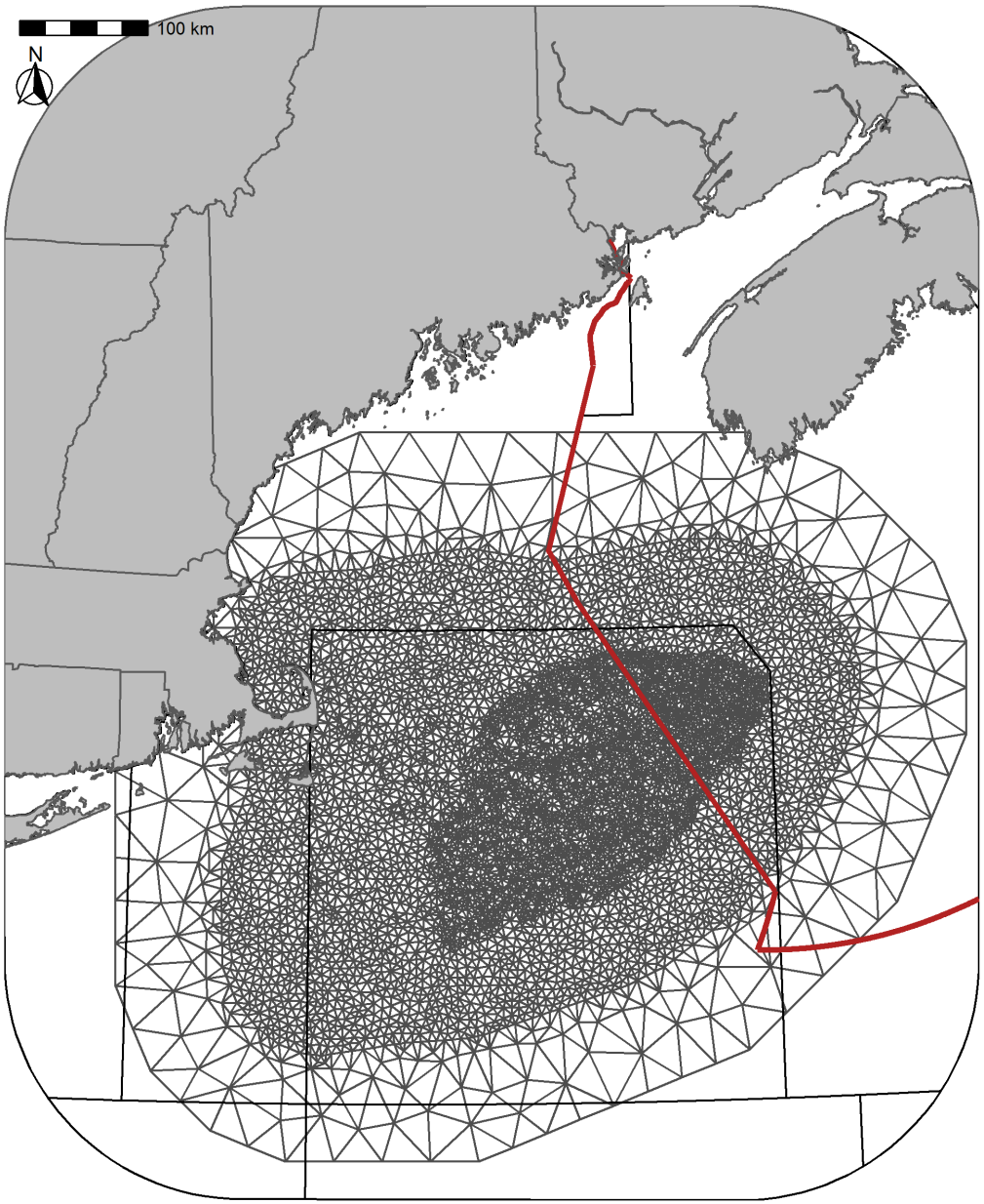

Figure S1: tester