

Evaluation of Global Change effect on Pacific saury using ecosystem models

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To evaluate global warming effects on Pacific saury, three-box ocean domain model which including Kuroshio, mixed water and Oyashio regions had been used with an ecosystem based bioenergetics model NEMURO.FISH (NEMURO for Including Saury and Herring). The model was forced by the sea surface temperature (SST) of global warming conditions generated by climate model outputs which contributed to IPCC-AR4 (Intergovernmental Panel on Climate Change 4th Assessment Report). Twelve climate models, which reproduced the Pacific Decadal Oscillation, were selected and B1, A1B, A2 carbon emission scenarios were used. Totally, thirty-three ensemble simulations were conducted and twenty-four (73%) results showed a decrease of wet weight of Pacific saury. The egg production was enhanced in eleven (33%) cases. However, the model did not include east-west migration of Pacific saury. We conducted numerical simulations including two dimensional horizontal migration of Pacific saury. Sea surface temperature, velocity and prey plankton fields were obtained by simulations with CHOPE-eNEMURO (Max-Planck-Institute Ocean Model coupled with extended NEMURO) using current and future climate forcings. A NEMURO.FISH type fish growth and migration model was forced with the current and future conditions. As a result, southward migration of saury was restricted by higher temperature under future climate. The number of saury advected by the Kuroshio Extension was increased and hence the distribution center was moved offshore. The restrict of southern migration diminish lower growth saury and uniform offshore condition stabilize the growth. However, the model predictability of prey zooplankton density has much uncertainty. Improvement of zooplankton predictability and evaluation of uncertainty with ensemble experiments are required as a future task.

Keywords: marine ecosystem model, fish growth - migration model, Pacific saury, Global Change