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Modeling large-amplitude recruitment variability of marine fish

ITOH, Sachihiko[1*] ; HASUMI, Hiroyasu[1]

[1]Atmosphere and Ocean Research Institute, The University of Tokyo

Marine ecosystem modeling has advanced considerably in the past few decades, enabling quantitative evaluation of biogeochemical cycles in the ocean. Some models are incorporated into the earth system model and applied for projecting future climate change. However, many of these models consider trophic levels up to zooplankton and do not include fish and other nekton. Although abundances of some marine fish species show large interannual fluctuations synchronous to environmental variations, few model frameworks had capability of explicit analyses on their linkage. A recently developed approach for fish modeling takes both biomass and number of individuals into consideration, which is one of necessary factors of fish community structure; however, even with this approach, present fish models do not usually reproduce drastic variation in the abundances of some small pelagic fishes such as sardine and anchovy. In the present study, we step into recruitment processes of marine fish, which has been suggested by field studies to be determinants of the population size. A food-web model for planktivorous and piscivorous fishes was developed, which will be coupled with a lower trophic ecosystem model and a hydrodynamic model. We focus on the environmental variability in the western North Pacific and the accompanied responses of sardine and anchovy, and test several growth and survival models during early life stages of these fishes. In the presentation, possible amplification processes from plankton to fish will also be discussed.