A challenge to evaluate effect of climate change on Japanese anchovy (*Engraulis japonicus*) in the East China Sea III

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We have evaluated climate change (global warming) effects on Japanese anchovy (*Engraulis japonicus*) in the East China Sea by integrating a fish-migration and growth model using environmental conditions derived from simulations of a coupled ocean circulation and ecosystem model with contemporary and future climate forcing. For the ocean circulation model, a high resolution (1/16 deg.) CHOPE (Max-Planck-Institute Ocean Model) was used. For the marine ecosystem model, eNEMURO, an extended version of NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography) was used. For future climate forcing, the output of MIROC-3.2(high) with the SRES A1B scenario was used. The initial spawning grounds were assumed in the area which depth is less than 1000 m and the sea surface temperature (SST) is between 14.1 and 20.1 degC and 27.2 and 27.8 degC based on the field data analyses. We estimated the spawning grounds in March, April and May. The fish growth and migration model was integrated for one year since the spawning.
Under the contemporary condition, the number of anchovy larvae advected to the northwestern side of Kyushu (NWK) showed the maximum in April, while it showed the maximum in March in the southwestern side of Kyushu (SWK). However, under the future climate during 2050-60, it showed the maximum in March both in the NWK and SWK. Therefore, the peak timing was advanced in the NWK under the future condition. Regarding the body size, larvae advected to the NWK showed the maximum mode body length in May, while those advected to the SWK showed it in April under the contemporary condition. Under the future condition during 2050-60, the timing was advanced by one month (April in the NWK and March in the SWK). Under the future condition during 2050-60, the number of larvae advected to the SWK in April and May and those advected to the NWK in May were drastically decreased. This result heavily depends on the assumption that the spawning ground is not formed in the region which SST is between 20.2 and 27.1 degC. Under the future condition during 2090-2100, the timing of the maximum advected larval number and growth was the same as those during 2050-60. However, the number of anchovy larvae advected to SWK was much more reduced. The results highly depend on the initial spawning distribution. As a future work, the estimation of spawning area should be improved.

Keywords: ecosystem model, fish growth-migration model, Japanese anchovy, climate change

