Variation of environment around the Kuroshio influences the recruitment of chub mackerel (*Scomber japonicus*)

*Hitoshi Kaneko[1], Takeshi Okunishi[1], Takashi Seto[2], Hiroshi Kuroda[3], Sachihiko Itoh[4], Shinya Kouketsu[5], Daisuke Hasegawa[1]

1. Tohoku National Fisheries Research Institute, Japan Fisheries Research and Education Agency, 2. National Research Institute of Fisheries Science, 3. Hokkaido National Fisheries Research Institute, 4. Atmosphere and Ocean Research Institute, The University of Tokyo, 5. Japan Agency for Marine-Earth Science and Technology

Chub mackerel (*Scomber japonicus*) in the North Pacific is one of the most important commercially fishes in Japan. It has been thought that its Recruit Per Spawning stock biomass (RPS) can be estimated based on an extended Ricker model including winter-time temperature around spawning ground, spawning stock biomass, and sardine biomass proposed by Yatsu et al. (2005). However, substantial degree of disagreement of RPS between the estimated from virtual population analyses and provided by the model is recognized especially after 2000. Because little study has been done concerning relationship between oceanic environment and annual variation of RPS after 2000, we investigate relationships between RPS and the environment such as winter time surface temperature around the spawning ground affecting spawner, and the Kuroshio pass affecting larvae thorough transports and temperature. In addition, we also attempt to improve the model concerning RPS after 2000. Then, based on particle tracking experiments conducted from mid-March to late April, we reveal importance of experienced temperature of larvae during ~10 days after hatch as well as February temperature of the spawning ground in the Kuroshio inside. Note that the experiments are made under the condition of fixed release positions for particle. It is also indicated that high RPS often occurs when the Kuroshio passes straight through the Izu islands chain during March when the spawner maturate, in contrast to lower RPS when the Kuroshio meanders along the islands. In the case of the Kuroshio meandering, worse RPS is shown when the winter time temperature in the near coast area (in the inside of the Kuroshio) is higher. These results suggest 1) importance of the inside area as a feeding grounds for spawner from late winter to early spring, 2) spatial restriction of spawning grounds tide to the inside area for chub mackerel as feeding and eggs production grounds for spawner, and 3) relationships between the pass of the Kursohio and annual variation of RPS through experienced temperature of larvae during spring related with the distance from the feeding ground for spawner to the Kuroshio axis. In addition to these results, one possibility of the poor reproducibility of the model by Yastu et al. (2005) after ~2000 is proposed as regime change of the Kursohio pass: the flow frequently passes closer to costal region east of the Izu island chain after 2000.

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