

魚類生産モデリング: 物質循環への影響と生態系サービス評価 Modeling fish production in the ocean: impacts on biogeochemical cycles and ecosystem service evaluation

伊藤 幸彦^{1*}; 伊藤 進一²

ITOH, Sachihiko^{1*}; ITO, Shin-ichi²

¹ 東京大学大気海洋研究所, ² 水産総合研究センター東北区水産研究所

¹ Atmosphere and Ocean Research Institute, The University of Tokyo, ² Tohoku National Fisheries Research Institute, Fisheries Research Agency

Marine organisms play fundamental roles in biogeochemical cycles in the ocean. Ecosystem models formulating chemical and biological processes relevant to these organisms and materials have been developed in the past few decades, enabling quantitative evaluation of biological production, carbon and nutrient cycles, and their impact on the climate system. However, many of these models consider trophic levels up to zooplankton. Although much of storage and flux of carbon and nutrients are observed in the lower trophic levels, which is a good reason to focus on this level, importance of higher trophic levels has been increasingly recognized. Here, we review modeling studies incorporating higher trophic levels than zooplankton, especially focusing on fish production models. There are two major motivations developing the fish production model. The first one is that lower trophic level models with zooplankton as the highest trophic level are sometimes controlled too strongly by parameterized zooplankton mortality terms. Although parameterization of mortality terms is needed unless the model contains the apex predator (trophic closure), inclusion of planktivorous fish components does decrease the arbitrariness of the biogeochemical cycle in the model. The second reason to develop fish production models, the more classical reason than the first one, is based on the fact that fish stocks themselves have been major food resources for human societies. In this context, some recent models do not only include commercially important large piscivorous fishes but also consider fishing fleets. Increasing concern for the conservations of marine mammals and sea birds also enhances the model development. There are two different streams of the fish modeling at present: size-based and species-based approaches. We review their advantages and limitations and discuss future improvements of preferable frameworks of the higher trophic models.

キーワード: 魚類生産モデル, trophic closure, 水産資源

Keywords: fish production model, trophic closure, fisheries resources