主論文の要約

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学 位 論 文 題 目

Potential habitat of neon flying squid (*Ommastrephes bartramii*) in western and central North Pacific from spatio-temporal models

（西部・中部北太平洋における時空間モデルによるアカイカの潜在的生息域分布の解明）

I explored the potential habitat of neon flying squid, ***Ommastrephes bartramii*** across western and central North Pacific from December to February (winter; 2001-2004) and May to July (summer; 1999-2014) using habitat modeling where fishing position and CPUE were used as dependent variables and environmental information and climate index as independent variables. Different habitat models (e.g. regression and machine learning) were constructed to infer the seasonal squid potential habitat, identify regions of pelagic hotspots and elucidate underlying mechanisms of hotspots formation. Ensemble model approach was used to reduce inter-model bias to create robust habitat suitability index (HSI) for management of fisheries. Moreover, to examine the impacts of interannual climate variability to squid potential habitat, results of empirical orthogonal function (EOF) of environmental time-series and generalized additive models (GAMs) were also examined. Projected effects of warming to squid habitat was also explored under future warming scenarios, based on IPCC-released SST projections.

Habitat model predictions and their ensemble showed that squid potential habitat were in Kuroshio-Oyashio transition zone (TZ) off Sanriku coast in winter and then moved further offshore from May through July. Squid potential habitat subsequently shifted north towards the subarctic frontal zone (SAFZ) by the end of June and July. From May to June, the squid's pelagic habitat were also found proximal to eddies in TZ and sub-surface isothermal domes in SAFZ in July. These oceanographic features are important in structuring the distribution and aggregation prey patterns in the ocean. Furthermore, during strong El Niño, squid potential habitat in central North Pacific was enhanced as forage conditions might become favorable due to colder and more productive waters. During strong La Niña, SST off the squid summer feeding grounds exhibited warmer than normal, resulting to enhanced stratification and lower net primary production. Under all different future warming scenarios (RCP4.5, RCP6.0 and RCP8.5), squid summer potential habitat was projected to decrease in magnitude and retreat northward as the ocean becomes warmer and stratified. Likewise, the extent and magnitude of northward displacement and HSI decrease were most pronounced in July and towards the end of the 21st century. The inferred squid HSI changes were also proportional to simulated warming magnitudes. The results of this research underpin important ecological implications on squid-environment interactions and projected effects of climate-driven changes to squid potential habitat. Such information could provide insights that could be useful for sustainable squid fishery and resource management.