# Change in lower trophic level ecosystems to decadal scale variation of climate system in the North Pacific Ocean

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The changes related to interdecadal climate variations, such as the Pacific Decadal Oscillation and the 18.6-y tidal cycle, have been discussed in many marine ecosystem studies. By analyzing data from observation of nutrient concentrations, decreasing and increasing trends of nutrients in the surface and subsurface layers, have been reported in many studies. Changes have also been observed in the biomass of phytoplankton and zooplankton. To clarify variability of lower trophic level productivity and its controlling factor, we simulated changes in the marine ecosystem caused by interdecadal climate variability, using the JRA55-do (Japanese 55-year atmospheric reanalysis) dataset from 1958 to 2017 to drive an ecosystem model, NEMURO, embedded in a global three-dimensional physical-biological coupled model, ‘COCO-NEMURO’. We compared and verified ecosystem model results with observations of phytoplankton and zooplankton species composition data collected by the Tohoku National Fisheries Research Institute, Japan Fisheries Research and Education Agency (FRA). Our model results showed that changes in biomass and nutrient concentration greatly differ depending on the region. According to our model results, sea surface temperature (SST) was very low during mid 1960s to mid 1970s, then SST increased after the mid 1970s to the end of 1990s in the western subarctic North Pacific. Changes in phytoplankton biomass was follow to this. However, the change in SST and phytoplankton and zooplankton biomass were contrary to this in the western subtropical North Pacific. We also checked decadal time series of annual mean sea ice concentration, SST, and phytoplankton biomass in the eastern Bering Sea and the western Arctic. The simulated sea ice concentration in the eastern Bering Sea decreased from the late 1970s to the early 1980s, while it was higher in the early 1990s and the late 2000s. The SST had its peaks in the late 1970s and the early 2000s. The phytoplankton biomass was inversely correlated with the sea ice concentration. In the western Arctic, the simulated sea ice concentration (SST) showed negative (positive) trends on the decadal timescale. The phytoplankton biomass has also been increasing, but its trend was not so simple. To elucidate the mechanism that sustains marine ecosystems, we will also analyze focusing on primary producers and zooplankton to key link to higher trophic levels.

Keywords: Climate change, decadal change, lower trophic marine ecosystem, marine ecosystem model 'NEMURO'

 