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## Distribution assessment of climate-induced changes of primary production in the Barents Sea ecosystem

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Changes in the Arctic environment in recent decades may result in favourable conditions for the increase of biological production. However, there are not many well-documented climate-related shifts in plankton, fish and benthic communities in the Arctic Ocean marine ecosystems, and there is significant uncertainty about the present and future productivity values. Researchers often estimate (using forecasts, etc.) how some key stocks may respond to future climatic changes to assess the prospects of fisheries.

In our study, applying the Ecopath multi-species balance production model, we estimated the distribution of climate-induced primary productivity increase, along the food web in the Barents Sea ecosystem. Assessment was made for two periods ("cold" (1970-1990) and "warm" (1991-2016)) and three regions - the Southern Barents Sea and the adjacent areas of the Norwegian Sea, the Svalbard Archipelago region, and the Northern Barents Sea. For each identified area, the food web has differences in both the structure and quantitative indices (for example, in abundance and biomass) of different trophic groups in different periods, in particular, during the increased ice coverage and relative warming.

We propose a new approach to assess food rations for the Ecopath model. It allows to consider more flexibly the change in the ecosystem food structure, associated with changes in biomasses (stocks) and the appearance of new species in the studied area due to environmental fluctuations related to marine climate warming. Based on the simulation results, we made conclusions concerning the observed and probable changes, related to the primary productivity increase, in the considered ecosystems of the three identified Barents Sea regions.

An integral indicator of the mean trophic level reflects climate-induced changes in the Barents Sea ecosystem. It remained almost unchanged in the southern region but increased for the Northern region and the Svalbard region. This is due to the fact that new species appeared in the structure of food webs of these regions and/or the existed species' biomass (stocks) changed during the warm period when compared to the cold one.

A generalized indicator of biological diversity is an additional evidence of climate-induced changes in the primary production. During the warm period, the Shannon Biodiversity Index for the Northern and the Svalbard regions increases, while it decreases in the Southern region mainly because the biomass of the main trophic groups (cod, herring) increases.

The commercial fishing increase in the Northern and the Svalbard Archipelago regions is likely to be expected. However, there is a possibility that there will be increased stratification between the

upper cold and less salty water masses formed by melt ice and the Atlantic water below, which becomes cooler and denser. This can lead to the decrease in the nutrients content of the productive zone and prevent the positive effects of the warm water inflow.