

# Polar cod (*Boreogadus saida*) stock in the Bering Sea

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## Introduction

The polar cod (*Boreogadus saida*) is distributed circumpolarly. The Bering Sea is the marginal part of the polar cod range. Despite the fact that polar cod is regularly observed in trawl catches during the complex surveys in the Bering Sea, there is no description of long-term dynamics based on Russian and US data for the entire water area of the Bering Sea.



Fig.1. Polar cod, western part of the Bering Sea (photo by I. Glebov, «TINRO»)

## Material & Methods

The mean long-term bottom layer temperature (2000-2015) is given according to the Copernicus (<https://www.marine.copernicus.eu>). The typification of the years according to the thermal regime was carried out on the basis of the analysis of the data on the ice cover of the Bering Sea for the period 1979-2017. Data obtained from National Snow & Ice Data Center (NSIDC) (Fetter et al. 2017, <https://nsidc.org/data/G02135/versions/3>)

To estimate the abundance parameters and to analyze the spatial distribution of polar cod, the data were gridded using average values for each 0.5° x 1° grid cell. (Volvenko 2003, 2015). The catchability coefficient was taken 1.

For Russian EEZ: data from 978 bottom trawls carried out by «VNIRO» research vessels from 1972 to 2017 were used to estimate the average long-term distribution of the polar cod in northwestern part of the Bering Sea.

For US EEZ: data from the open database on bottom catches RACE ([https://www.afsc.noaa.gov/RACE/groundfish/survey\\_data/data.htm](https://www.afsc.noaa.gov/RACE/groundfish/survey_data/data.htm)) 1982-2018 were used, as well as surveys on the continental slope for the period 2002-2016, 1978 trawls in total.

## Results & Discussion

Polar cod formed concentrations of different density of Bering Sea, reaching in some years (1999, 2001) to Olyutorsky and Karaginsky bays. Maximum concentrations of polar cod are noted in the northwestern part of Anadyr Bay, in Norton Sound, off St. Lawrence Island and Nunivak Island. The results of trawl surveys showed differences in the spatial distribution of polar cod depending on the “warm” and “cold” years (fig.2).

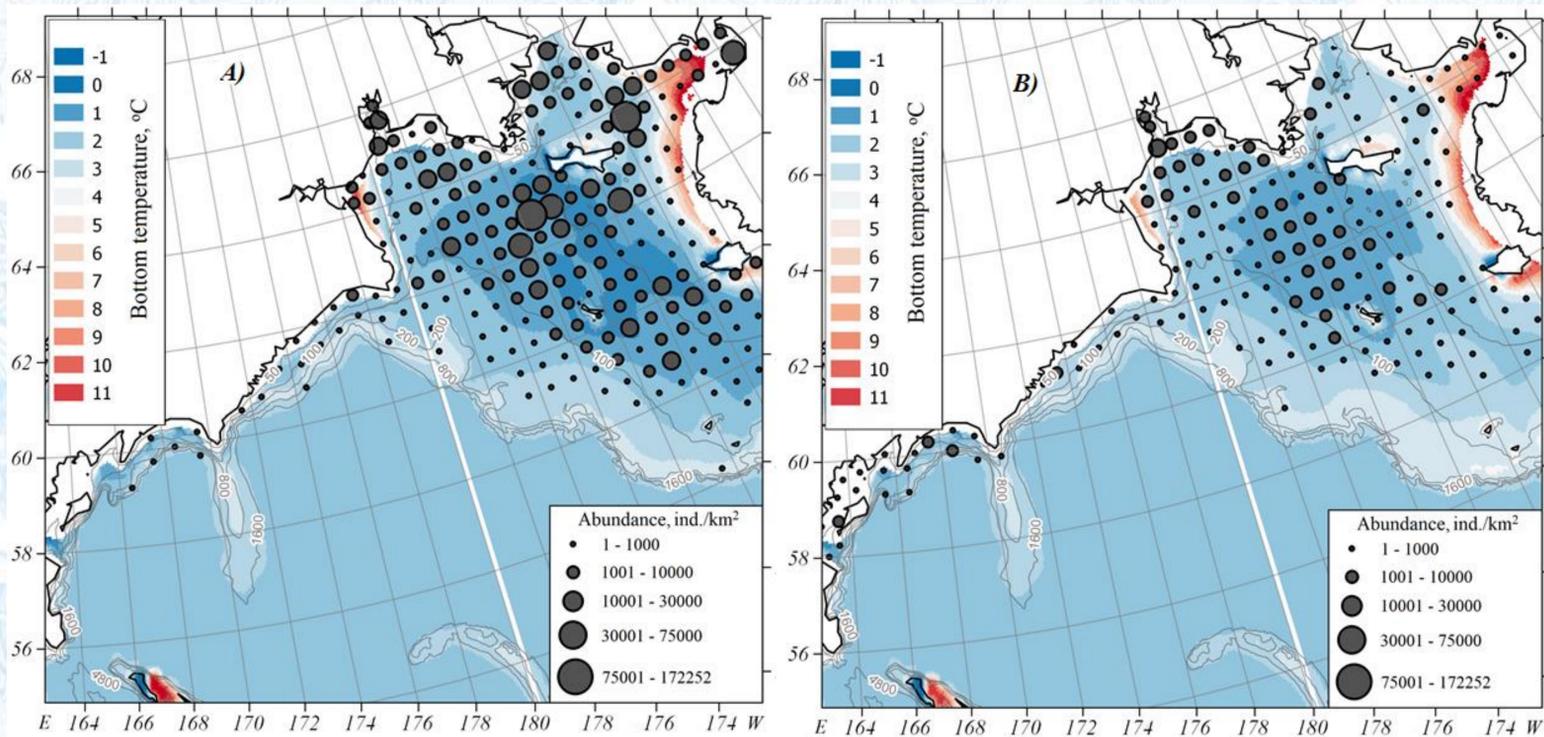


Fig.2 Relative abundance of polar cod in the Bering Sea: A) – «cold» years, B) – «warm» years

Years	Weight-average
1990	47.5
2000-2009	12.9
2010-2017	41.7

Table 1. Long term dynamic of polar cod abundance in northwestern part of the Bering Sea (kg /km<sup>2</sup>)

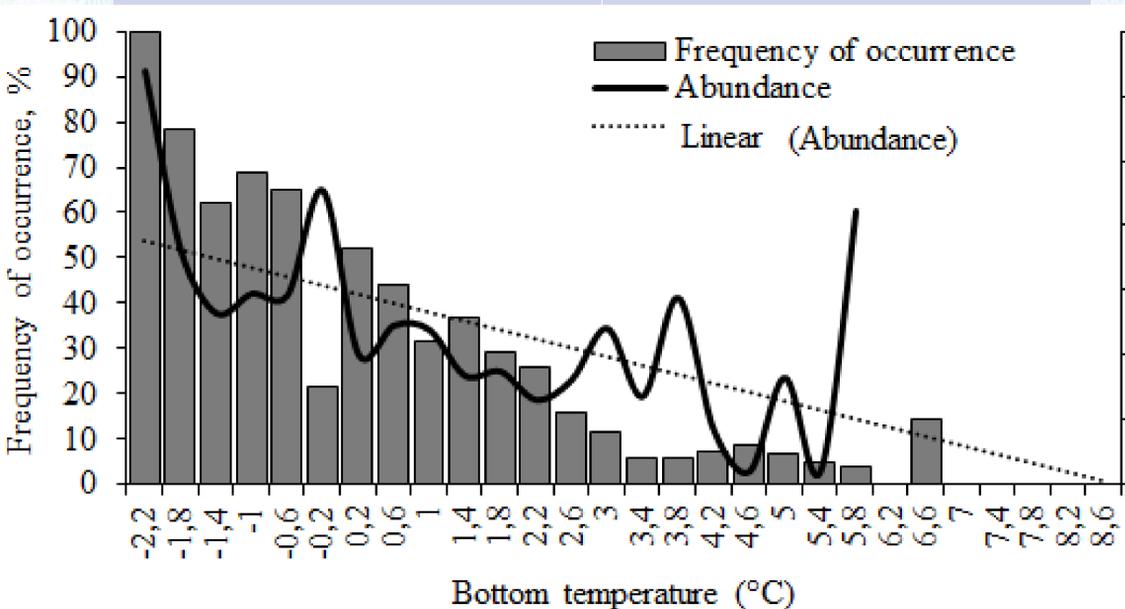


Fig.3 Dependence of abundance on bottom temperature

Despite the fact that the densest aggregations were confined to areas with a low bottom temperature, the observed climate warming is accompanied by a retreat of the polar front and a reduction in the area of ice fields, which leads to a shift in the distribution boundaries of the polar cod and reduction of its abundance and changes in ecosystem. Thus, in the next 5 years, a further decrease in the abundance and biomass of polar cod can be assumed and with further reduction in the area of its range.