

## Introduction

Over the last 3 million years the marine biota of the Arctic Ocean has changed, influenced by dramatic environmental fluctuations. During periods of glaciation, the biota was strongly depressed, geographical and bathymetric species ranges changed and some species vanished. During periods of warming and transgression, the Arctic biota was strongly supplemented by invaders from the Atlantic and Pacific Oceans.

Attempts to estimate the scale of changes of the Arctic biota have been made for more than a hundred years. Publications have mainly focused on: the presence of pre-Pliocene elements in the modern Arctic biota (i), the ratio of biota of North Atlantic and North Pacific origin in the modern Arctic biota (ii), the dispersal of the Arctic fauna along the depth gradient (from the shelf into the abyssal and in the opposite direction) and the role of Arctic depths as a refuge for shallow-water fauna (iii) and on the biogeographical regionalization of the Arctic Ocean and the age of the modern distributions of the Arctic biota (iv).

There are significant disagreements over the above four areas of study. The presence of species with Arctic pre-Pliocene ancestors in the modern Arctic biota is recognized by some authors and challenged by others; the role of the major donor-region is given as either to the North Pacific or the North Atlantic; the dominant vector of vertical dispersal is characterized as the Arctic submergence or the Arctic emergence and the number of biogeographical units in the Arctic Ocean varies in publications from two to over 50.

This thematic issue aims to demonstrate that contradictory results of biogeographical studies often don't exclude each other, but complement and point to the complexity of biogeographical processes in the modern Arctic Ocean. The characteristics of the biogeographical structure and the history of the Ocean vary, depending upon the scale of the study, the level of life systems considered, animal or plant ecological

groups and taxa.

The number of biogeographical subdivisions revealed by the biotic (species based) approach to regionalization is smaller than the numerous subdivisions based on the biocenotic (community based) and landscape approaches. A group of small biocenotic-landscape regions falls into one large biotic province. The results of studies on biogeographical regionalization, based on different approaches, can be combined into generalized schemes in studies of large ecosystems, in which live components are «biotic complexes» and the abiotic are «biotic regions» (Mironov, present volume).

The most complicated spatial changes in the species composition of the Arctic fauna occur in areas of overlap with the boreal fauna, in the Chukchi Sea (Petryashov et al., present volume) and the Barents Sea (Jirkov, present volume). Even slight variations in approaches to biogeographical regionalization of these areas yield significantly different results. The biogeographical history of the Arctic Ocean includes different scenarios of colonization of the basin. Cosmopolitan genera, with few differences in pattern to their modern distributions, penetrated the Arctic Ocean following different pathways (Budaeva, Rogacheva, present volume).- The Arctic fauna of bivalves and echinoderms analysed using the same approach, revealed different dominant donor regions: the North Atlantic for the former and the North Pacific for the latter (Krylova et al., present volume). Higher taxa show variations in the ratio of species originating in shallow- and deep-water habitats. Thus, the Arctic submergence of the shelf fauna to the abyssal has been demonstrated for many genera of Amphipoda, but is rarely found in Isopoda (Mironov et al., present volume). Dispersal into the depths is followed by depth-related speciation, with different scenarios in different taxa (Rogacheva et al., present volume).

Global changes of biota in the post-glacial Arctic Ocean occurred over a very short geological time scale. Previously published data and

the original results presented and reviewed in the present volume, all indicate a rapid reaction of the benthic fauna to fluctuations in the environment of the Arctic Ocean. The Arctic biota provides a rare opportunity to study large-scale marine ecosystems at early stages of evolution.

Biogeographical processes in the Arctic Ocean are diverse and complicated. They cannot be described by a single scheme. The taxa

not considered in the present volume and different approaches to biogeographical studies may reveal new patterns in the biogeographical structure and history of the Arctic Ocean.

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