HIDEA – Hidden diversity of plankton in the European Arctic

European Arctic is amongst the most susceptible to the climate change areas of the World's Ocean, and under all climate change scenarios it is projected to undergo dramatic rises of sea surface temperature, already warming more rapidly than the global mean. Additionally, the relatively warm Atlantic waters, which temperature is also increasing in recent years, transported northwards with the West Spitsbergen Current, penetrate more northern parts of the European Arctic, what intensifies the observed changes in the environment. The increasing amounts of the Atlantic waters and sea temperature rise cause changes in the distribution ranges of both the Atlantic and the Arctic species as well as the inflow of new species to the Arctic. All of the above described processes are sometimes called the "atlantification" of the Arctic.

The growing body of literature examined various influences of the climate change to biota thriving there focusing, however, either on the well-studied taxa, at single site type, or employing only taxonomic, rarely supported with molecular species identification, aspects of species diversity. As a result, taxa that are difficult to identify, or rare, largely escaped scientific attention (e.g., gelatinous zooplankton, bacterioplankton), and no broad-scale comparisons between remote areas were undertaken, not to mention the complete lack of studies simultaneously investigated molecular, morphological and functional levels of biodiversity, which is a good measure of ecosystem's stability and self-organization.

The main scientific objective of the project is to assess the influence of climate change and so called atlantification of the Arctic on the biodiversity of plankton in the wide-spectrum of sizes and ecological groups: from pico- to mesoplankton, and from bakterioplankton, through planktonic protists, to zooplankton, as well as on the functioning of pelagic food web in the area influenced by the West Spitsbergen Current. We will especially focus on the poorly known taxonomic groups and the ones that are predicted to increase in numbers and biomass with the ongoing climate change, such as bakterioplankton and gelatinous zooplankton.

The additional aim of the project will be to develop a methodology based on the techniques of modern molecular biology, which will allow for a relatively fast and cheap qualitative assessment of plankton community, or a more detailed analysis of selected taxonomic groups' diversity. The use of metabarcoding enables to more precisely assess zooplankton biodiversity than the use of traditional methods based on morphology, as well as it makes it possible to study a pelagic microbiome in the European Arctic. In the future, this method may be widely used for: i) selecting regions, in which the processes connected to climate change, intensified inflow of Atlantic water masses or exposure to potential anthropogenic pressure; ii) the routine quantitative and qualitative analysis of local biodiversity, based on taxonomic methods.

As the study area, we have selected the region influenced by the West Spitsbergen Current, which is a continuation of the Norwegian Atlantic Current, and transports Atlantic waters and associated biota through the Norwegian and Greenland Seas and influences considerably properties of the Arctic Ocean. Additionally, we plan to sample three Svalbard fjords: Hornsund, which is of an Arctic character, and two Atlantic-influenced fjords, Kongsfjorden and Isfjorden. Sampling is planned in three consecutive years 2018-2020 from onboard of RV Oceania, belonging to the Institute of Oceanology, Polish Academy of Sciences. The sampling will include the collection of hydrological data, and four plankton size fractions (pico-, nano-, micro-, and mesoplankton). The samples will be analysed based on both organism morphological features and metabarcoding. The data obtained from metabarcoding and taxonomic analysis of zooplankton samples will be analysed with bioinformatic and multivariate statistical analyses, and combined with hydrological data.

The proposed project not only focuses on an important Arctic marine ecosystem in the era of rapid climate change, but it also fits well to the current trend of undertaking interdisciplinary research, because of integrating molecular and morphological techniques into the biodiversity analyses.