Floating in the sea water, microscopic, invisible to the unaided eye, single-celled organisms, together with terrestrial plants, produce the oxygen that we breathe. Contrary to popular belief about the dominant role of tropical forests in oxygen production, they are the "truly green lungs" of the planet, responsible for more than half of the world's oxygen production and carbon dioxide absorption. In the case of changes in their qualitative and quantitative structures, the Earth's atmosphere would be subjected to significant, noticeable for ecosystem changes. For istance, the amount of oxygen at the sea level would drop by half, i.e. to the value occurring at the height of 5000 m, and the greenhouse effect, so far resulting in an increase in air temperature by about 1°C per decade, would accelerate rapidly.

The negative effects of loss or reduction in the numbers of these organisms would also affect the inflow of energy and matter in the sea, and, through the transfer of matter stored in sea on land by bi-environmental organisms (e.g., planktivorous seabirds), also in terrestrial food web. This would be due to various functions that perform planktonic (living in the water column) protists in the sea ecosystem. They are represented by autotrophic forms, which are the equivalent of terrestrial plants (so called phytoplankton – primary producers, e.g., diatoms, chlorophytes, some cryptophytes), heterotrophs (grazers) - relying on already produced organic matter (e.g., dome dinoflagellates, ciliates) and mixotrophs that through the evolution “patented” mixing of these two forms of nutrition (e.g., some ciliates able to temporarily use their victims' cells responsible for photosynthesis, which undigested produce for their host essential for life sugars). Moreover, due to the wide range of cell size among protists (if the smallest are equivalent of half-meter fish, the largest - colonial forms correspond to the size of city districts as Manhattan), protists that feed on smaller cells, often inaccessible directly for zooplankton, transfer the energy up the food chain.

Since these organisms do not have the capacity of active movement or only in a significantly limited extent (as in flagellates), protists are "sentenced" to environmental conditions at their place of living. Their life cycle (short, with a fast alternation of generations) results in a rapid response to changes in the environment. Differentiation of communities along with the global warming, with a clear reduction in primary producers and the increase in hetero- and mixotrophs, has already been observed as a response of protists to the climate change. While in the temperate, tropical and equatorial areas, protist studies are relatively easily conducted throughout the year, in substantially colder, seasonally ice-covered and much more susceptible to the climate change polar regions, studies are limited to short-term (mainly summer) observations. The lack of long-term data, especially covered the least explored polar night and early spring, effectively hampers examination of the seasonality of polar protist communities and complete (year-round) observation of their climate-driven variability.

In 2012-2013, a group of researchers at the University Centre in Svalbard (UNIS, Longyearbyen, West Spitsbergen) held a first for the European Arctic two-year continuous field campaign in Isfjorden. The materials were seasonally (with weekly to monthly intervals) collected for comprehensive analysis of protist communities and measurements of key environmental parameters (including the water temperature and salinity, nutrient concentrations, amount of suspension matter and the availability of light in the water column). The first part of the biological material was analysed using genetic methods. Examined DNA provided information on the overall biodiversity of protistan plankton (primarily picopankton – cells below 3 µm), while the analysis of RNA was used as a basis to determine their activity in the environment. The second part was dedicated to study protists from nano- (3-20 µm) and microplanktonic (> 20 µm) size fraction, the basic element of a zooplankton diet and the key link between pikoplankton with higher order consumers. Marine Ecology Department of the Institute of Oceanology of Polish Academy of Sciences (IOPAN) has the access to these nano- and microplanktonic samples, together with a complementary set of environmental data. Due to the limitations of constantly developed molecular methods (e.g., the lack of complete gene libraries; applied methodology designed mainly to picoplankton), the results obtained by UNIS require compilation and detailed comparison with data obtained using classical microscopy methods (i.e., Utermöhl’s method), carried out by IOPAN. Microscopic analysis will provide a complete (year-round) checklist of protists of the investigated area and will allow for estimation and tracking fluctuations in protist abundance, biomass and their size and trophic structures.

Examination of the effects of climate-driven environmental variability on seasonal dynamics and development of the European Arctic planktonic protist communities, the objective of this project, covers the period of inter-annual, considerable differences in the Atlantic water inflow to the area. In 2012, we observed unusual, doubled, massive intrusion of Atlantic waters to Isfjorden in winter and summer, resulting in a significant warming of the fjord waters. In 2013, this advection took place only in summer, which is more "typical", annually observed situation in the West Spitsbergen region. Thus, it can be assumed that oceanographic conditions in 2012 reflected conditions forecasted for the Arctic warming with strong influence of warmer waters, while 2013 represented a year of the “typical” for the European Arctic waters environmental conditions.

Strong, inter-annual differences in hydrographical conditions were associated with clear differences in hydrooptics and hydrochemistry of the water column. Comparative analysis of environmental data (collected during sampling and satellite-derived) together with the results of protists analysis, implemented in this project, will allow defining protist communities characteristics in two contrasting years (warm year *vs* cold year).

Finally, we will be able to fill the existing gap in knowledge on the seasonal dynamics of the Arctic protist communities and forecast the direction of changes (e.g. through future modeling of ecological processes) in the face of the progressive Arctic warming.

The project results, published in international journals and presented at scientific conferences, will contribute to raise the profile of Polish oceanographic research in the field of marine biology and certainly will find interest among a wide range of scientists dealing with microorganisms, zooplankton, fish and exploring the processes occurring between the sea bottom and water column.