The food webs of small freshwater ecosystems are highly dynamic throughout the year. Specifically, this applies to plankton assemblages Seasonal succession – cyclic replacement of one set of species by another – is a well-known process. However, climatic changes, such as global warming, can lead to shifts in the timing of succession stages. In addition, an increase of the temperature is responsible for the loss of lake ice cover. Half of the world's lakes freeze periodically and the ice cover is an essential part in the functioning of their food webs. Therefore, mild winters and longer periods without ice are a threat to these ecosystems.

Originally, winter was considered a season of little interest in freshwater studies, as it was assumed that succession in the food web would be ‘reset’ due to the low temperature and low light availability. However, studies which tackled winter lake surveys report complex under-ice dynamics of planktonic communities, large-scale phytoplankton (algae) development and actively overwintering zooplankton (planktonic animals). Predicted milder winters with shortened or absent ice-cover on the lakes may boost activity of planktonic organisms, disturbing the seasonal succession cycle. The aim of this project is to explore relationships between species within the freshwater food webs during the winter season and study what are the consequences of ice cover loss.

The studies will be carried out in a set of shallow waterbodies and will consider: 1) pre-wintering food web conditions; 2) overwintering; 3) post-wintering conditions, with an emphasis on how overwintering communities unfolded on spring plankton communities. In order to track dependencies within the food webs, measurements of stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) ratios will be used. This technique allows identification of the food source in the diet of studied organism and to estimate its trophic position. In addition, phytoplankton and zooplankton functional traits (characteristics of species roles in the environment) will be used to describe functional diversity of studied communities.

The work plan will consist of a field surveys conducted in a set of waterbodies aiming to study pathways of energy flow in freshwater food webs during the winter season and explore how overwintering planktonic communities influence spring communities. Furthermore the project assumes carrying out an in-lake mesocosm experiment, with enclosures simulating regular and short-term ice cover, to study how winter stagnation (non-mixed water column) influences the food web conditions. Cross-seasonal cascading effects in freshwater ecology are poorly understood and the urgency of their better perception is highlighted by the fact that climate change has a strong impact on the seasonal cycle of freshwater ecosystems