DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Plankton communities are a key component in the ecosystems of freshwater lakes. Interactions between primary producers (phytoplankton or photoautotrophs) and primary consumers (zooplankton or heterotrophs) affect the overall functioning of freshwater ecosystems. However, the transfer of energy and matter between these two important trophic levels is complicated by the profound differences in the elemental and biochemical composition of primary producers and consumers. We hypothesize that the efficiency of transfer of matter and energy from phytoplankton to zooplankton varies based on both environmental factors and the species composition of zooplankton. By manipulating environmental factors such as fish pressure, zebra mussel density, nutrient loading and zooplankton species composition and abundance, we can determine the combination of factors that favor efficient transfer of matter and energy from phytoplankton to zooplankton. The results from this proposed research will provide information that can be used towards the development and implementation of biomanipulation to manage aquatic ecosystems.

Experimental (mesocosm) studies will be performed to establish how the relationships between phytoplankton and zooplankton can change under the effects of various factors in three trophic (meso-, low and high eutrophic) state conditions. The treatments will consist of the presence/absence of alien large-bodied cladocerans, zebra mussels and fish in a 2x2x2 factorial design, each will be replicated in triplicate mesocosms. This will result in use of 72 mesocosms in the planned field experiment. During the experiments, samples will be collected for measurements of bacteria, phytoplankton and different zooplankton taxonomic groups abundance and biomass, nutritional values, including the essential polyunsaturated fatty acids (PUFA) of the ω 3 family (Omega 3) and stochiometric ratios C:N:P. The trophic efficiency of transfer of energy (organic carbon) and PUFA from phytoplankton to zooplankton, will be calculated and expressed as transfer ratio (per cent) between the primary and the secondary productions in the lakes of various trophic states, fish pressure and the density of mollusk-filtrators (*Dreissena polymorpha*) in the Mazurian Lakeland in Poland.

What is the main driver in the lakes carbon cycling, fish pressure, quality of food etc. or their combined effects is often under the question. Whereas each of factors regulating the abundance and structure of zooplankton organisms has been well studied separately, data on their combined effects remain very limited. Therefore, investigations of combined effects become very important, in most cases they would not be a simple sum of the isolated factors (Weidman et al., 2014) and can promote a better understanding of regulation mechanisms in aquatic communities. Especially we were interested in which factor combinations promote increases of efficiency of transfer of matter and energy from phytoplankton to zooplankton.

Such studies are also significant for development of environmental management methods. Nowadays such processes as global warming and human activity intensify eutrophication in the freshwater lakes resulting in decreases of efficiency of transfer of matter and energy from phytoplankton to zooplankton. In lakes, the energy transfer efficiency between phyto- and zooplankton commonly varies in the range *ca* 5 and 30% (Lacroix et al. 1999), and for higher trophic levels in pelagic food webs it is also around 10% (Schulz et al. 2004). The efficient systems can support 25 times more biomass of zooplankton than inefficient eutrophic systems (Brett et al. 1997). Eutrophication is commonly accompanied by blooms of cyanobacteria species, especially those producing various toxins, including hepatotoxins, neurotoxins and cytotoxins which are harmful for the health of people while the essential PUFA which are known to protect against cardiovascular diseases are continuously diminishing in fish tissues. Many countries in the European Union are faced with a challenge to create conditions for reducing or preventing lake eutrophication by reducing the excessive growth of highly toxic cyanobacteria and to provide efficient transfer of matter and energy, especially that of PUFA of the ω 3 family (Omega 3), within the lake food webs. Understanding the mechanisms for rising efficiency of transfer of matter and energy from phytoplankton to zooplankton can allows us to develop methods for alleviating the consequences of negative impacts.