The periodic abiotic changes in the environment affect the rhythmic, internal timing mechanisms of organisms, called biological clocks. The biological clock is responsible e.g. for animals' decision of when to forage, migrate or reproduce, which expose them to different biotic and abiotic challenges. e.g. by affecting interspecific interactions by temporal niche partitioning. The main synchronizer of organism's biological clock is light, but natural light cycles are nowadays disrupted by the introduction of artificial light at night (ALAN). It comes from a variety of electrical sources designed to improve human living conditions, as streetlights or internal building lightnings. Nowadays more than 50% of the global population live in distance less than 3 km to a freshwater body, which makes the freshwater ecosystems equally vulnerable to be affected by ALAN than terrestrial ecosystems. Indeed, growing number of research on ALAN showed that it affects many biological aspects, including dispersal timing, aggression or melatonin production of a wide variety of freshwater organisms, from microorganisms, through phyto- and zooplankton, amphipods or crayfish to fish, thus having serious impacts on global biodiversity. This is especially true for white light-emitting diodes (LED), which become more and more common because of their high efficiency and potential to reduce the global CO_2 emission. Unfortunately, this light source emits light in a broad range of wavelength, thus having potential to affects wide variety of organisms. Another white LED characteristic which raises concern of many scientists is its significant peak at short wavelengths corresponding to blue light, for which many organisms are sensitive. Thus, the goal should be to learn as much as possible about effects of ALAN on organisms so that in the future we can look for solutions to reduce the negative impact of nocturnal lighting on their ecology.

Another threat to biodiversity related to the human activities is the biological invasions phenomenon. This is the process by which an organism is introduced to a region beyond its native range, where it becomes established and maintains a stable population, affecting native organisms through e.g. competition or predation. The invasion of non-native species has significantly increased in the past 200 years, thereby causing gradual homogenization of fauna and flora on Earth and the freshwater fish are among the largest group of animals involved in biological invasions. Combining effects of ALAN and biological invasions is important because increased light pollution is related to areas with high human interference, which in turn are the main hot-spots for invasive species. There are some studies showing that ALAN modifies behaviour and distribution of the invasive species and may affect their potential to influence invaded ecosystems. The question is whether invasive species, after emergence in artificially lit areas, may have an advantage over native species as a result of the greater tolerance of the former to increased ALAN levels. Thus, the knowledge about invasive species ecology in artificial light conditions compared to the native species is important to recognize how invaders impact on native communities may change in the future, when the increase in ALAN pollution is predicted.

We are going to expand the knowledge on this topic by performing laboratory experiments focusing on the long-term effects of ALAN on freshwater fish species. We intend to investigate how ALAN may affect fish species with different circadian rhythms, i.e. characterized by the day or night activity, because we are of the opinion that ALAN may affect them differently. Moreover, as fish species with the same circadian activity we are going to use invasive and native species to compare their responses to ALAN. The representatives of species with nocturnal activity will be the native European bullhead *Cottus gobio* and the invasive racer goby *Babka gymnotrachelus*. As species characterized by diurnal activity, we chose the native Eurasian perch *Perca fluviatilis* and the invasive pumpkinseed *Lepomis gibbosus*.

We are going to keep the fish in the laboratory for 4-week period in the light cycle disturbed by ALAN (provided by white LED) and examine their growth and oxidative stress. The oxidative stress is defined as the imbalance between the production of the harmful reactive oxygen species in cells and antioxidative mechanisms of the organism. After this long-term experiment, we are going to perform series of short-term experiments to reveal potential mechanisms responsible for results obtained from the long-term experiment. These will be the respirometry assay (assessing the fish physical capacity based on their oxygen consumption), behavioural assay (to assess fish activity levels) and the functional response experiment (to investigate how effective tested fish will be in foraging on prey offered with different abundances).

The project will provide novel knowledge about the long-term effects of ALAN on freshwater fish growth and oxidative stress. Comparing the susceptibility to ALAN of native and invasive species with the same circadian activity can help predict further ecological impacts of the latter on invaded ecosystems as a result of increasing light pollution.