DOCTORAL DISSERTATION ABSTRACT

Piotr Kłosiński

Factors shaping the competitive advantage of invasive goby fish species over their native counterparts in the context of climate change

The doctoral dissertation is part of the research stream on biological invasions – an ecological process that is becoming increasingly common due to human activity and poses a threat to biodiversity and the functioning of ecosystems on a global scale, leading to the progressing homogenisation of fauna and flora on Earth. Global changes in environmental conditions, such as climate change, can facilitate invasions of alien species. The main aim of the dissertation was to expand the knowledge on the impact of abiotic factors associated with climate change (elevated temperature, hypoxia, acidification) on the metabolism and behaviour of invasive and native fish species co-occurring in the environment, in the context of assessing their adaptation to water warming and achieving competitive advantage in such conditions. Four experiments were performed under controlled conditions in the laboratory, testing two species of gobies (the racer goby *Babka gymnotrachelus*, the monkey goby *Neogobius fluviatilis*) spreading in inland waters of Europe and two native species (the European bullhead *Cottus gobio*, the gudgeon *Gobio gobio*). The first experiment investigated the effect of elevated summer temperature (25 vs. 17 °C) on the standard and maximum metabolic rate of fish. The aerobic scope was determined based on these parameters, indicating physiological performance (aerobic capacity). The following two experiments examined the effect of short-term progressive hypoxia and acidification on routine metabolic rate. The last experiment concerned the effect of elevated summer temperature (25 vs. 17 °C) on the competitive abilities of fish for limited food resources. Studies have shown that although at higher temperatures, the gobies did not consistently outperform the native species in terms of higher aerobic scope, they had lower living costs by maintaining lower standard metabolic rates. Gobies showed greater tolerance to hypoxia compared to native species. In the case of acidification, greater tolerance to pH drops was noted in the monkey goby but not in the racer goby, compared to the native competitor. Even though the tested juvenile gobies did not show higher aggression than the native species, they more actively accessed food than the latter, regardless of temperature. The results of the studies suggest that in terms of the tested physiological and behavioural traits, the tested goby species are better adapted to

changing environmental conditions related to global climate change. With water warming, they will maintain a competitive advantage over their native counterparts. However, the invasion success of the racer goby may be attenuated by progressing water acidification.

07.04.2025 r. Piotr Kłosiński