Title: Behavioural reactions to stressful situations in invasive, Ponto-Caspian goby fish species and their native counterparts

Author: Mateusz Augustyniak

# Abstract

Biological invasion is a process of introducing organisms with human assistance outside their native range, where they can sustain a stable population, spread to nearby areas and cause changes in invaded ecosystems. Human intensifies this process on spatial and temporal scales by removing geographical barriers and allowing organisms to move for longer distances in a shorter time compared to natural dispersal mechanisms. As a consequence, invasive species constitute a serious threat to global biodiversity. One of the key aspects of biological invasion studies is the insight into features of invasive species, including behavioural characteristics, which determine their success in newly settled areas.

The main aim of this dissertation was to expand the knowledge about the behavioural reactions of invasive Ponto-Caspian gobies (Gobiidae) and sympatric native species to stress related to their appearance in the novel environment. Knowing this is important to assess the invasive potential of Ponto-Caspian gobies as a model of a specific group of benthic, solitary fish species. Three experiments were performed on two gobies species spreading in European freshwaters (the racer goby *Babka gymnotrachelus* and the monkey goby *Neogobius fluviatilis*) and sympatric native species similar in biology and ecology (the European bullhead *Cottus gobio* and the gudgeon *Gobio gobio*, respectively). In the first experiment, antipredator behaviours facing predatory fish were assessed. The aim of the second experiment was to assess behavioural reactions to novel, unfamiliar environments (the shelter occupancy test, the open field test) or a sudden change in a familiar environment (the novel object reaction test). In the last experiment, behavioural reactions to social information, i.e. information provided by the behaviour of others (con- and heterospecifics), related to danger or resource location in novel environments were studied.

It was found that invasive gobies: (1) did not show more effective antipredator behaviours compared to natives; (2) were bolder, i.e. less associated with the shelter and explored the novel, unfamiliar environment more extensively than natives; (3) were able to use social information about danger from con- and heterospecifics, and the monkey goby did the same also for social information about resource location. These results suggest that invasive gobies may gain a competitive advantage over sympatric native species by more extensive exploration and resource exploitation in newly settled environments. The similar susceptibility to predation compared to native prey species pointed out the potential of invasive gobies

to affect food webs by including invasive Gobiidae in the diet of the native predators, thus reducing the abundance of gobies in invaded ecosystems. Although, the ability of gobies to detect danger based on the behaviour of other individuals and potentially avoid direct confrontation with a predator, may favour their expansion. The results obtained under this dissertation provide novel insight into the invasive potential of benthic Ponto-Caspian gobies and underlie the role of behaviour as a potential mechanism affecting invasion success in newly settled areas.

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