



New insights into alien aquatic plants ecology - response model to an elevated water temperatures

Mateusz Draga¹, Maciej Gąbka¹, Ewa Szczęśniak², Stanisław Rosadziński¹, Daniel Lisek¹, and Łukasz Bryl³

¹Department of Hydrobiology, Faculty of Biology, Adam Mickiewicz University in Poznań, Poznań, Poland
(mateusz.draga.08@gmail.com)

²Department of Botany, Institute of Environmental Biology, University of Wrocław, Wrocław, Poland

³Department of Trace Analysis, Faculty of Chemistry, Adam Mickiewicz University in Poznań, Poznań, Poland

Freshwater ecosystems are widely recognized as a significant global biodiversity hotspot. Unfortunately, they are also highly vulnerable to the expansion of invasive aquatic species, whose spread is considered among the top threats to these ecosystems. Especially problematic are alien aquatic plants species whose rapid growth often disrupts local communities and may even alter physicochemical conditions of a given freshwater ecosystem. Since most of invasive aquatic plants are native to tropical regions of the world, their occurrence in some Central and Eastern Europe countries was, until relatively recently limited by cold winters typical for this part of the continent. However, in the last two decades, we have observed a sharp increase in these species abundances in this part of Europe, which can be linked to the warmer winters resulting from the ongoing climate change. In our study, we examine the effects of temperature changes resulting from global warming on the development and occurrence of several aquatic alien plant species. Our analysis is based on our unique data base that contains extensive information about all currently known alien vascular aquatic plant species present in Poland as well as their precise location. This data is notable for being the first such database summarizing the current status of aquatic plant invasions for this country. Based on it, as well as temperature data from the last several years, we created generalized additive models (GAM) for temperature response for each of 15 aquatic alien plant species known for Poland. Our results show a strong relationship between rising temperatures and the spread of certain species, i.e. *Azolla filiculoides*. Furthermore, spread of such species as *Elodea nuttallii* and *Lemna turionifera* in Poland does not rely strongly on temperature. Presence of some species was found to be highly dependent on highly thermally altered or thermally contaminated waters, i.e. *Vallisneria spiralis*, *Hygrophila polysperma*, and thus their occurrence is still limited only to such locations. Our results confirm the major role of elevated temperatures and thermal modification of waters in the distribution of alien aquatic plants.