

Abstract

Hybridizing species of the *Daphnia longispina* complex are key taxa in plankton communities of many European lakes. In several of these lakes, it has been documented that the taxonomic structure of the complex during the 20th century has substantially changed following human-mediated environmental changes, particularly eutrophication and re-oligotrophication and fish stock changes. We characterize these changes in Lago Maggiore (Italy/Switzerland), a southern pre-alpine lake, which also passed through the human-mediated environmental changes.

Lago Maggiore is one of best and longest studied European lakes so a large number of historical *Daphnia* samples from regular monitoring are available. Because local *Daphnia* do not form dormant egg banks suitable for genetic analysis (being able to overwinter in the water column), we used a combination of morphology and geometric morphometrics (elliptic Fourier analysis) to evaluate the taxonomic and phenotypic changes in the *Daphnia longispina* complex in Lago Maggiore since the mid-20th century (1948-2012), and attempted to characterize the impact of environmental changes over the respective period on *Daphnia* body shape and size. Examination of *Daphnia* phenotype indicates indeed the prevailing presence of *D. longispina* (*hyalina* morph) in the 1940s, dominance of helmeted *D. galeata* morphs after 1980s, only occasional presence of *D. cucullata* in 1986 and 1992, as well as common intermediate phenotypes that likely represent interspecific hybrids since the 1940s. Geometric morphometric analyses indicate that most of the variation in *Daphnia* body shapes can be summarized along a single multivariate axis. Inter-annual and seasonal variation in *Daphnia* body shapes have been characterized, as well as the relationship between taxonomic assignment and body shape. However, we could not document a clear impact of specific environmental characteristics in the lake on the *Daphnia* shape.