



## **Temperature increase in the Austrian Danube - causes and consequences**

**I Zweimueller**

Limnology and Freshwater Biology, University Vienna (e-mail: irene.zweimueller@univie.ac.at)

The mean water temperature of the Austrian Danube increased by approx. 1°C per ten years over the last decades (yearly means measured at Vienna). This increase exhibited a striking seasonality: significant increases were found in the winter and the summer, whereas fall and spring temperatures remaining fairly constant. Including mean air temperature in the analysis explained a considerable amount of the long-term trend in water temperature, but not all of it.

Ecological consequences are to be expected and are already taking place. The paper provides examples for four different aspects:

- (1) Nutrient processing: increasing temperatures already lead to a reduction in nitrate concentrations with consequences on the N:P-ratio.
- (2) Autecology: temperature changes alters the growth patterns - and therefore survival - of important river biota. The example will show a model for impacts of temperature increases on the early development of key fish species, the nase (*Chondrostoma nasus*).
- (3) Synecology: a series of biological habitat expansions have taken place in the Austrian Danube in the last decades - and the process is obviously going on. The impact of global warming on this process is not really understood, as the temperature requirements of most non-native species are poorly documented.
- (4) Synchronisation between the environment and the biological processes: the example presented deals with the timing of spring floods. The shift of spring floods will potentially bring about a change in biological events correlated with the spring floods, for example spawning times of fishes and the environmental conditions for their early

life stages.

This paper emphasises that, although dramatic weather conditions are important for short-term changes in the biota and for public awareness, it is still the “silent” overall changes in the environment bringing about the most fundamental changes.