

## **High environmental temperature and low pH stress alter the gill phenotypic plasticity of Hoven's carp *Leptobarbus hoevenii***

### **ABSTRACT**

Climate warming and low pH environment are known to negatively impact all levels of aquatic organism from cellular to organism and population levels. For ammonotelic freshwater species, any abiotic factor fluctuation will cause disturbance to the fish, specifically at the gills which act as a multifunctional organ to support all biological processes. Therefore, this study was designed to investigate the effect of temperature (28 vs. 32°C) and pH (7.0 vs. 5.0) stress on the gill plasticity of Hoven's carp after 20 days of continuous exposure. The results demonstrated that high temperature and low pH caused severe changes on the primary and secondary lamellae as well as the cells within lamellae. An increasing trend of the proportion available for gas exchange was noticed at high temperature in both pH exposures, which resulted from a reduction of the primary lamellae width with elongated and thinner secondary lamellae compared to fishes at ambient temperature. Following exposure to high temperature and acidic pH, Hoven's carp experienced gill modifications including aneurysm, oedema, hypertrophy, curling of secondary lamellae, epithelial lifting, hyperplasia and lamellae fusion. These modifications are indicators of the coping mechanism of Hoven's carp to the changing environment in order to survive.