

Effects of water temperature changes on the endogenous and exogenous rhythm of oxygen consumption in the elvers *Anguilla japonica*

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Abstract

This study is to investigate the effects of water temperature changes on the endogenous and exogenous rhythm of oxygen consumption rate (OCR) in the elver *Anguilla japonica* exposed to the different water temperature patterns of three simulated 12-, 14- and 24-h cycles.

The wild freshly-collected elvers in the estuary, when removed from their natural environment, exhibited a clear endogenous circatidal rhythm in the OCR under constant darkness and constant temperature ($15 \pm 0.1^\circ\text{C}$). However, if the temperature was variable, the OCR of the elvers appeared to coincide with a gradual increasing rate ($\Delta t = 1^\circ\text{C}/12\text{-h}$ or 24-h) of water temperature in the experimental chamber. It is believed that the increasing rate ($\Delta t = 1^\circ\text{C}/12\text{-h}$ or 24-h) of water temperature was significant enough to affect the rhythmicity of OCR of the elvers.

The peaks of the elvers OCR, which was exposed to the repeating increase of decrease ($\Delta t = \pm 1^\circ\text{C}/14\text{-h}$) in water temperature, displayed a clear rhythmicity of 14-h intervals, corresponding to repeated exposure cycles of 14-h. In the present study, the results indicate that respiration rhythms of the elvers are controlled not only by exogenous factors as a minor water temperature change of 1°C , but also by an endogenous circatidal rhythm. The possible mechanisms underlying these temperature responses were discussed, and implications of such findings for eco-physiology and metabolic activity rhythms of elvers were highlighted.