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Marine Biodiversity and Ecosystems

A Systemic Biological Study on Adaptive Energy Provision in Fish Under Temperature Variability Challenges

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Abstract

Organisms have experienced seasonal temperature variance and evolved the specific coping measure in different niche. On the other hand, seasonal thermal variance is regarded as a major trigger of the coping measures. Nowadays, winter warming caused by climate change decrease thermal fluctuation. However, the extreme cold weather which result in major ecological variation and economic losses still irregularly occurs. In contrast to endotherms, ectothermic fishes experience ambient temperature as an abiotic factor that is central to performance and survival. Therefore, the effect of thermal fluctuation has ignited a surge of scientific interest from ecologists, economists and physiologists, among others. The present study hypothesizes that the ectothermic fishes develop different adaptive energy allocation mechanism in different thermal fluctuation environment, further affects their cold-tolerance. Basic energy maintenance, energy fuel storage, reproduction and development are four basic energy allocated elements. In the first and second chapters, this study rearing cold-experienced (CE) and cold-naïve (CN) lines of tropical tilapia to examine the transgenerational effects of thermal fluctuation on these four elements. The results show that transgenerational plasticity in response to thermal perturbations in the study. It provides novel insights into the mechanisms by which thermal tolerance capacity might be affected by climate change. The third chapter of this study attempts to adjust the fish metabolic process base on the mechanisms that found in first and second chapters. Our results suggest that supplying carboxyl-containing metabolites or altering the gluconeogenesis of fish under cold stress may benefit tilapia cold-tolerant enhancement.