ASSESSING THE CRITICAL THERMAL TOLERANCE AND PHYSIOLOGICAL STRESS OF *Mystus gulio* UNDER HYPOXIC AND NORMOXIC CONDITIONS

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Session: 2023–2024

A thesis submitted in the partial fulfillment of the requirements for the degree of Master of Science in Fish Biology and Biotechnology

Department of Fish Biology and Biotechnology

Faculty of Fisheries

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Chattogram-4225, Bangladesh

June 2025

Authorization

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The author

June 2025

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Abstract

Understanding critical thermal tolerance and physiological stress responses of fish is crucial for assessing their resilience to environmental changes. This study evaluated the critical thermal maximum (CTmax) and minimum (CTmin) under normoxic (with oxygen supply) and hypoxic (without oxygen supply) conditions in *Mystus gulio*, a commercially important climate-prone fish from the Bay of Bengal. Under normoxia, the CTmax and CTmin were recorded as 41.8 ± 0.24 °C and 11.6 ± 0.33 °C, respectively, while under hypoxia, critical thermal tolerance was 36.9 ± 3.44 °C and 13.5 ± 0.36 °C, respectively. Oxygen saturation in *Mystus gulio* at CTmax and CTmin was significantly reduced ($p < 0.05$) under hypoxia compared to normoxia and starting point. Oxygen consumption rates (OCR) and opercular respiratory rates rose significantly at CTmax under hypoxia. Hemato-biochemical parameters revealed notable changes, having significantly lowered levels of hemoglobin (Hb) and red blood cell (RBC) counts while the level of glucose (Glu), cholesterol (Chl) and white blood cell (WBC) counts increased significantly at hypoxic conditions in both CTmax and CTmin. Erythrocytic cellular and nuclear abnormalities were more prevalent under hypoxia in both CTmax and CTmin. Water quality parameters also fluctuated with temperature changes. Dissolved oxygen (DO) levels decreased notably at CTmax under hypoxia, while free CO_2 levels showed opposite trend. *Mystus gulio* recovered successfully from immediate before CTmax and CTmin when supplementing oxygen and stopped temperature increment. These findings demonstrate the reduced thermal tolerance of *Mystus gulio* under hypoxia and highlighted significant physiological and cellular stress responses, providing critical insights into the species' adaptive capacity under environmental stressors.

Keywords: Thermal tolerance, CTmax, CTmin, haematlogical parameters, erythocytic abnormalities, opercular respiratory rate, *Mystus gulio*