



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

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Roll No.: 0124/02

Registration No.: 1481

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

Chattogram Veterinary and Animal Sciences University

Chattogram-4225, Bangladesh

June 2025

Authorization

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The author

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**This is to certify that we have examined the above Master's thesis and have
found that is complete and satisfactory in all respects and that all revisions
required by the thesis examination committee have been made**

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Acknowledgment

I am profoundly thankful to the Almighty for providing me with the resilience, determination, and patience to successfully complete my Master of Science (MS) degree in Fish Biology and Biotechnology and my thesis.

I extend my heartfelt gratitude to my MS supervisor, **Dr. Md. Mahiuddin Zahangir**, Associate Professor and Head, Department of Fish Biology and Biotechnology at Chattogram Veterinary and Animal Sciences University, for his unwavering support, expert mentorship, insightful feedback, and continuous encouragement, which were pivotal to my success.

I am sincerely grateful to my MS co-supervisor, **Professor Dr. Mohammed Nurul Absar Khan**, Department of Fishing and Post-Harvest Technology, Faculty of Fisheries, Chattogram Veterinary and Animal Sciences University, for his invaluable guidance and support.

My deep appreciation goes to **Mrs. Azmaien Naziat**, Lecturer, Department of Fish Biology and Biotechnology, Chattogram Veterinary and Animal Sciences University, for her steadfast support, which greatly contributed to my development as a confident and skilled researcher.

I am also thankful to **Mrs. Shifat Ara Noor**, Lecturer in the Department of Fish Biology and Biotechnology, Chattogram Veterinary and Animal Sciences University, for her consistent encouragement and support.

I am fortunate to recognize the invaluable assistance and companionship of my fellow researchers, **Shaharier Ahmed**, **Md. Jobran Mia** and **Md. Shamim Rahman**, whose kindness and support during my research were deeply appreciated.

Finally, I am immensely grateful to my parents **Md. Khalilur Rahaman**, Senior Teacher, Govt. Muslim High School, Chattogram and **Sayed Kausar Akter** and my younger brother **Hozaifa Bin Khalil**, for their boundless support, blessings, and sacrifices, which have been my pillar of strength and inspiration throughout this journey.

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 (CT_{max}) and minimum (CT_{min}) 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 CT_{max} and CT_{min} 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 CT_{max} and CT_{min} 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 CT_{max} 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 CT_{max} and CT_{min}. Erythrocytic cellular and nuclear abnormalities were more prevalent under hypoxia in both CT_{max} and CT_{min}. Water quality parameters also fluctuated with temperature changes. Dissolved oxygen (DO) levels decreased notably at CT_{max} under hypoxia, while free CO₂ levels showed opposite trend. *Mystus gulio* recovered successfully from immediate before CT_{max} and CT_{min} 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, CT_{max}, CT_{min}, haematological parameters, erythrocytic abnormalities, opercular respiratory rate, *Mystus gulio*