



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

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Roll No.: 0124/02

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**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**

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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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## Table of Contents

Chapter	Title	Page no.
	<b>Authorization</b>	ii
	<b>Signature page</b>	iii
	<b>Acknowledgment</b>	iv
	<b>Table of Contents</b>	v–vii
	<b>List of Plates</b>	viii
	<b>List of Figures</b>	ix–x
	<b>List of Tables</b>	xi
	<b>Abstract</b>	xii
1	<b>Introduction</b>	<b>1–6</b>
	1.1 Background	1–5
	1.2 Objectives of the study	6
2	<b>Review of Literature</b>	<b>7–18</b>
	2.1 Global climate change and its impact on aquatic ecosystems	7–8
	2.2 Relevance to climate change and aquaculture	8–9
	2.3 Thermal tolerance in fish	9–11
	2.3.1 Methodologies for assessing thermal tolerance	9–10
	2.3.2 Species-specific thermal tolerance	10–11
	2.4 The role of dissolved oxygen (DO) in growth and metabolism	11
	2.5 Oxygen requirement for different fish species	12
	2.6 Hypoxia and its effects in fish	12–15
	2.6.1 Behavioral adaptation of fish to hypoxia	12
	2.6.2 Physiological and biochemical responses to hypoxia	13

	2.6.3 Hormonal and stress response to hypoxia	13–14
	2.6.4 Impact of hypoxia on immune function	14
	2.6.5 Effects of hypoxia on growth performance of fish	14
	2.6.6 Effects of hypoxia on respirometry	14–15
	2.7 Synergistic effects of temperature and hypoxia on fish physiology	15–16
	2.8 <i>Mystus gulio</i>	16–18
	2.9 Research gap	18
3	<b>Materials and Methods</b>	<b>19–27</b>
	3.1 Study area	19
	3.2 Experimental fish	19–20
	3.3 Experimental design	20–21
	3.4 Oxygen consumption at CTmax and CTmin	21–22
	3.5 Measurement of hemato-biochemical parameters	22–24
	3.6 Cellular and nuclear abnormalities of erythrocytes	24–25
	3.7 Recovery of <i>M. gulio</i> from CTmax and CTmin	26
	3.8 Measurement of water quality parameters	27
	3.9 Statistical analysis	27
4	<b>Results</b>	<b>28–37</b>
	4.1 Critical thermal tolerance (CTmax and CTmin) of <i>Mystus gulio</i> under normoxic and hypoxic conditions	28–29
	4.2 Oxygen saturation at CTmax and CTmin under normoxia and hypoxia	29–30

	4.3 Oxygen consumption rate at CTmax and CTmin under normoxia and hypoxia	30–31
	4.4 Opercular respiratory rate at CTmax and CTmin under normoxia and hypoxia	31–32
	4.5 Hematobiochemical changes at CTmax and CTmin under normoxia and hypoxia	32–33
	4.6 Cellular and nuclear abnormalities of erythrocytes at CTmax and CTmin under normoxia and hypoxia	33–35
	4.7 Recovery time of <i>Mystus gulio</i> at CTmax and CTmin	36
	4.8 Changes in water quality parameters at CTmax and CTmin under normoxia and hypoxia	37
5	<b>Discussion</b>	<b>38–44</b>
6	<b>Conclusions</b>	45
7	<b>Recommendations</b>	46
	<b>References</b>	<b>47–74</b>
	<b>Brief Biography of the Author</b>	75

## List of Plates

<b>Plate no.</b>	<b>Title</b>	<b>Page no.</b>
1	Study area	19
2	<i>Mystus gulio</i>	20
3	Experimental set up	21
4	Initial data collection	22
5	Measuring hemato-biochemical parameters	23
6	Counting blood cells (RBC and WBC) under microscope	24
7	Blood smear preparation	25
8	Measurement of water quality parameters	26

## List of Figures

Figure no.	Title	Page no.
1	Temperature tolerance (A) CTmax and (B) CTmin of <i>Mystus gulio</i> under normoxia and hypoxia. Values with different alphabetical superscripts differ significantly ( $p < 0.05$ ) between treatment groups. All values are expressed as mean $\pm$ SD (n=8).	28
2	Oxygen saturation (%) at (A) CTmax and (B) CTmin of <i>Mystus gulio</i> under normoxia and hypoxia. Values with different alphabetical superscripts differ significantly ( $p < 0.05$ ) between treatment groups. All values are expressed as mean $\pm$ SD (n=8).	29
3	Oxygen consumption rate (O <sub>2</sub> /Kg/hr) at (A) CTmax and (B) CTmin of <i>Mystus gulio</i> under normoxia and hypoxia. Values with different alphabetical superscripts differ significantly ( $p < 0.05$ ) between treatment groups. All values are expressed as mean $\pm$ SD (n=8).	30
4	Opercular respiratory rate (OCR, beats/min) at (A) CTmax and (B) CTmin of <i>Mystus gulio</i> under normoxia and hypoxia. Values with different alphabetical superscripts differ significantly ( $p < 0.05$ ) between treatment groups. All values are expressed as mean $\pm$ SD (n=8).	31
5	Erythrocytic cellular abnormalities of <i>Mystus gulio</i> under normoxia and hypoxia; a) regular cells; b) spindle; c) tear-drop shaped; d) elongated; e) fusion; f) twin.	34
6	Erythrocytic nuclear abnormalities of <i>Mystus gulio</i> under normoxia and hypoxia; a) regular cells; b) binuclei; c) notched nuclei; d) nuclear degeneration; e) micronucleus; f) karyopyknosis.	35

7	Recovery time of <i>Mystus gulio</i> at (A) CTmax and (B) CTmin under normoxia and hypoxia. All values are expressed as mean $\pm$ SD (n=8).	36
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## List of Tables

<b>Table no.</b>	<b>Title</b>	<b>Page no.</b>
1	Changes in hemato-biochemical parameters during the determination of temperature tolerance of <i>Mystus gulio</i> under normoxia and hypoxia conditions at CTmax and CTmin	33
2	Cellular abnormalities of erythrocytes during the determination of temperature tolerance of <i>Mystus gulio</i> under normoxia and hypoxia at CTmax and CTmin	34
3	Nuclear abnormalities of erythrocytes during the determination of temperature tolerance of <i>Mystus gulio</i> under normoxia and hypoxia CTmax and CTmin	35
4	Changes in water quality parameters during the determination of temperature tolerance of <i>Mystus gulio</i> under normoxia and hypoxia conditions CTmax and CTmin	37

## 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<sub>max</sub>) and minimum (CT<sub>min</sub>) 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<sub>max</sub> and CT<sub>min</sub> were recorded as  $41.8 \pm 0.24$  °C and  $11.6 \pm 0.33$  °C, respectively, while under hypoxia, critical thermal tolerance was  $36.9 \pm 3.44$  °C and  $13.5 \pm 0.36$  °C, respectively. Oxygen saturation in *Mystus gulio* at CT<sub>max</sub> and CT<sub>min</sub> 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<sub>max</sub> 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<sub>max</sub> and CT<sub>min</sub>. Erythrocytic cellular and nuclear abnormalities were more prevalent under hypoxia in both CT<sub>max</sub> and CT<sub>min</sub>. Water quality parameters also fluctuated with temperature changes. Dissolved oxygen (DO) levels decreased notably at CT<sub>max</sub> under hypoxia, while free CO<sub>2</sub> levels showed opposite trend. *Mystus gulio* recovered successfully from immediate before CT<sub>max</sub> and CT<sub>min</sub> 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<sub>max</sub>, CT<sub>min</sub>, haematological parameters, erythrocytic abnormalities, opercular respiratory rate, *Mystus gulio*