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Thermal tolerance and oxygen consumption of Indian Major Carps acclimated to four temperatures

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Abstract

Critical thermal maxima (CTMax), critical thermal minima (CTMin), lethal temperature maxima (LTMax) and lethal temperature minima (LTMin) were determined in Indian Major Carps (*Labeo rohita*, *Catla catla* and *Cirrhinus mrigala*) acclimated to 26°C, 31°C, 33°C and 36°C for 30 days. At each acclimation temperatures, CTMax, CTMin were 40.63, 41.91, 42.65, 42.86 and 13.73, 14.2, 15, 15.58 (*L. rohita*), 40.45, 41.39, 42.63, 42.73 and 13.92, 14.4, 15.2, 15.63 (*C. catla*), 42.25, 42.55, 42.76, 43.07 and 12.12, 13.7, 13.81, 13.95 (*C. mrigala*), respectively. Similarly, LTMax and LTMin at 26°C, 31°C, 33°C and 36°C were 41.16, 42.3, 43.06, 43.31 and 13.31, 14.71, 14.43, 14.9 (*L. rohita*), 41.03, 41.7, 42.96, 43.06 and 13.6, 13.95, 14.81, 14.98 (*C. catla*), 42.51, 42.93, 43.11, 43.68 and 11.9, 13.3, 13.45, 13.56 (*C. mrigala*), respectively.

Rate of oxygen consumption with and without acclimation were determined at 26°C, 31°C, 33°C and 36°C and were significantly ($p<0.05$) different.

Final preferred temperature in Indian Major Carps was estimated through Q_{10} to be between 31°C and 33°C.

Thermal tolerance polygon values over entire range of tolerance region (12–40°C were 744.8°C^2 in *L. rohita*, 728.8°C^2 in *C. catla* and 801.8°C^2 in *C. mrigala*, respectively.

Keywords: Critical thermal maxima; Critical thermal minima; Lethal temperature maxima; Lethal temperature minima; Thermal tolerance polygon; Preferred temperature; Oxygen consumption rate; Indian Major Carps; *Labeo rohita*; *Catla catla*; *Cirrhinus mrigala*

1. Introduction

Temperature affects virtually all biochemical, physiological activities of fishes. The survival and growth of poikilothermal teleosts are immediately influenced by temperature fluctuations in their environments. All teleostean species have developed their own specific adaptive mechanism, both behavioural and physiological, to cope up with temperature fluctuations (Prosser and Heath, 1991). These adaptive capabilities enable them to survive through acclimation and adaptation to stressful temperature conditions (Hazel and Prosser, 1974).

Higher temperatures up to certain limit favour aquaculture by reducing the time required to produce marketable sized animals and allow more generations per year. On the contrary, temperature adversely affects the health of the animal by increasing metabolic rate and subsequent oxygen demand, invasiveness and virulence of bacteria and other pathogens that cause a variety of pathophysiological disturbances in the host (Wedemeyer et al., 1999).

The United States National Research Council proposed that the global mean air temperature may increase

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