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The emergence emergency: a mudskipper's response to temperatures

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Abstract:

Temperature has a profound effect on all life and a particularly influential effect on ectotherms, such as fishes. Amphibious fishes have a variety of strategies, both physiological and/or behavioural, to cope with a broad range of thermal conditions. This study examined the relationship between prolonged (5 weeks) exposure to a range of temperatures (22, 25, 28, or 32°C) on oxygen uptake rate and movement behaviours (i.e., thermoregulation and emergence) in a common amphibious fish, the barred mudskipper (*Periophthalmus argentilneatuis*). At the highest temperature examined (32°C, approximately 5°C above their summer average temperatures), barred mudskippers exhibited 33.7 to 97.7% greater oxygen uptake rates at rest ($\dot{M}O_{2Rest}$), emerged at a higher temperature (CT_e; i.e., a modified critical thermal maxima (CT_{Max}) methodology) of 41.3±0.3°C relative to those maintained at 28, 25, or 22°C. The 32°C-maintained fish also ceased movement activity at the highest holding temperature suggesting that prolonged submergence at elevated temperatures is physiologically and energetically stressful to the individual. Using exhaustive exercise protocols with and without air exposure to simulate a predatory chase, the time to recovery was examined for all individuals. When submerged, mudskippers required 2.5x longer recovery time to return to resting