Hardhead Catfish Thermal Performance

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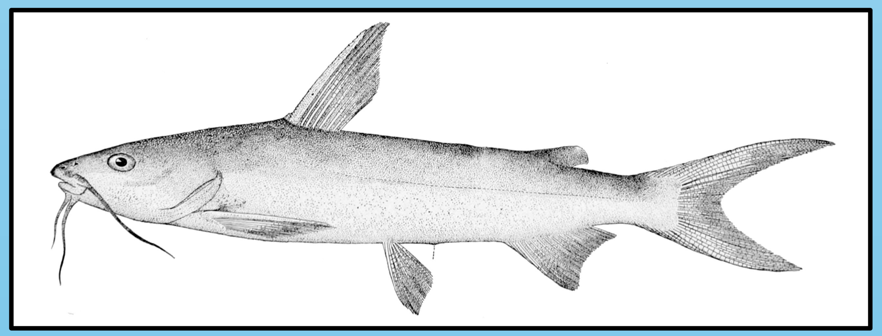
Introduction

- As global temperatures continue to rise, it is vital to understand how different species will face the consequences.
- The Hardhead Catfish, Ariopsis felis, is one of many Gulf fish species affected by rising ocean temperatures due to climate change.
- A. Felis are a suitable model species because they are one of the only species in ecological studies found to be active and feeding at or above 34ºC.
- This study aims to determine the thermal tolerance of Hardhead Catfish in the Northern Gulf of Mexico using metabolic and behavioral studies.
- How A. Felis uses oxygen under different thermal conditions can reveal how long it would be able to survive before experiencing symptoms such as disorientation and loss of equilibrium, which can lead to death.
- Understanding A. Felis thermal tolerance is essential to see how their metabolic scope responds to rising water temperatures due to climate change.



Hardhead Catfish, *Ariopsis felis*

Important Vocabulary

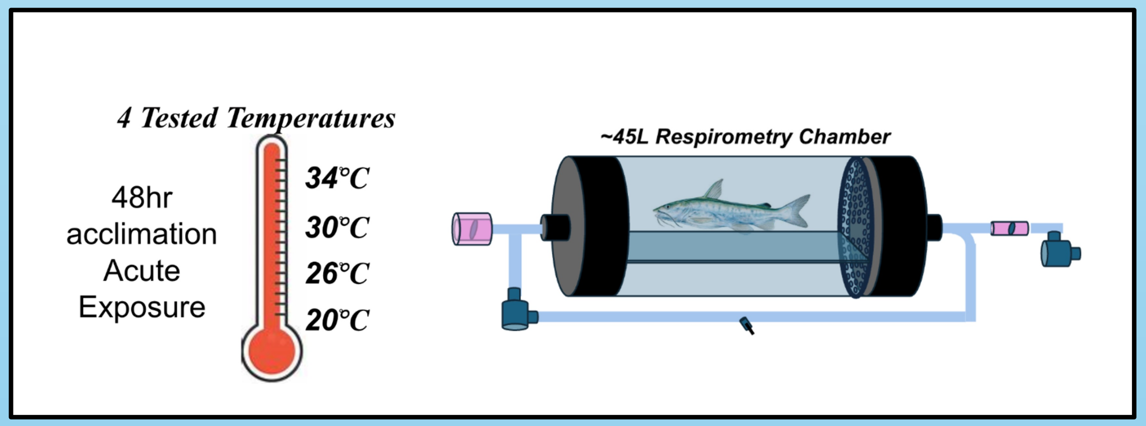
- **Ctmax:** is the temperature at which an organism's ability to control movement and behavior becomes disordered, which can lead to death.
- **Metabolic Rate**: a measure of how much energy is used to support bodily functions.
- **Maximum Metabolic Rate (MMR):** highest metabolic rate measured.
- **Resting Maximum Metabolic Rate (SMR):** lowest metabolic rate that sustains consciousness when the organism is at rest.
- **MO2: Metabolic rate of oxygen consumption.**

Methods

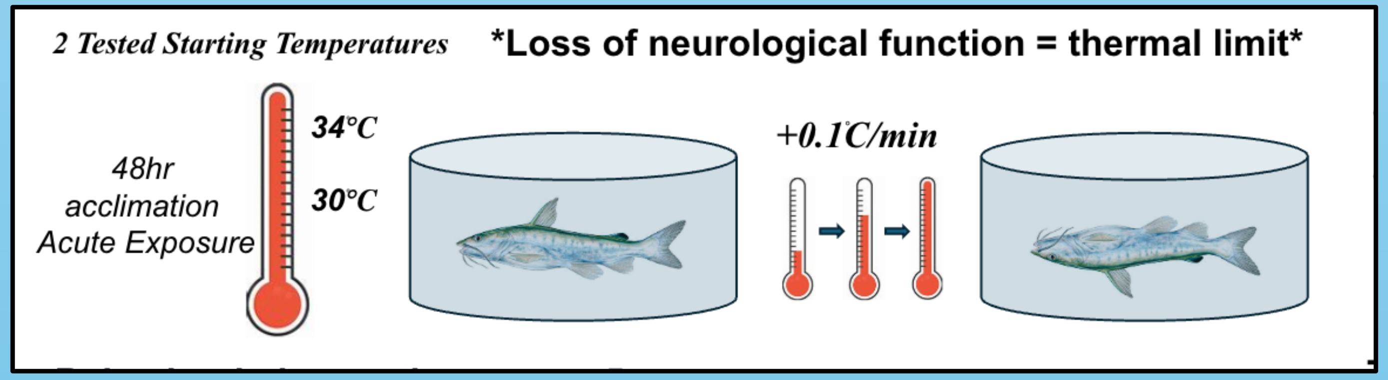
Procedures: Intermittent respirometry was used to measure maximum and resting metabolic rate

1. Subject was acclimated to tested temperature (20, 26, 30, 34ºC) for 48 hours.
2. Subject was manually chased to exhaustion.
3. Subject is placed in the respirometry chamber and MMR is recorded immediately.
4. Subject goes through a period of rest for 24 hours and SMR is calculated using the average of the lowest of MO2 vales.

Respirometry Chamber Design



Critical Thermal Maximum (CTmax) – Identifying critical thermal limit



Results

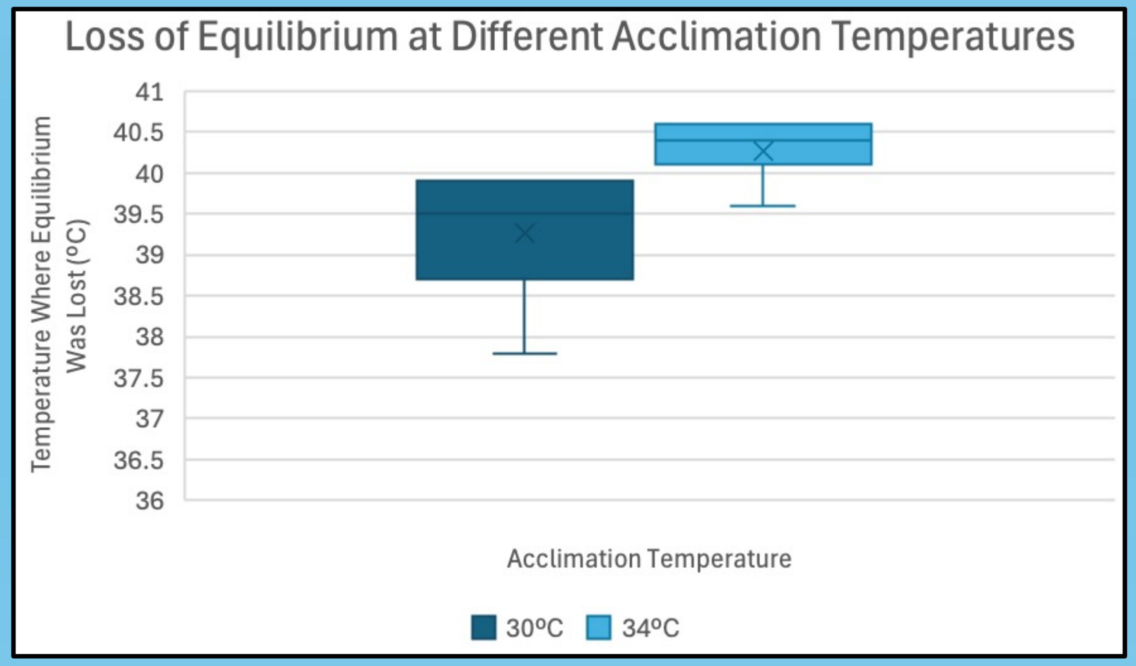


Figure 1: The temperature where equilibrium was lost was higher at an acclimation temperature of 34ºC than 30ºC.

Results Continued

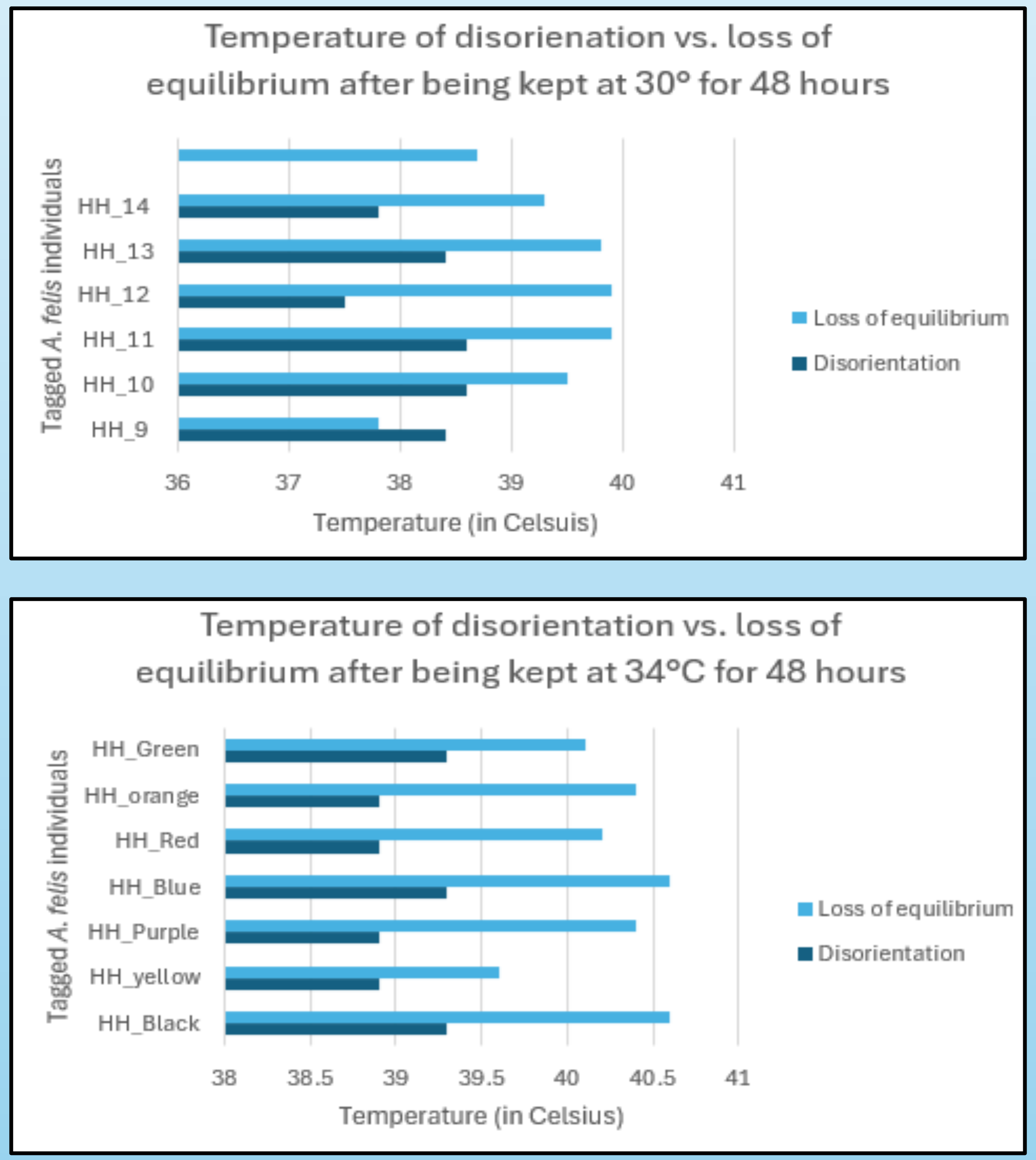


Figure 2: The temperature where disorientation and loss of equilibrium occurred was higher at an acclimation temperature of 34ºC than 30ºC.

Conclusion

- CTmax was shown to change depending on the acclimation temperature.
- Short-term acclimation can increase the A. felis threshold for what temperature affects neurological performance negatively but only up to a certain point.
- These findings can help assist future studies in understanding thermal tolerance and can even help local and global fisheries continue to support their communities with a better grasp of how their animals can thrive as the climate continues to change.
- There is still much to learn about thermal tolerance in marine species, especially since climate changes can be very extreme and unpredictable.
- Future research will look at 14-day thermal acclimation, larger sample sizes, analysis of heat shock proteins, and even different species like pompano and bonnetheads.

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