The influence of age on differences in tolerances to extreme environmental conditions in *Fundulus heteroclitus* populations from Maine and Massachusetts

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Audio recording of presentation

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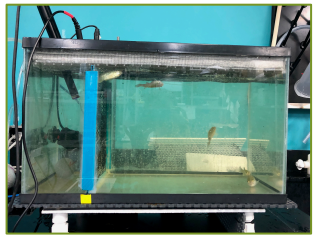
Background

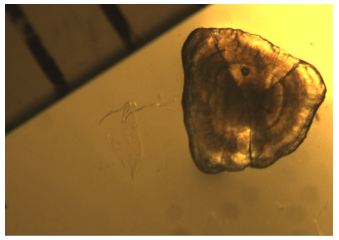
Summary: Otoliths are used to age fish from populations that experience different habitat temperatures, and correlate age with metabolic and thermal tolerance traits.

- *Fundulus heteroclitus* live in brackish water habitats that experience a wide range of temperatures.
- For ectotherms, temperature may impact growth, metabolic rate, and thermal tolerance.
- Critical Thermal Maximum (CTMax), is the highest temperature at which the fish lose their ability to control their movements but are still able to respirate.
- This temperature is considered deadly because the fish is unable to escape predation or any other factors that might kill it.
- In teleost fish, growth and age can be measured using otoliths (inner ear stones), which deposit seasonal rings that are darker in winter during periods of slow growth and lighter in summer during periods of more rapid growth

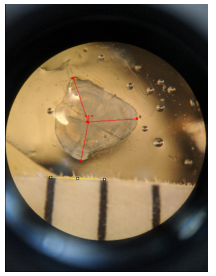
Methods



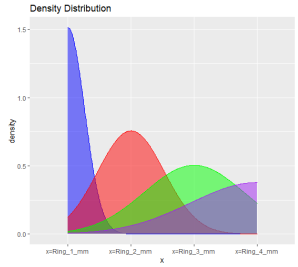
1. Measure critical thermal maximum (CTMax)



2. Extract and photograph the otolith using the MicroPix Application



3. Measure the ring distance using ImageJ



4. Assign ring distances to age groups

5. Statistical analysis in R studio used linear models to examine how age influenced body mass and critical thermal maximum.

Results

Body Mass

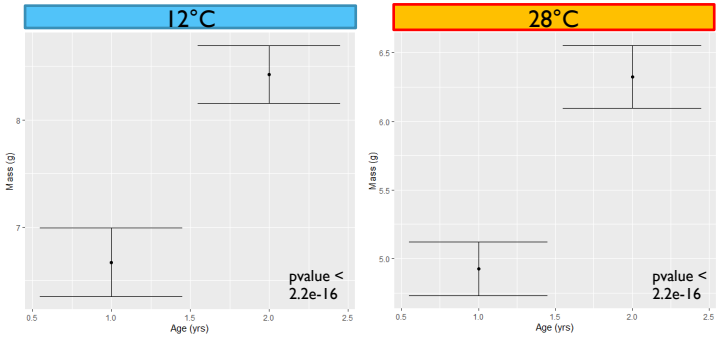


Figure 1. Age vs. the mean mass when acclimated to 12°C. Error bars show ± one standard error.

Figure 2. Age vs. the mean WAM mass when acclimated to 28°C. Error bars show ± one standard error.

CTMax

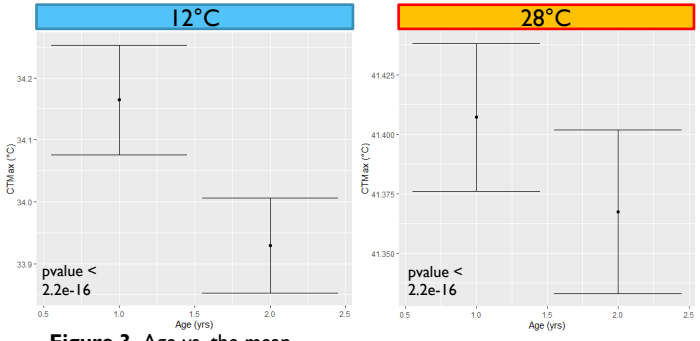


Figure 3. Age vs. the mean CTMax when acclimated to 12°C. Error bars show ± one standard error.

Figure 4. Age vs. the mean CTMax when acclimated to 28°C. Error bars show ± one standard error.

Conclusions

• Age has a significant influence on mass at both acclimation temperatures with two-year old's being larger than one-year old's. This demonstrates that the otolith method works well in determining fish age in this species.

• Age has a significant influence on CTMax at both acclimation temperatures. CTMax is higher at age 1 than age 2 for both acclimation temperatures. The smaller, younger fish have a higher thermal tolerance then the bigger, older fish.

Future Applications

- May be applied to other species facing similar environmental conditions.
- May help in a larger understanding of species adaptations to a changing environment due to climate change.

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References: Burnett, K., et al. (2007). *Fundulus* as the premier teleost model in environmental biology: Opportunities for new insights using genomics. *Elsevier*, 257-286., Campana, S.E. 2004. Photographic Atlas of Fish Otoliths of the Northwest Atlantic Ocean. *NRC Research press, Ottawa, Ontario*, 284 pp., Comte, L., J. O. (2016). Evolutionary and environmental determinants of freshwater fish thermal tolerance and plasticity. *Global Change Biology, 23,* 728-736.