

# Metabolic Temperature Sensitivity of Killifish

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## INTRODUCTION

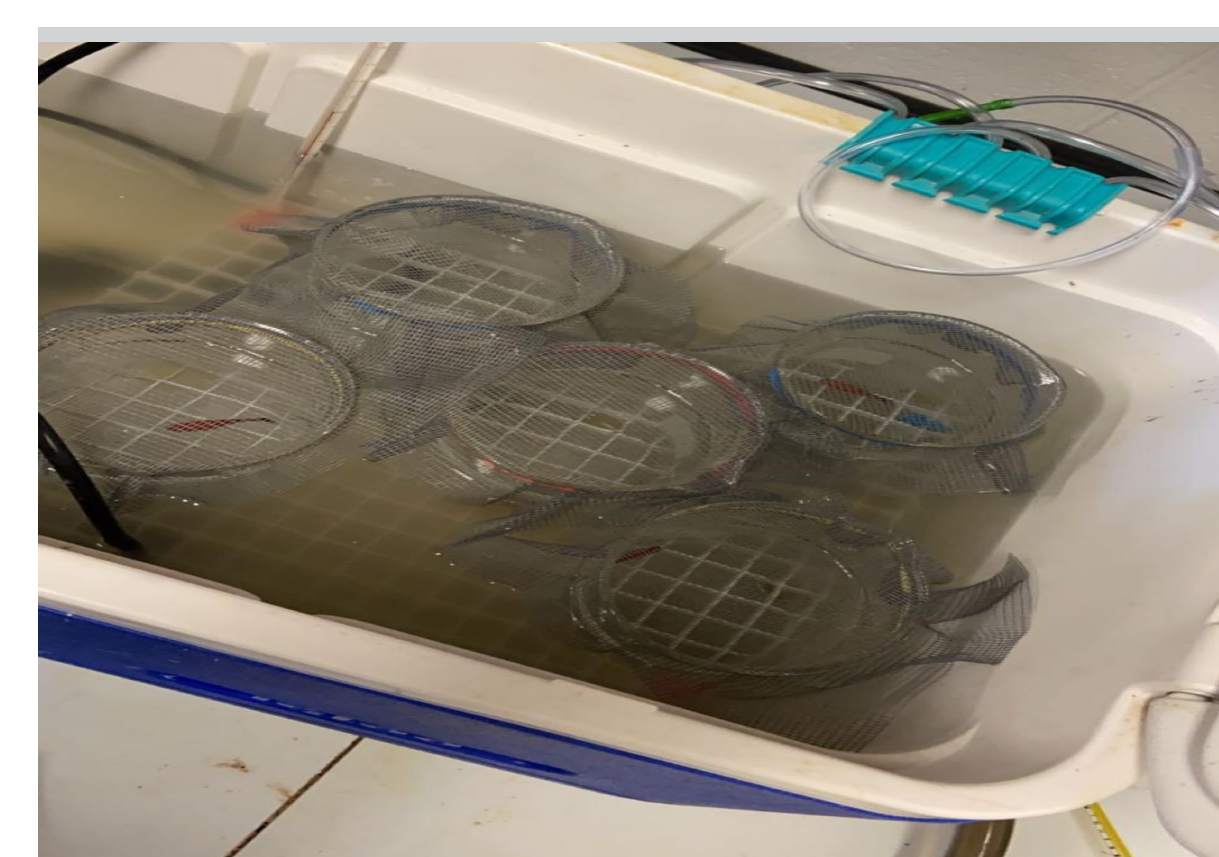
The killifish family Cyprinodontidae (also known as the egg-laying toothcarps) are small nearshore fishes associated with shallow seagrass and salt marsh habitats. More than 40 species of fundulus have been described, at least three of which are common in Northwest Florida including the Gulf Killifish, *Fundulus grandis*, the longnose killifish *Fundulus similis*, and the diamond killifish, *Adinia xenica*. Killifishes are well-known for their ability to survive extreme fluctuations in temperature and salinity, and while they prefer vegetated shallow waters zones where they feed on small invertebrates, their proclivity for shallow seagrass areas exposes them to rapid temperature and salinity changes. All three species are closely related, but it is unclear if all three species exhibit similar temperature sensitivity. A comparative assessment of thermal sensitivity among species would provide a better understanding of Killifish thermal physiology, and how they may respond to warming surface water temperatures.

## AIM

The objective of our study is to gain a better understanding of how killifish respond to changes in water temperature, with a goal of forecasting how these fishes may fare in the future as nearshore water temperatures continue to rise. We are working with gulf killifish, longnose killifish, and diamond killifish species, *Fundulus grandis*, *Fundulus similis*, and *Fundulus seminolis*. Specifically, we will quantify and statistically compare thermal tolerance of all three species, and interpret the results relative to the fishes' activity and distribution in their natural habitat.

## METHOD

Critical thermal maximum protocols will be used to determine upper thermal limits (CTmax) of fishes acclimated to a series of three different treatment temperatures. Each species will be acclimated in the laboratory to the same temperature set-points for two-weeks prior to heat tolerance



Chronic temperature testing to determine the minimum temperature tolerance based on loss of equilibrium

each to 500 ml glass beakers, and the beakers placed in a recirculating water bath. Upper thermal tolerance limits will be determined using standard critical thermal methodology. In this experiment, critical thermal maximum temperatures will be determined for each killifish species by slowly heating beaker water at a rate of 0.35 °C per minute until loss of

equilibrium (LOE) is observed. The mean LOE value of all fish in a trial will be taken as the critical thermal maximum for the species, and CTM temperatures among species will be statistically compared.

Pictured is *Fundulus similis*, the Longnose killifish



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## RESULTS

During the duration of SURP the Sailfin and Marsh Killifish were placed in trials to obtain their chronic temperature maximums of the two different fish. Every five minutes the temperature was raised one degree with five fish of each species in the trials. These fish were placed in beakers in a warming bath to help regulate the temperature at a constant rate amongst the five fish.

The Sailfins began in a bath temperature of 19.5 degrees celsius. As the five minute increments passed, the water temperature varied between raising one to two degrees. During the test the fish lost equilibrium between 37 to 39 degrees celsius with a trial length of 75 minutes. As the fish began losing equilibrium they began panicking and their activity spiked.

The marsh fish were then tested under the same conditions with a starting bath temperature of 19.4 degrees celsius. They were also placed in beakers that sat in a water bath. The temperature in the water bath varied by rising two to three degrees every five minutes. After 55 minutes the fish began to lose equilibrium as well. Equilibrium was lost between 37 and 39 degrees celsius.

Marsh		
Time	Beaker Temp.	Bath Temp
0	19.5	19.4
5	20.3	21.5
10	22	24.5
15	24.3	27.2
20	26.4	29.3
25	28.4	30.9
30	30.4	33
35	32.3	34.9
40	34.2	36.7
45	36	38.4

## CONCLUSIONS

Looking at the data collected on the Chronic temperature tests of the two different species of Killifish it can be concluded that these fish share maximum temperature tolerances for heat. Due to them being in the same family it was anticipated that no change would occur but tested to ensure. It is seen that the Sailfins lasted longer in the water bath than the Marsh fish. This could be due to the more rapidly changing temperature in the Marsh fish over the Sailfins. Further testing will be conducted to ensure the accuracy of the data collected as well as chronic temperature collection for cold tolerances.

Sailfin		
Time	Beaker Temp.	Bath Temp
0	19.8	19.5
5	20.4	21.3
10	21.4	22.9
15	22.9	24.6
20	24.2	26
25	25	27.1
30	27	28.4
35	28.5	29.9
40	29.8	31.4
45	31.3	32.8
50	32.4	33.7
55	33.7	25.1
60	34.9	36.3
65	36	37.4
70	37.7	38.6
75	38.3	39.6

Pictured is the data collected during the trials of CT maximum testing for heat of the Sailfin and Marsh Killifish species