

DRAFT Mountain Sucker (*Catostomus platyrhynchus*) Thermal Tolerance Analyses – Juvenile and Adult, Summer

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Introduction

Recommended summer chronic and acute thermal tolerance values for juvenile and adult mountain sucker and their justification are discussed below. The recommended tolerance values were developed in accordance with the “*DRAFT Methodology for Developing Thermal Tolerance Thresholds for Various Fish in Nevada – Juvenile and Adult, Summer*” (September 2015).

Chronic Thermal Tolerance Thresholds

Table 1 provides a summary of the range of chronic temperature tolerance values for mountain sucker for various lines of evidence. These values are based upon a review of 1 publication, the details of which are summarized in Attachment A. There is obviously a wide range of temperatures from which to select an appropriate value and best professional judgment is called for. NDEP’s approach is to accept the EPA recommendations from Brungs and Jones (1977) unless the literature review provides a compelling reason to utilize other values. However, in the case of the mountain sucker, EPA has not recommended a chronic thermal tolerance value. Based upon the available information, NDEP concluded that a chronic thermal tolerance value of 26°C is appropriate. This value is within the range of values derived from the literature.

Table 1. Summary of Chronic Temperature Tolerances

Category	Temperature (°C)
Other Information	
Overall Range	10 – 28
Usual Range	15 – 23
Recommended Chronic Temperature Tolerance (MWAT)	26

Acute Thermal Tolerance Thresholds

Table 2 provides a summary of the range of acute temperature tolerance values for mountain sucker for various lines of evidence. These values are based upon a review of 2 papers and publications, the details of which are summarized in Attachment B.

For ease of presentation, the CTM values have been summarized by acclimation temperature. However, as discussed in the methodology document, only the CTM values for acclimation temperature near the recommended chronic criterion (26°C) are to be included in the acute criterion development process. For mountain sucker, CTM values for acclimation temperatures 25°C are utilized for criterion development.

Table 2. Summary of Acute Temperature Tolerances

Category	Temperature Tolerances (°C)	Potential Acute Criteria (°C)
Laboratory Lethal Studies – CTM		
Acclim. = 20°C	32.3 – 32.9	
Acclim. = 22.5°C	32.6 – 33.2	
Acclim. = 25°C	33.6 – 34.0	28.2 – 28.6 ¹
Field Studies		28
Recommended Acute Temperature Tolerance (MDMT)		28

¹CTM values reduced by 3.4°C to estimate quasi-UILT values, and reduced by 2°C to provide 100% survival

A review of the literature suggests that an appropriate acute criterion should fall between 28 and 28.6°C. NDEP's approach is to accept the EPA recommendations from Brungs and Jones (1977) unless the literature review provides a compelling reason to utilize another value. However, in the case of mountain sucker, EPA did not provide an acute thermal threshold recommendation. Based upon the available information, NDEP concluded that an acute thermal tolerance value of 28°C is appropriate. This value is within the range of values derived from the literature and is slightly higher than the recommended chronic threshold of 26°C.

References

Brungs, W.A. and B.R. Jones. 1977. Temperature Criteria for Freshwater Fish: Protocol and Procedures. EPA-600/3-77-061. Environmental Research Laboratory, Duluth, Minnesota.

Colorado Water Quality Control Division. 2007. Colorado temperature database.

Schultz, L.D. and K.N. Bertrand. 2011. An assessment of the lethal thermal maxima for mountain sucker. Western No. American Naturalist 71(3), 404-411.

Smith, G.S. 1966. Distribution and Evolution of the North American Catostomid Fishes of the Subgenus *Pantosteus*, Genus *Catostomus*. Museum of Zoology, Univ. of Michigan, No. 129.

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ATTACHMENT A

Detailed Summary of Chronic Thermal Tolerance Values for Mountain Sucker, Juvenile and Adult, Summer

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Table A-1. Chronic Temperature Tolerances – Other Information

Reference	Temperature (°C)	Comments
Smith (1966)	15 – 23	Daytime summer temperatures of mountain sucker habitat are reported to range from about 10 to 28°C and are usually between 15 and 23°C.
	10 – 28	

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ATTACHMENT B

Detailed Summary of Acute Thermal Tolerance Values for Mountain Sucker, Juvenile and Adult, Summer

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Table B-1. Acute Temperature Tolerances – Laboratory Lethal Temperatures, Critical Thermal Maximum

Reference	Size or Age	Acclim. Temp. (°C)	Rate	Temperature (°C)	Endpoint
Schultz and Bertrand (2011)	Adult	20	0.3°C/min (18°C/hour)	32.3	Loss of equilibrium
		20		32.9	Death
		22.5		32.6	Loss of equilibrium
		22.5		33.2	Death
		25		33.6	Loss of equilibrium
		25		34	Death

Table B-2. Acute Temperature Tolerances – Field Studies

Reference	Temperature (°C)	Comments
Smith (1966)	28	Daytime summer temperatures of mountain sucker habitat are reported to range from about 10 to 28°C and are usually between 15 and 23°C