

**DRAFT White Bass (*Morone chrysops*) Thermal Tolerance Analyses – Juvenile and Adult, Summer
March 2016**

Introduction

Recommended summer chronic and acute thermal tolerance values for juvenile and adult white bass 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 white bass for various lines of evidence. These values are based upon a review of 6 papers and publications, 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 white bass, EPA does not provide a chronic thermal threshold recommendation.

As discussed in the methodology, chronic temperature criteria are generally not set to ensure the most optimum conditions. In fact, Brungs and Jones (1977) recommends chronic criterion for a given fish species that is between the optimum temperature and the UUILT. Therefore, NDEP recommends a chronic value of 30°C which is within the upper range of the tolerances taken from the literature.

Table 1. Summary of Chronic Temperature Tolerances

Category	Temperature (°C)
Laboratory Temperature Preference Studies	
Average Preferences	18 – 30
Upper Preferences	20 – 34
Final Preference	27.8
Temperature Preference Field Studies	26 – 31.4
Thresholds from Colorado (MWAT)	30.3
Recommended Chronic Temperature Tolerance (MWAT)	30

Acute Thermal Tolerance Thresholds

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

Only the UILT and CTM values for acclimation temperature near the recommended chronic criterion (30°C) are to be included in the acute criterion development process. For white bass, only 2 acclimation temperatures (one of which was not reported) were represented in the UILT/CTM literature. Both of these results were assumed to be appropriate for consideration in criterion development.

Table 2. Summary of Acute Temperature Tolerances

Category	Temperature Tolerances (°C)	Potential Acute Criteria (°C)
Laboratory Lethal Studies – UILT/UUILT		
UILT		
Acclim. = 28°C	33.5	31.5 ¹
Laboratory Lethal Studies – CTM		
Acclim. = Unknown temperature	35.3	29.9 ²
Thresholds from Colorado		30.6
Recommended Acute Temperature Tolerance (MDMT)		31

¹UILT values reduced by 2°C to provide 100% survival (See *Methodology*)

²CTM values reduced by 3.4°C to estimate quasi-UILT values. Quasi-UILT values then reduced by 2°C to provide 100% survival (See *Methodology*)

A review of laboratory studies and other information suggest that an appropriate acute criterion should fall between 29.9 and 31.5°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 white bass, EPA did not provide an acute thermal threshold recommendation. Based upon the available information, NDEP concluded that an acute thermal tolerance value of 31°C is appropriate. This value is within the range of values found in the literature and is slightly higher than the chronic threshold of 30°C.

References

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ATTACHMENT A

Detailed Summary of Chronic Thermal Tolerance Values for White Bass, Juvenile and Adult, Summer

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Table A-1. Chronic Temperature Tolerances – Laboratory Preference Studies

Reference	Age or Size	Acclim. Temp. (°C)	Average Preference Temperature		Upper Preference Temperature		Final Preferendum	
			Temp. (°C)	Comment	Temp. (°C)	Comment	Temp. (°C)	Comment
Barans and Tubbs (1973)	Young of year, adult	1 - 23	18 – 30	Average preferences (based upon modes of data)	20 - 34	Upper preference (80% of temperatures selected)		
Reutter and Herdendorf (1974 and 1976)	Young of year	22 - 26			29.5	1 standard deviation above final preferendum	27.8	

Table A-2. Chronic Temperature Tolerances – Field Studies

Reference	Temperature (°C)	Comment
Eaton et al. (1995)	31.4	Based upon 95 th percentile of 5% highest weekly average temperatures
Gammon (1973)	28 – 29.5	Based upon instantaneous temperature readings during electroshocking
Yoder and Gammon (1976)	26 - 29	Based upon instantaneous temperature readings during electroshocking

Table A-3. Chronic Temperature Tolerances – Colorado

Reference	Temperature (°C)	Comments
Colorado WQCD (2007)	30.3	Recommended level as MWAT

ATTACHMENT B

Detailed Summary of Acute Thermal Tolerance Values for White Bass, Juvenile and Adult, Summer

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Table B-1. Acute Temperature Tolerances – Laboratory Lethal Temperatures, UILT/UUILT

Reference	Size or Age	Acclim. Temp. (°C)	Test Duration	UILT		UUILT	
				Temp. (°C)	Comment	Temp. (°C)	Comment
Cvancara et al. (1977)	Young-of-year	28	2-d	33.5			

Table B-2. Acute Temperature Tolerances – Laboratory Lethal Temperatures, Critical Thermal Maximum

Reference	Size or Age	Acclim. Temp. (°C)	Rate	Temperature (°C)	Endpoint
Reutter and Herdendorf (1976)	Adult	Unknown	Unknown	35.3	Lost swimming ability

Table B-3. Acute Temperature Tolerances – Colorado

Reference	Temperature (°C)	Comments
Colorado WQCD (2007)	30.6	Recommended level as DM