



Memorandum

To: DEQ Water Quality Staff

From: Connie Dou, Water Quality Standards Program Manager

Date: Jan. 22, 2026

Subject: Implementation of Cool Water Species Narrative Criterion for the Malheur River Basin

Introduction

This memorandum describes the Oregon Department of Environmental Quality's interpretation and application of the cool water species narrative criterion for temperature in the Malheur River Basin. The cool water species narrative criterion at OAR 340-041-0028(9)(a) states that "No increase in temperature is allowed that would reasonably be expected to impair cool water species." This criterion is applicable in the following reaches designated "cool water species" aquatic life use (OAR 340-041, Figure 180A): Malheur River (Namorf Dam to confluence with the Snake River); Bully Creek (Bully Creek Reservoir to confluence with the Malheur River); Willow Creek (Brogan Creek to confluence with the Malheur River). This interpretation is based on the native cool water species present in each reach and their thermal requirements.

Background

The Malheur River (Namorf Dam to mouth), Bully Creek (Reservoir to mouth) and Willow Creek (Brogan to mouth) are the only waterbodies designated for cool water species use in the Malheur River Basin. The cool water species designation on the Malheur River applies from the mouth at the confluence with the Snake River to Namorf Dam (river mile 67). On Bully Creek, the designation applies from the mouth at the confluence with the Malheur River to the dam at Bully Creek Reservoir (river mile 14). On Willow Creek, the designation applies from the mouth at the confluence with the Malheur River to Brogan Creek (river mile 26.5). See Figure 1 for a map of the three waterbodies currently designated for cool water species fish and aquatic life use. DEQ uses a stepwise approach to implement the narrative cool water species criterion (DEQ, 2008). DEQ bases its evaluations on the best available information and professional judgment. Pertinent information includes the species present and their thermal requirements.

DEQ followed the procedures outlined in the Temperature Water Quality Standard Implementation IMD to interpret the narrative provision of the cool water species criterion (DEQ, 2008, Section 3.12). DEQ's analysis included the following steps:

1. Evaluate applicability of criterion for trout
 - a. DEQ considered if it would be reasonable to apply the Redband & Lahontan Cutthroat Trout criterion of 20 °C plus the human use allowance. This value would still support cool water species, which have higher tolerance of warmer temperatures than trout.

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- b. DEQ determined applying the Redband or Lahontan Cutthroat Trout criterion would not be reasonable because the areas designated for cool water species did not have Redband or Lahontan Cutthroat Trout present at any life stage.
- c. In addition, the NorWeST stream temperature model shows temperatures exceed 20 degrees as an August mean temperature in the waterbodies designated for cool water species (Isaak et al., 2017).

2. Identify cool water species and thermal tolerances
 - a. DEQ identified the cool water species present in the designated reaches and compiled available information on their thermal tolerance ranges.
 - b. Then DEQ identified which of the cool water species has the most sensitive thermal tolerance range.
3. Determine the narrative temperature translator
 - a. DEQ determined the narrative temperature translator value by the thermal tolerance range of the most sensitive species using EPA recommended methods.

These steps are described in greater detail below.

Malheur River Basin cool water species evaluation

DEQ reviewed the Oregon Department of Fish and Wildlife fish habitat distribution database and life stage timing tables (ODFW, 2023) and consulted with the ODFW district biologist about the fish species in the Malheur River basin. ODFW's information shows that Redband Trout may be present along reaches within the Malheur River basin, however, not in the reaches that are currently designated for cool water species. Of the three reaches designated for cool water species protection, only the Malheur River (Namorf Dam to Mouth) and Willow Creek (Below Malheur Reservoir) have native cool water species present. ODFW fish distribution maps do not show the presence of native cool water species in Bully Creek (Below dam).

Malheur River (Namorf Dam to Mouth) cool water species

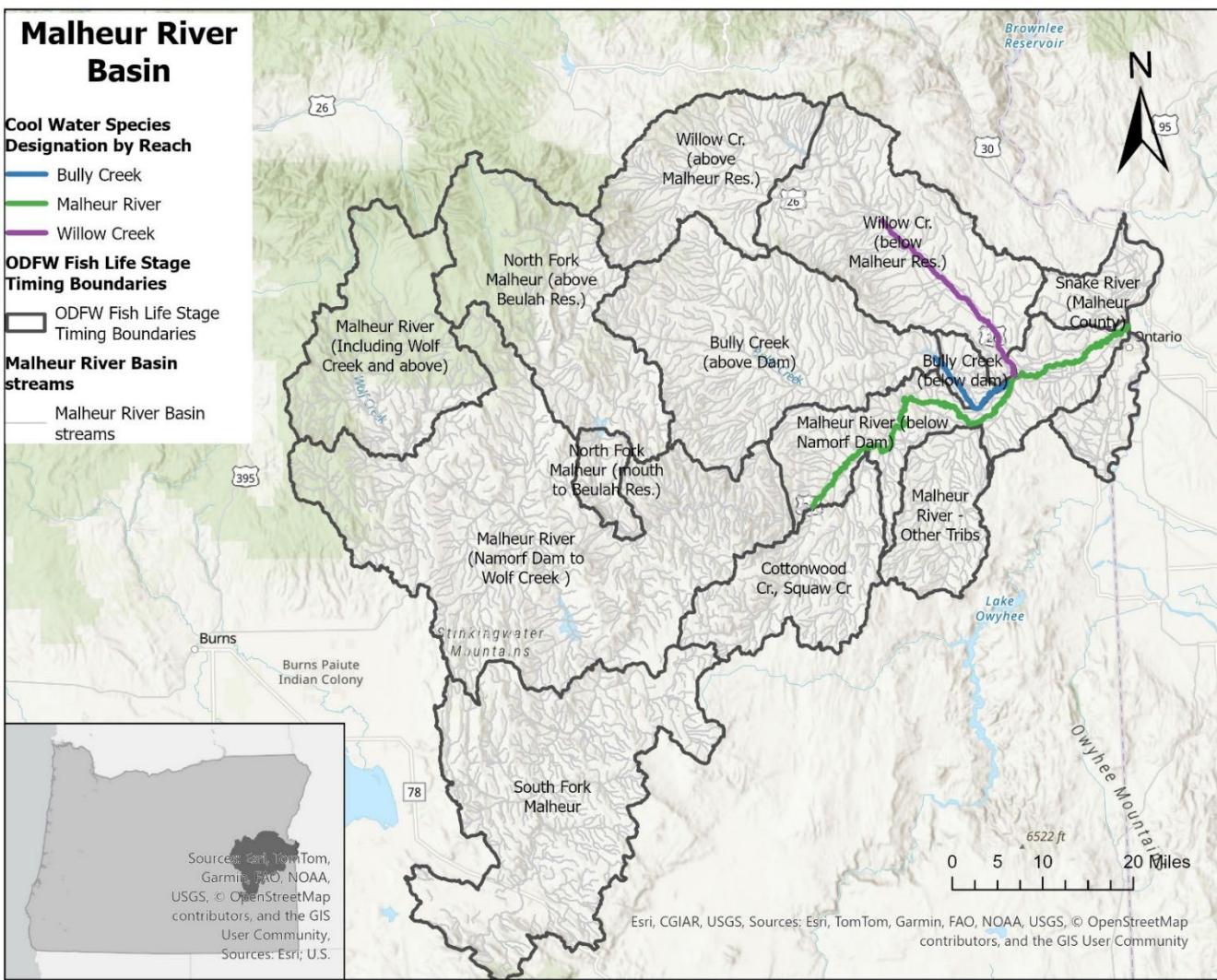
DEQ review of ODFW fish habitat distribution database and life stage timing tables show that the following native cool water species are present in the Malheur River (Namorf Dam to Mouth):

- Longnose Dace (*Rhinichthys cataractae*)
- Chiselmouth (*Acrocheilus alutaceus*) (An EPA RIS "Representative Important Species" for Oregon)
- Largescale Sucker (*Catostomus macrocheilus*)
- Northern Pikeminnow (*Ptychocheilus oregonensis*)
- Redside Shiner (*Richardsonius balteatus*)
- Leopard Dace (*Rhinichthys falcatus*)
- Speckled Dace (*Rhinichthys osculus*)
- Bridgelip Sucker (*Catostomus columbianus*)
- Mountain Sucker (*Catostomus platyrhynchus*)



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Figure 1: Map of waterbodies designated for cool water species fish & aquatic life use in the Malheur River Basin (effective as of Oct. 2025).



A review of available studies evaluating the temperature tolerance of the cool water species present in the Malheur River (Namorf Dam to Mouth) was completed to identify a target temperature to implement the cool water species narrative rule. We found temperature tolerance studies for all species except Bridgelip sucker and Mountain sucker. A summary of the studies follows.

Based on review of available studies, Redside shiner is the most temperature sensitive cool water species based on adult optimal growth occurring at 18 °C (Johnson et al., 2023). Longnose dace has been observed in temperatures up to 22.7 °C (Edwards et al., 1983), with a critical thermal maximum in laboratory studies of 31.4°C (Wismer et al., 1987). Chiselmouth exhibit an adult preference for temperatures greater than 20°C (Gray and Dauble, 2001) and are absent in temperatures below 20°C (Rosenfeld et al., 2003).



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Spawning of Chiselmouth, Northern Pikeminnow, and Mountain sucker could occur between April and July, based on observations of spawning timing from the Columbia River, British Columbia, Montana, and Nevada. However, exact spawning timing for these species in the lower reach is unknown. These species initiate spawning when water temperatures exceed 12°C -18°C (Gadomski et al., 2001; Gray and Dauble, 2001; Montana FWP, 2023; Roberge et al., 2001; Roberge et al., 2002; and Snyder, 1983). DEQ could not identify documentation of lethal maximum temperatures for egg incubation for these species. Spawning in these species appears to be initiated as temperatures warm to a certain level, and the species may shift spawning to times when temperatures are favorable (Gadomski et al., 2001). Moodie found there was no survival of incubated Chiselmouth eggs unless temperatures were greater than 12°C (Moodie, 1966). Minimum, rather than maximum, thermal requirements may be the limiting factor for distribution of Chiselmouth (Rosenfeld, 2003).

Carveth et al. (2006) reported four endpoint thermal maxima for Speckled dace collected from Arizona rivers. The lowest temperature of all the endpoints reported is the initial loss of equilibrium (ILOE) at 34.7°C (95% confidence interval of 0.4°C) for fishes acclimated to 25°C waters. Other reported endpoints are summarized in Table 1.

Beitinger et al. (2000) conducted a review and summarized the results of several temperature tolerances studies of multiple North American freshwater species. For Speckled dace, a study by Castleberry and Cech (1993) reported a loss of equilibrium at 32.4°C with a standard deviation of 1.90°C. The acclimation temperature was 20°C. John (1964) reported the ultimate incipient upper lethal temperature for Speckled dace is about 33°C for young fish and 32°C for older fish (Table 4-6). The fish were not acclimated for this study. Black (1953) identified the Largescale sucker as having a 100% survival after 24 hours at 25.7°C, a 50% survival at 29.4°C, and no survival at 32.2°C. Northern pikeminnow has a similar upper thermal tolerance, with 50% survival after 24 hours at 29.3°C. Leopard dace have a 50% survival at 28.3°C. Available data for the Mountain sucker shows an observed occurrence at 10-28°C (Smith, 1966) and a recommended acute tolerance (MDMT) of 28°C (NVDEP, 2016). Additional details on all species discussed are found in Table 1.

Willow Creek (Below Malheur Reservoir)

DEQ review of ODFW fish habitat distribution database and life stage timing tables show that the following native cool water species are present in Willow Creek (Below Malheur Reservoir):

- Largescale Sucker (*Catostomus macrocheilus*)
- Bridgeline Sucker (*Catostomus columbianus*)
- Speckled Dace (*Rhinichthys osculus*)
- Redside Shiner (*Richardsonius balteatus*)

Based on review of available research, Redside shiner is the most temperature sensitive cool water species based on adult optimal growth occurring at 18 °C (Johnson et al., 2023). The thermal tolerances of the remaining species (Largescale sucker, Bridgeline sucker, and Speckled dace) have been described in the preceding section.



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Johnson et al. (2023) used a bioenergetic model for Redside shiner to determine that adult optimal growth occurred at 18°C. Laboratory growth experiments were conducted to corroborate model performance. Black (1953) reported the upper lethal temperature for Redside shiner as 27.6°C for 50% survival after 24 hours of exposure. Results of thermal tolerance studies for additional cool water species in Willow Creek are found in Table 1.

Bully Creek (Below dam)

ODFW fish distribution maps do not show the presence of native cool water species in Bully Creek (Below dam) because private property ownership adjacent to Bully Creek, restricts accessibility to conduct fish habitat surveys (ODFW, personal communication, 2025). However, similar composition of species as the downstream Malheur River can be expected in Bully Creek. Therefore, the applicable cool water criterion is 23.2°C. For downstream protection, this is the same applicable criterion of the nearest downstream waterbody, the Malheur River.

Table 1: Summary of Malheur River Basin cool water species thermal tolerance data

Species	Acclimation Temperature (°C)	Endpoint	Upper thermal limit (°C)	Source
Longnose Dace (<i>Rhinichthys cataractae</i>)	15	Critical thermal maximum (lab)	31.4	Spotila et al. 1979, cited in Wismer et al 1987
	NA	Adult present	5.4 – 22.7 (Lake Michigan)	Brazo et al., 1978
	NA	Optimal Spawning (Lake Michigan)	14 - 19	Brazo et al., 1978
	NA	Egg incubation	15.6	McPhail and Lindsey, 1970 cited in Edwards et al., 1983
	NA	Short term max for successful embryo survival	20	Wismer et al, 1987
	NA	Adult present (Utah streams)	12.8 - 21.1	Sigler and Miller, 1963 cited in Edwards et al., 1983
	NA	Adult present (Lake Michigan)	5 - 18.5	Brazo et al., 1978 cited in Wismer et al., 1987
	NA	Adult optimal (Lake Michigan)	8 -14	
	NA	Adult present	5.4 - 22.7	Edwards et al., 1983



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Species	Acclimation Temperature (°C)	Endpoint	Upper thermal limit (°C)	Source
	NA	Present	14 - 22	Mullen et al., 1995
Chiselmouth (<i>Acrocheilus alutaceus</i>)	NA	Observed absence in field	<20	Rosenfeld et al. 2003
	NA	Adult preference	>20	Gray and Dauble, 2001
	NA	Spawning initiation	15	Gray and Dauble, 2001
	NA	Spawning peak	13 - 20	Gray and Dauble, 2001
	NA	100% mortality, eggs	≤12	Moodie, 1966
	11.5	50% mortality after 24 hours, adult	27	-
Redside Shiner (<i>Richardsonius balteatus</i>)	NA	Optimal growth, adult	18	Johnson et al., 2023
	14	100% survival after 24 hours, adult	22.8	Black, 1953
		50% survival after 24 hours, adult	27.8	
		No survival after 24 hours, adult	30.3	
	NA	Spawning initiation	14.5 - 18	Gray and Dauble, 2001
	NA	100% survival, egg incubation	30.3	Scharpf, 2008
Leopard Dace (<i>Rhinichthys falcatus</i>)	NA	Spawning observed (in situ)	10 -16	Gray and Dauble, 2001
	NA	Optimal temperature, juvenile	21.2	Roberge et al., 2001
	NA	Adult present	15 -18	Peden, 1991 cited in Roberge et al., 2002
	NA	Adult present (modeled)	21.2	Porter et al., 2000
	14	100% survival after 24 hours, adult	25.2	Black, 1953



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Species	Acclimation Temperature (°C)	Endpoint	Upper thermal limit (°C)	Source
		50% survival after 24 hours, adult	28.3	
		No survival after 24 hours, adult	28.3 - 31.1	
Northern Pikeminnow (<i>Ptychocheilus oregonensis</i>)	19-22	50% survival after 24 hours, adult	29.3	Black, 1953
	NA	Spawning initiation (Columbia R. populations, May -June)	14 - 18	Gadomski et al., 2001; Gray and Dauble, 2001; Roberge et al., 2002
	NA	Adult preference	21.7 ("warmest available")	Bartoo, 1972
Largescale Sucker (<i>Catostomus macrocheilus</i>)	19	100% survival after 24 hours, adult	25.7	Black, 1953
	19	50% survival after 24 hours, adult	29.4	
	19	0% survival after 24 hours, adult	32.2	
Speckled Dace (<i>Rhinichthys osculus</i>)	20	Initial loss of equilibrium	32.4 ± 1.90	Castleberry and Cech, 1993 cited in Beitinger et al., 2000
	25	Initial loss of equilibrium	34.4 ± 0.4	Carveth et al., 2006
		Final loss of equilibrium	34.4 + 0.4	
		Flaring opercula	37.0 ± 0.1	
		Death	36.9 ± 0.3	
	30	Initial loss of equilibrium	35.8 ± 0.6	
	NA	Final loss of equilibrium	36.9 ± 0.1	
	NA	Flaring opercula	37.0 ± 0.1	
	NA	Death	36.9	
Mountain Sucker	NA	Ultimate incipient upper lethal temperature	33 (young fish) 32 (old fish)	John, 1964
		Observed occurrence in the field	10 - 28	Smith, 1966



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Species	Acclimation Temperature (°C)	Endpoint	Upper thermal limit (°C)	Source
<i>(Catostomus platyrhynchus)</i>	NA	Spawning initiation (Truckee River, NV, May 1- August 1)	11 - 19	Snyder, 2011
	20	Loss of equilibrium	32.4 - 32.9	Schultz, 2011
	22.5	Loss of equilibrium	32.5 - 33.2	
	25	Loss of equilibrium	33.6 - 34	NVDEP, 2016
	NA	Recommended Acute Tolerance (MDMT)	28	
Bridgelip Sucker <i>(Catostomus columbianus)</i>	NA	Peak spawning	8 - 13	Dauble, 1980 cited in Roberge et al., 2002
	NA	Optimal spawning	6 - 13	Roberge et al., 2002
	NA	Spawning observed	8 - 19	Murdoch et al., 2005

Standards Interpretation: Cool Water Species Criterion and Human Use Allowance

In general, EPA's national temperature criteria recommendations for fish consist of formulas to calculate a protective weekly average temperature exposure is based on the optimal growth temperature and the upper incipient lethal temperature (Table 2) (EPA, 1986). This yields an MWAT that must be converted to 7dAM to align with DEQ's temperature criteria metric (DEQ, 2008). Following EPA's guidance for temperature standard development for Pacific Northwest States, a constant lab exposure temperature corresponds to a 7DADM temperatures of approximately +2°C (EPA, 2003).

Figure 2: Equations to calculate MWAT and 7dAM for Redside Shiner

$$MWAT = 21.3 = 18 + \left[\frac{(27.8 - 18)}{3} \right]$$

Conversion from MWAT to 7dAM in Pacific Northwest, 7dAM = MWAT + 2°

Source: EPA, 1986, EPA, 2003 & DEQ, 2008

Additionally, Oregon water quality standards have provisions for human use (OAR 340-041-0028(12)(b)). The human use allowance (HUA) is an insignificant addition of heat (0.3°C) authorized in waters that exceed the applicable temperature criteria. Following a temperature TMDL, or other cumulative effects analysis, wasteload and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3°C (0.5°F) above the applicable biological criterion (DEQ, 2008).



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Malheur River

Water temperatures greater than a 7-day average maximum (7dAM) temperature of 23.2°C would reasonably be expected to impair the cool water species present in the reach of the Malheur River from the confluence of Namorf Dam to the mouth. Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is 23.2°C or greater. This is applicable year-round.

Willow Creek

Water temperatures greater than a 7-day average maximum (7dAM) temperature of 23.2°C would reasonably be expected to impair the cool water species present in the reach of Willow Creek below Malheur Reservoir to the confluence with the Malheur River. Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is 23.2°C or greater. This is applicable year-round.

Bully Creek

The same temperature criteria from the nearest downstream waterbody, the Malheur River, are applicable in Bully Creek. Thus, water temperatures in Bully Creek that exceed a 7-day average maximum (7dAM) temperature of 23.2°C would reasonably be expected to impair the cool water species present below its confluence with the Malheur River. Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is 23.2°C or greater. This is applicable year-round.

Implementing the cool water species narrative criterion

Water quality programs implementing cool water species narrative criterion in the specified reaches will reference the Temperature Narrative Translator Values as listed in Table 2 and in accordance with implementation guidelines described in OAR-340-041-0028(12). Programs implementing this criterion include water quality permitting, watershed management, and water quality assessment. DEQ will use current assessment methodology to determine if the cool water species narrative criterion is not being attained for purposes of CWA section 303(d) assessments.

Summary

Table 2: Summary of temperature targets implementing the cool water species narrative in the Malheur River Basin.

Reach	Assessment Unit ID	Temperature Narrative Translator Value (°C 7dAM)	Most Temperature Sensitive Species
Malheur River (Namorf Dam to mouth)	OR_SR_1705011702_05_103270 OR_SR_1705011704_05_102767 OR_SR_1705011706_05_102745	23.2	Redside Shiner (<i>Richardsonius balteatus</i>)



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Willow Creek	OR_SR_1705011904_05_102785 OR_SR_1705011906_05_102769	23.2	Redside Shiner (<i>Richardsonius Balteatus</i>)
Bully Creek (below dam)	OR_SR_1705011803_05_102777	23.2	Redside Shiner (<i>Richardsonius Balteatus</i>)



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