State of Oregon
DEQ Department of Environmental Quality

Memorandum

To: DEQ Water Quality Staff

From: Connie Dou, Water Quality Standards Program Manager

Date: Feb 9, 2026

Subject: Implementation of Cool Water Species Narrative Criterion for Rickreall Creek

Executive Summary

This memorandum describes the Oregon Department of Environmental Quality's interpretation and application of the cool water species narrative criterion for temperature (Oregon Administrative Rule 340-041-0028(9)) in Rickreall Creek. Rickreall Creek (assessment unit OR_SR_1709000701_02_104591) is located at the mouth at the confluence of the Willamette River (river mile 0) to the east end of Dallas City Park at approximately river mile 14. The designated aquatic life use for this reach is "cool water species" (OAR 340-041-0340, Figure 340A) and this interpretation is based on the native cool water species present and their thermal requirements.

Table 1: Summary of temperature narrative translator values implementing the cool water species narrative in Lower Rickreall Creek

Time period	Temperature Narrative Translator Value (°C 7dAM)	Most Temperature Sensitive Species
June 1 – Sept. 30	22.8	Prickly sculpin (*Cottus asper*)
Oct. 1 – May 31	18.0	Winter steelhead (*Oncorhynchus mykiss*)

Introduction

The narrative cool water species criterion in OAR 340-041-0028(9)(a) states "No increase in temperature is allowed that would reasonably be expected to impair cool water species." This memorandum describes DEQ's interpretation and application of the cool water species narrative criterion for temperature for Rickreall Creek. Rickreall Creek is located in the Middle Willamette Subbasin (assessment unit OR_SR_1709000701_02_104591) and is one of two waterbodies designated for the subcategory cool water species use in the Willamette Subbasins. The designation applies from the mouth at the confluence of the Willamette River (river mile 0) to the east end of Dallas City Park at approximately river mile 14. This reach of Rickreall Creek is hereafter referred to as "the lower reach".

DEQ prepared findings in this memo in September 2023 and they can also be found in the Total Maximum Daily Load for the Willamette Subbasins Technical Support Document, amended in May 2025. The Long Tom River below Fern Ridge Reservoir (Upper Willamette Subbasin) is also designated for cool water use but findings pertaining to the Long Tom River are found in a separate memo.

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Summary

Under the Clean Water Act, states must designate the uses of a waterbody and provide water quality for the protection and propagation of fish, shellfish, and wildlife, where attainable (40 CFR 131.10(j)). Rickreall Creek is designated for Fish & Aquatic Life use of Cool Water Species use from the east end of Dallas City Park to the mouth at the confluence of the Willamette River, approximately RM 0-14. Hereafter referred to as "the lower reach". The cool water species temperature standard in rule 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." DEQ uses a stepwise approach to implement the narrative standard (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 and salmonid uses
    a. DEQ considered if it would be reasonable to apply the Redband & Lahontan Cutthroat Trout criterion of 20 °C plus the 0.3 degrees Celsius human use allowance to the reach. The value would still support cool water species, which have higher tolerance of warmer temperatures than trout.
    b. DEQ determined applying the Redband or Lahontan Cutthroat Trout criterion would not be reasonable because DEQ does not have enough information at present to determine if 20 degrees Celsius is attainable.
    c. There are periods when winter steelhead migrate through Lower Rickreall Creek, which require temperatures less than 20 degrees Celsius.
2) Identify cool water species and thermal tolerances
    a. DEQ identified the cool water species present in Rickreall Creek and compiled 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 targets
    a. DEQ determined the narrative temperature translator value by the thermal tolerance range of the most sensitive species using EPA recommended methods. A temperature target was also developed for the peak periods when winter steelhead are migrating.

Each of these steps are described in greater detail below.

Protection of trout and seasonal salmonid uses

DEQ reviewed the ODFW fish habitat distribution database and life stage timing tables (ODFW, 2023) and consulted with the ODFW district biologist about the fish species in Lower Rickreall Creek. ODFW's information shows that native trout species are not present at any time of year, therefore the Redband & Lahontan trout criterion does not apply. ODFW's information shows that Rickreall Creek provides seasonal habitat for cold water salmonid species, including steelhead trout (Oncorhynchus mykiss) and Coastal Cutthroat trout (Oncorhynchus clarkii).

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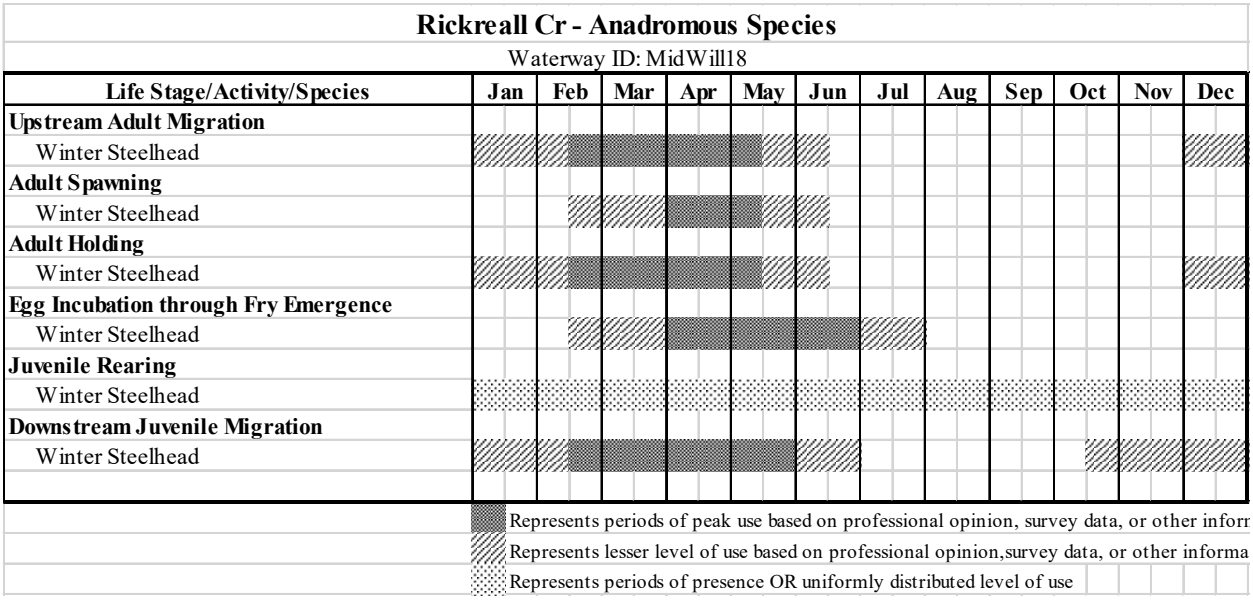
Rickreall Creek salmonid uses

Various life stages of steelhead trout are present in the watershed at certain times of year (ODFW, 2023). The following timing tables are for the entire Rickreall Creek basin. The lower reach is not spawning or egg incubation habitat and steelhead trout use is absent or limited during the warmer months.

Figure 1. Anadromous salmonid species use in Rickreall Creek (Source: ODFW[1]).



[1] ODFW Fish Life Stage Timing Tables https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=42654.xml

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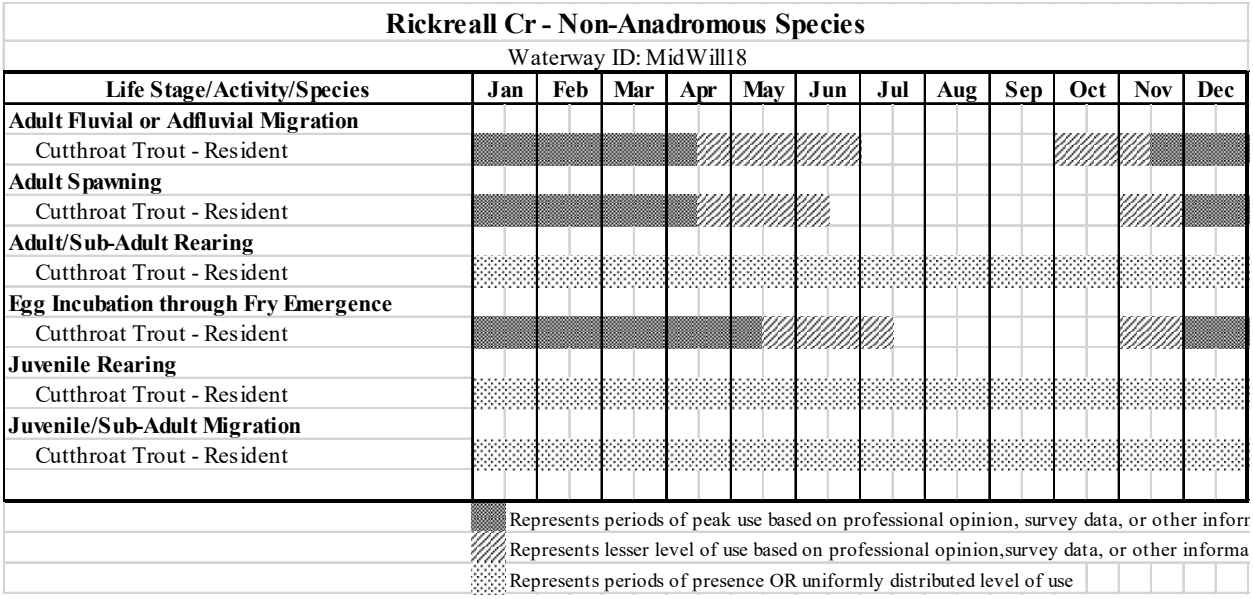
Figure 2. Resident salmonid species use of Rickreall Creek (Source: ODFW[1]).



From the ODFW timing tables it is not clear what timing of use is specific to the lower reach compared to the rest of the watershed. The spawning habitat and likely the primary rearing habitat is upstream of the City of Dallas and the lower reach. Data on abundance of cold-water species in the lower reach relative to the other waters of the Rickreall Creek watershed is limited. ODFW provided DEQ with supplemental studies of fish presence in the Rickreall Creek Watershed.

A detailed survey of fish presence for multiple cool and cold-water species was conducted in Rickreall Creek in 2002 (Chastain et al. 2002). The authors sampled nine sites on the main stem of Rickreall Creek from river mile 0.56 to 28 monthly for a year, from April 2001–March 2002. Four of the sites sampled (Sites #1-4) are within and representative of the lower reach (Figure 3). A fifth site (Site #5) is located at or above the endpoint of the lower reach in Dallas City Park, and therefore is not representative of the lower reach. The authors found the Rickreall Creek watershed has a relatively intact native fish community, and that sites #1-4 were dominated by cool water species (Chastain et al. 2002, Figure 2a).

No anadromous salmonid species were detected at site #1, near the mouth of Rickreall Creek, at any time of year (Figure 4). Coho, Chinook, and steelhead salmon were detected at sites #2-4 sporadically between October 1 and May 31 (Figure 5 through Figure 8). Resident Cutthroat trout were detected sporadically between September 1 and April, but never in consecutive months except for Site #4 (Figure 7). One detection of Cutthroat trout occurred in July at site #3 (Figure 4-6). The total number of Cutthroat captured at site #3 and site #4 appears to be less than 10 individuals for the entire year (Chastain et al. 2002, Figure 7g).

In contrast, at site #6, approximately 2 stream miles upstream of Dallas City Park in the portion of Rickreall Creek designated for Salmon and Trout Rearing and Migration use, and expected to be more prime rearing habitat, anadromous salmon or resident Cutthroat trout were detected every month of the year. This suggests a low level or only sporadic use of the lower reach, downstream of the City of Dallas, by cold water salmonid species, namely Cutthroat trout only, between June and October, consistent with the designated use of Cool Water Species.

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Chapman et al. (c. 2003) also conducted a bi-weekly snorkel survey within the lower reach at Villwok's Ford (approximate river mile 7.7) from May – September 2003. This site is identical to site #3 sampled by Chastain et al in 2002. They did not detect any anadromous salmon species, including juvenile steelhead, at the site between May and September. Cutthroat trout were detected downstream of the ford in May, July, August and September, but only sporadically upstream of the ford one week of May and one week of June (Figure 5).

No counts of individuals detected were included in the study. The authors indicate that the ford is not a barrier to Cutthroat trout passage. Chastain et al did not find Cutthroat trout at the same site during the same months in 2002, suggesting only low or sporadic levels of use by Cutthroat in the summer (Table 2).

Figure 3. Sampling sites on the Rickreall Creek mainstem (Chastain et al. 2002)

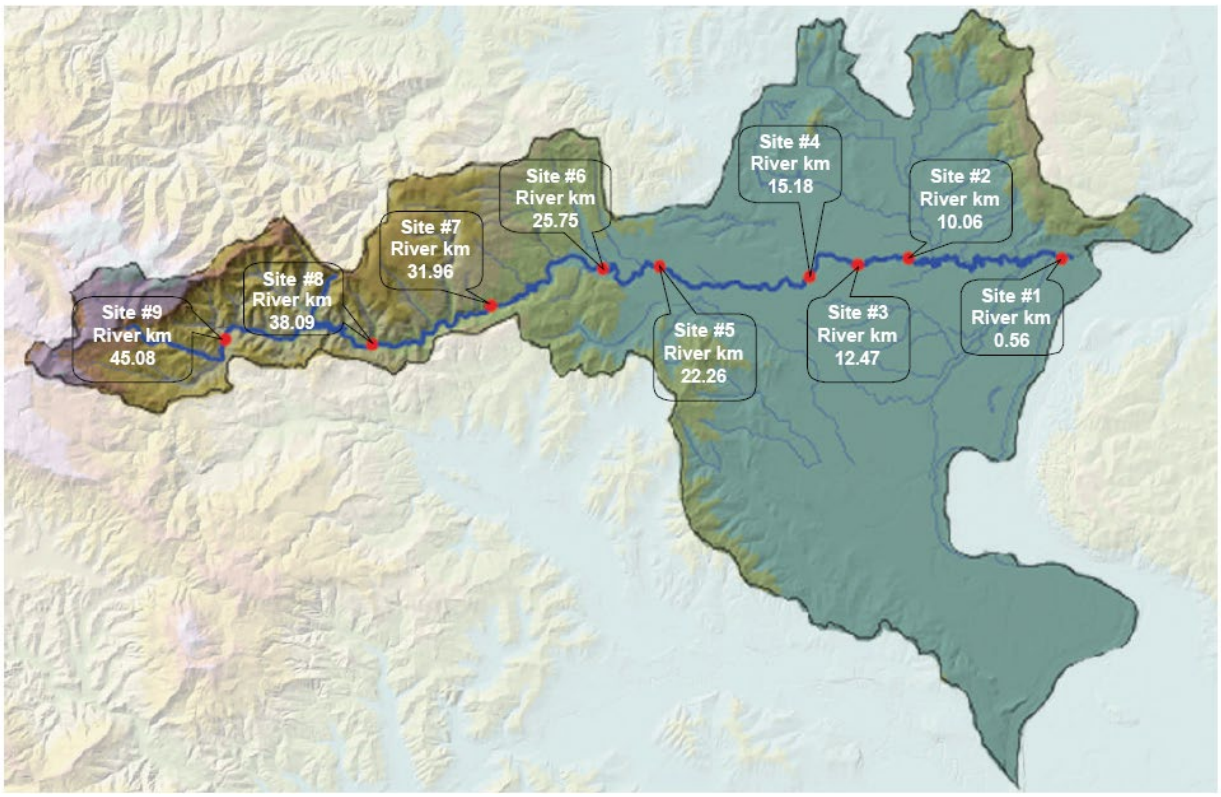

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Figure 4. Temporal distribution of fish species encountered at approx. river mile 0.34 (Site #1) April 2001 – March 2002 (Chastain et al. 2002, Figure 3a).

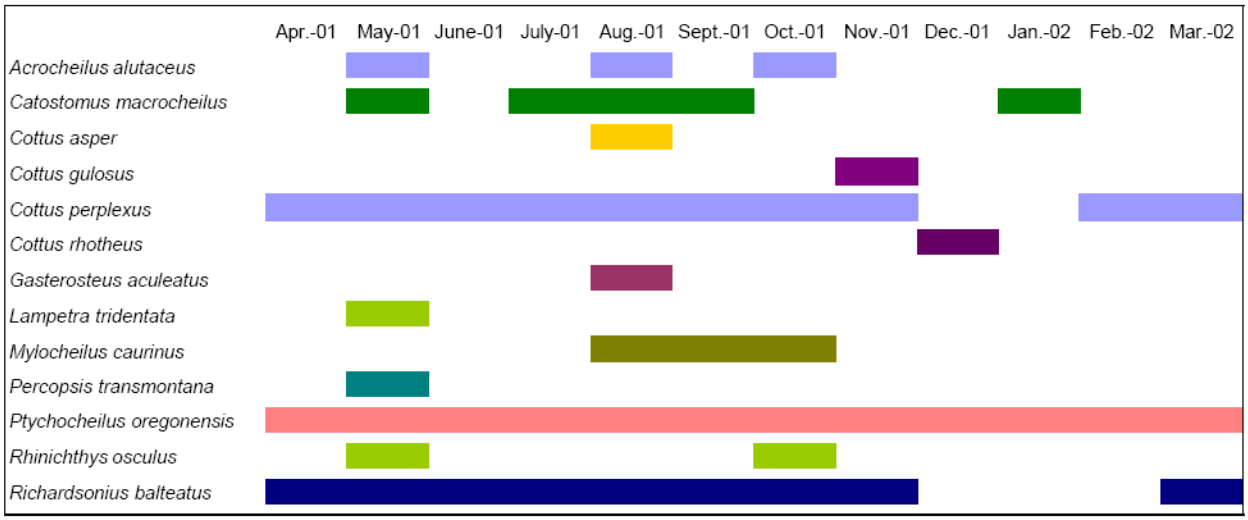

Figure 5. Temporal distribution of fish species encountered at approx. river mile 6.25 (Site #2) April2001 – March 2002 (Chastain et al. 2002, Figure 3b). The salmonid species detected include cutthroat trout (O. clarkii), Coho salmon (O. kisutch), and Chinook salmon (O. tshawytscha).

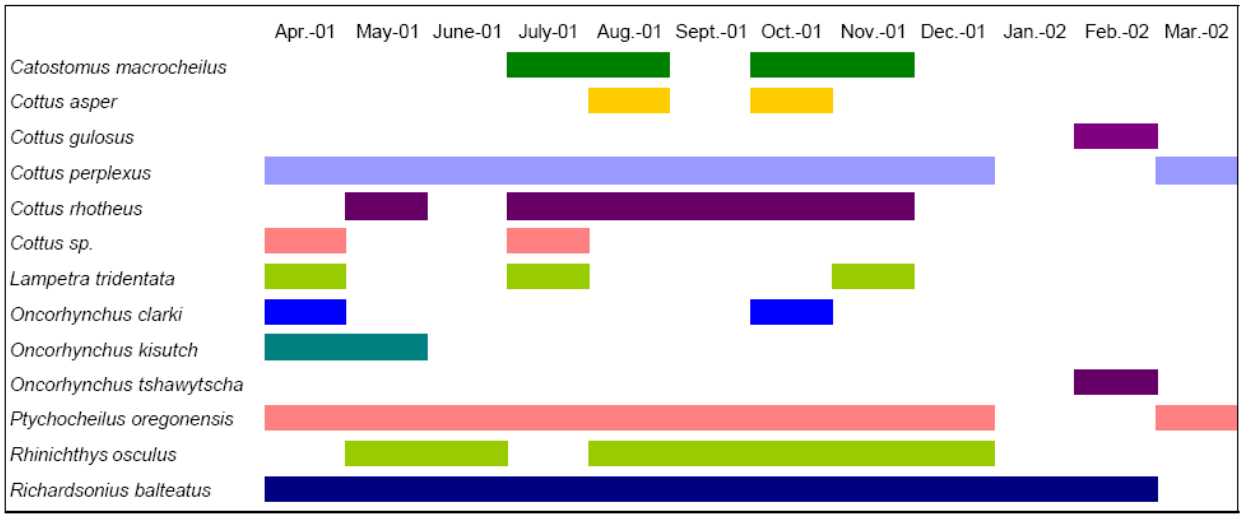

Figure 6. Temporal distribution of fish species encountered at approx. river mile 7.75 (Site #3) April 2001 – March 2002 (Chastain et al. 2002, Figure 3c). The salmonid species detected include cutthroat

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trout (O. clarkii), steelhead/rainbow trout (O. mykiss), Coho salmon (O. kisutch), and Chinook salmon (O. tshawytscha).

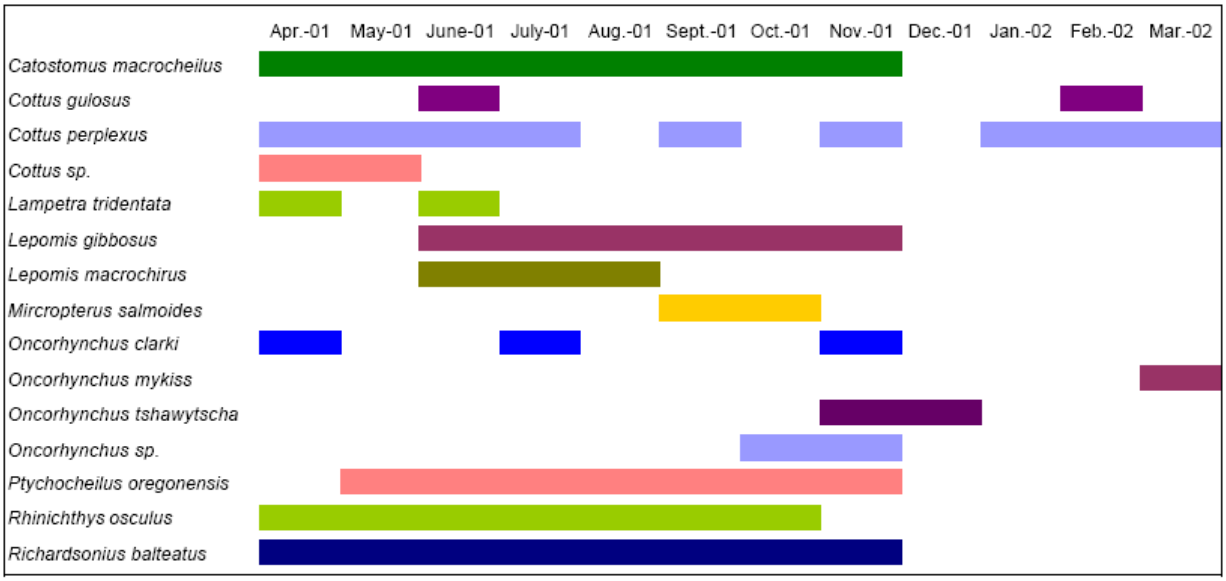

Figure 7. Temporal distribution of fish species encountered at approx. river mile 9.4 (Site #4) April2001 – March 2002 (Chastain et al. 2002, Figure 3d).

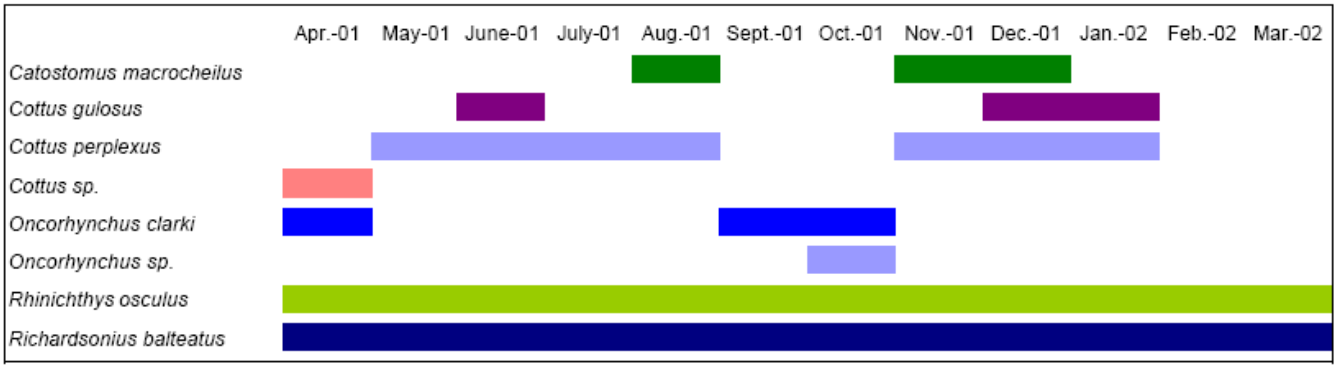

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Figure 8. Temporal distribution of fish species encountered at approx. river mile 13.83 (Site #5) April 2001 – March 2002 (Chastain et al. 2002, Figure 3d). The salmonid species detected include cutthroat trout (O. clarkii) and another salmonid (Onchorhynchus spp).

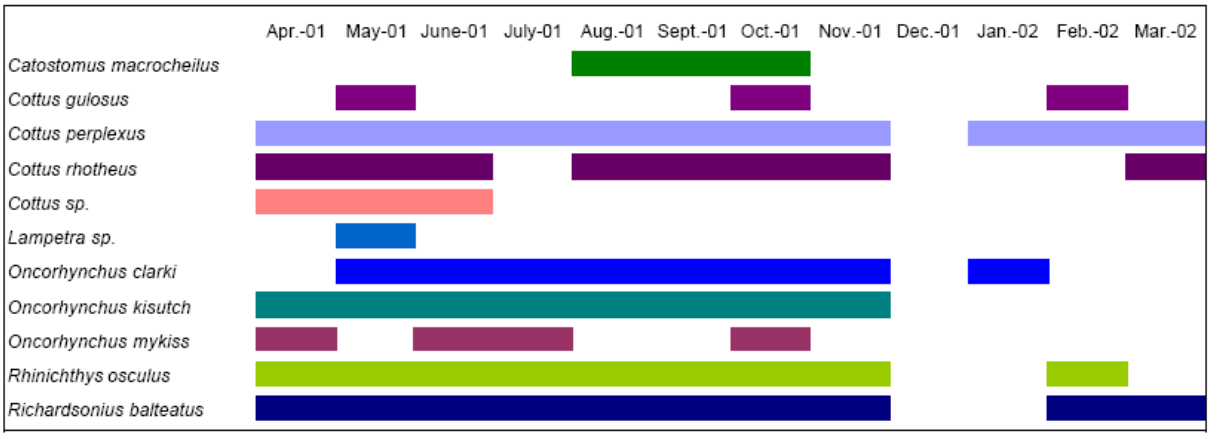

Table 2. Species observed downstream and upstream of Villwok's For approximately river mile 12 (May-September). (Chapman et al. undated, Table 10)

	Downstream of ford							
Species	May 23	June 1	June 6	June 27	July 12	July 26	Aug. 18	Sept. 6
Ptychocheilus oregonensis	No	Yes	No	Yes	Yes	Yes	Yes	No
Lepomis spp.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Oncorhynchus clarki	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Catostomus machrocheilus	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lampetra tridentata	No	Yes	No	No	No	No	No	No
	Upstream of ford							
Ptychocheilus oregonensis	No	No	No	No	No	No	Yes	No
Lepomis spp.	No	No	No	No	No	No	No	No
Oncorhynchus clarki	Yes	No	No	No	No	Yes	No	No
Catostomus machrocheilus	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Lampetra tridentata	No	No	No	No	No	No	No	No

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Rickreall Creek cool water species

DEQ reviewed the Oregon Department of Fish & Wildlife (ODFW) fish habitat distribution database and life stage timing tables for the Rickreall Creek watershed (ODFW, 2023) and consulted with the ODFW district biologist about the fish species in the lower reach. Based on this information, DEQ determined the resident cool water species that may be present in Rickreall Creek downstream of Dallas include Speckled dace (*Rhinichthys osculus*), Redside shiner (*Richardsonius balteatus*), Largescale sucker (*Catostomus macrocheilus*), Prickly sculpin (*Cottus asper*), and Pacific lamprey (*Entosphenus tridentatus*). The exact timing of cool water species use of Lower Rickreall Creek is not fully understood, but multiple cool water species have been observed in the reach from April to November (Chastain et al., 2002). ODFW's information also shows that adult and juvenile winter steelhead (*Oncorhynchus mykiss*) migrate through the lower reach of Rickreall Creek. The peak migration period in ODFW's timing tables is February 15 through May 31 (ODFW, 2023).

A review of available studies evaluating the temperature tolerance of the cool water species present in Lower Rickreall Creek was completed to identify a target temperature to implement the cool water species narrative rule. We found temperature tolerance studies for all species except Largescale sucker, summarized below.

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 endpoints reported are summarized in Table 3.

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 (Table 3).

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 3). The fish were not acclimated for this study.

Black (1953) evaluated the temperature tolerance for some freshwater fish found in the Okanagan Lakes in British Columbia, Canada. The upper lethal temperatures, defined as the temperature at which 50 percent of the fish died in 24 hours, was 24.1°C for Prickly sculpin and 27.6°C for Redside shiner. All fish survived after 24 hours at treatment temperatures of 22.8°C for both species. No fish survived after 24 hours at treatment temperatures of 26.5 and 30.3°C for Prickly sculpin and Redside shiner, respectively (Table 3).

Whitesel and Uh (2023) reported the ultimate incipient upper lethal temperature after 7 days for larval Pacific lamprey was 28.3°C based on the time to death and 30.2°C based on the percent mortality approach (Table 3). In experiments of direct acute exposure, larval were acclimated to different temperatures ranging from 19.8 to 23.3°C for 7-9 days and then placed in various treatment temperatures. The LT50 was calculated, which is the number of hours at which 50% of the larval survived. The LT50 was 1 hour or less at treatment temperatures ranging from 31.1 to 33.4°C. The LT50 ranged from 43.1 to 80.5 hours in treatment temperatures of 29 to 29.3°C. In experiments of acclimated chronic exposure over a 30-day period, 100% of the larval lamprey survived in the treatment temperatures of constant exposure ranging from 21 to 27°C. No larval lamprey survived in constant treatment temperatures of 30 and 33°C over the 30-day period.

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Table 3. Cool water species present in Lower Rickreall Creek and associated thermal tolerances

Species	Acclimation Temperature (°C)	Endpoint	Endpoint Temperature (°C)	Source
Speckled dace (Rhinichthys osculus)	20	Initial loss of equilibrium	32.4 ± 1.90	Castleberry and Cech (1993) via 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	35.9 ± 0.2	
		Death	36.0 ± 0.4	
	30	Initial loss of equilibrium	35.8 ± 0.6	
		Final loss of equilibrium	36.9 ± 0.1	
		Flaring opercula	37.0 ± 0.1	
		Death	36.9 ± 0.3	
	NA	Ultimate incipient upper lethal temperature	33 (young fish) 32 (old fish)	John (1964)
Redside shiner (Richardsonius balteatus)	14	100% survival after 24 hours	22.8	Black (1953)
		50% survival after 24 hours	27.6	
		No survival after 24 hours	30.3	
Prickly sculpin (Cottus asper)	18–19	100% survival after 24 hours	22.8	
		50% survival after 24 hours	24.1	
		No survival after 24 hours	26.5	
Pacific lamprey (Entosphenus tridentatus)		Ultimate incipient upper lethal temperature (7 days) based on time to death	28.3	Whitesel and Uh (2023)
		Ultimate incipient upper lethal temperature (7 days) based on percent mortality	30.2	

Based on review of available temperature tolerance studies, Prickly sculpin are the most temperature sensitive cool water species. Black (1953) reported the upper lethal temperature as 24.1°C. The upper lethal temperature was based on 50% survival after 24 hours of exposure to various treatment temperatures. Other endpoints reported for Prickly sculpin include the treatment temperature at which all fish survived after 24 hours (22.8°C) and the treatment temperatures with no survival after 24 hours (26.5°C).

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These results indicate that Prickly sculpin have a narrow temperature margin between complete survival and the point at which half the population died (1.3°C). This was taken into consideration when setting the target temperature. Exposure to water temperatures greater than 24.1°C for just a few hours will likely not cause significant harm, but it is unclear if exposure for just a few hours a day over the course of 7 or more days would have a similar impact as a constant 24-hour exposure. Due to this uncertainty, DEQ selected the more protective endpoint (22.8°C) expressed as the instream 7DADM temperature target plus an insignificant addition of heat for human use equal to 0.3°C. This target will limit the exposure time to temperatures that would result in impairment to Prickly sculpin. This target applies from June 1 through September 30. The following section will explain when the cool water species applies versus when salmonid species uses apply.

Standards Interpretation: Cool Water Species Criterion and Human Use Allowance

Water temperatures greater than a 7-day average maximum (7dAM) temperature of 22.8°C would reasonably be expected to impair the cool water species present in the lower reach of Rickreall Creek. Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is 22.8°C or greater from June 1 to September 30.

Water temperatures greater than a 7-day average maximum (7dAM) temperature of 18°C would reasonably be expected to impair adult winter steelhead (Oncorhynchus mykiss), Coho salmon, and Chinook salmon that may be migrating through the lower reach of Rickreall Creek, and juvenile winter steelhead or Coastal Cutthroat trout (Oncorhynchus clarkii) that may be rearing within the lower reach of Rickreall Creek. This value is consistent with Oregon's water quality standards for temperature (OAR 340-041-0028 (4)(c)). Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is 18°C or greater from October 1 to May 31. This narrative translator value will also protect the most sensitive cool water fish.

If ambient 7DADM temperatures trend to always being cooler than both temperature targets presented in Table 1 and all exceptions outlined in OAR 340-41-0028(11)(c) are not applicable, the Protecting Cold Water criterion shall be applied with the 0.3°C HUA based on an increase above the cooler ambient temperature.

Implementing the cool water species narrative criterion

The DEQ water quality programs implementing cool water species narrative criterion in the specified reaches will reference the Temperature Narrative Translator Values as listed in Table 1 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.

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