State of Oregon
DEQ Department of Environmental Quality

Cool Water Species Temperature Narrative Criteria

Interpretation Procedure

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Document information

This document was prepared by Oregon Department of Environmental Quality

Water Quality Standards

700 NE Multnomah Street, Suite 600

Portland Oregon, 97232

Contact: James McConaghie

Phone: (503) 229-5619

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Document development

Prepared by: James McConaghie, Water Quality Standards Coordinator

Tatyana Isupov, Water Quality Standards Specialist

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Reviewed by: Connie Dou; Standards, Source Water Protection and Assessments Manager

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Approved by:

Approved date:

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Acronyms used in this directive

7DADM: 7-day average daily maximum

DEQ: Oregon Department of Environmental Quality

EPA: United States Environmental Protection Agency

HUA: Human Use Allowance

MDMT: Maximum daily maximum temperature

MWAT: Maximum weekly average temperature

OAR: Oregon Administrative Rule

ODFW: Oregon Department of Fish and Wildlife

UILT: Upper Incipient Lethal Temperature

UUILT: Ultimate Upper Incipient Lethal Temperature

Purpose

The purpose of this Interpretation Procedure is to promote consistent application and interpretation of Cool Water Species Narrative Criterion. The Interpretation Procedure supplements the Temperature Water Quality Standard Implementation- A DEQ Internal Management Directive (2008). This Interpretation Procedure is to be used to inform Water Quality Standards staff when determining narrative temperature targets for waterbodies designated to protect narrative cool water species uses.

Applicability

This Interpretation Procedure is to be used primarily by DEQ water quality staff. This document describes procedures to assist in interpreting Oregon's cool water species narrative criterion for temperature and for determining applicable narrative translator(s) or other numeric temperature targets for Clean Water Act purposes.

Background

The narrative cool water species criterion in Oregon Administrative Rule 340-041-0028(9)(a) states that "No increase in temperature is allowed that would reasonably be expected to impair cool water species." Waters of the State that support cool water species are identified on subbasin tables and figures set out in OAR 340-041-0101 to 340-041-0340; Tables 140B, 190B and 250B, and Figures 180A, 201A and 340A.

OAR-340-041-0002 (12) defines "Cool Water Species" to *mean[s] aquatic organisms that are physiologically restricted to cool waters including, but not limited to, native sturgeon, Pacific lamprey, suckers, chub, sculpins and certain species of cyprinids (minnows.)*

DEQ's Temperature IMD identifies that DEQ should use a stepwise approach to implement the narrative provision of the cool water species criterion (DEQ, 2008). The Department bases its evaluations on the best available information and professional judgment. Pertinent information includes: the species present and their thermal requirements, physical characteristics of the waterbody, current ambient temperatures and the magnitude, duration and frequency of the proposed temperature target.

The basic procedure for interpreting the narrative criterion is as follows:

1. Identify the reach or reaches designated for the Cool Water Species aquatic life use.
2. Identify the native aquatic species present, including any salmonid species, if applicable.
3. Identify whether criteria for Redband and Lahontan Cutthroat Trout criterion is attainable.
4. Review scientific literature for thermal tolerance of each cool water species.
5. Identify the most sensitive cool water species.
6. Derive a numeric target based on EPA 1986, or other justifiable method.
7. Document the narrative translator derivation process in a memorandum.

Implementation Procedures

Identify and describe the reaches designated for cool water species

Waters of the State that support cool water species are identified on subbasin tables and figures set out in OAR 340-041-0101 to 340-041-0340; Tables 140B, 190B and 250B, and Figures 180A, 201A and 340A. Once identified, describe the waterbody's location, including watershed, assessment unit ID, and river miles where the cool water species criterion applies.

Identify the native aquatic species present

To identify native aquatic species present. At minimum review the ODFW fish habitat distribution database and life stage timing tables. Identify both native cool water species and any salmonid species, if applicable. Consult with the ODFW district biologist about native species in the applicable watershed, including aquatic species not included in the ODFW fish habitat distribution map. This process will likely require cross-referencing ODFW fish habitat fish distribution maps, ODFW Fish Life Stage Timing Boundaries, DEQ Water Quality Standards, and Watershed Boundary Datasets.

Determine if the criteria for Redband and Lahontan Cutthroat Trout is attainable

First, following guidance in the 2008 Temperature Standards Implementation IMD, DEQ will consider if it is reasonable to apply the Redband & Lahontan Cutthroat Trout criterion of 20°C, which will not impair cool water species because they have a greater tolerance of warm temperatures than trout. This approach is applicable if the areas designated for cool water species have Redband or Lahontan Cutthroat Trout present at any life stage and if the reach is currently attaining 20°C, or can attain 20°C under natural or restored condition.

If the reach cannot attain 20°C under natural or restored conditions, or DEQ lacks sufficient information to determine attainment of 20°C, DEQ shall determine which cool water species are present in the designated reaches and identify temperature narrative translator values based on scientific data or professional experience of the thermal tolerance information available for those species.

Review scientific literature for thermal tolerance for each cool water species

After determining which native aquatic species are present, DEQ will review scientific literature for thermal tolerance information for those species. Potential sources of thermal tolerance information can include scientific studies, reports from federal, state, and international wildlife management agencies, and other scientific literature. It may also be helpful to reference literature cited in prior cool water species interpretation memos. If using citations from prior memos, confirm that newer data has not been published in the interim. ODFW may also have additional information available.

See Table 1 for an example of thermal tolerance information that will be used to determine a narrative translator value for temperature.

Table 1: Example of thermal tolerance information

Species	Acclimation Temperature (°C)	Endpoint	Upper thermal limit (°C)	Source
Redside Shiner *(Richardsonius balteatus)*		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

Identify the most sensitive cool water species

When salmonids are not present

DEQ will identify the species with the lowest thermal tolerance. Key metrics for comparison are:

- Upper Incipient Lethal Temperature (UILT), often reported as 50% survival after 24 hours
- Ultimate Upper Incipient Lethal Temperature (UUILT), often reported as no survival after 24 hours
- Optimal growth temperature

Compare data for adult and juvenile life stages and spawning, if available. Note that data for all relevant measures of thermal tolerance for less well studied cool water species are often lacking. DEQ suggests use of best professional judgement and consultation with ODFW or Fish and Wildlife biologists when data sources are limited.

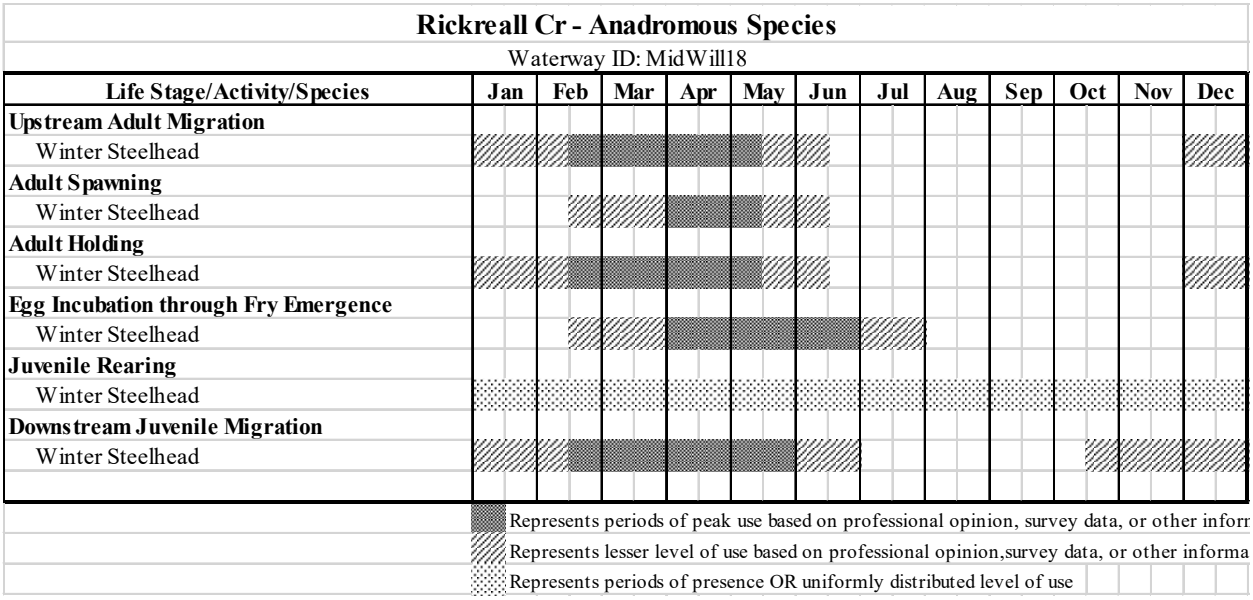
Thermal tolerance data is most often available as adult survival thresholds for 100%, 50% and 0% survival after 24 hours. If similar thresholds for juvenile or egg survival, or spawning success are available, these should be considered if these life stages are present during the months of peak summer water temperatures in the waterbody.

DEQ will base interpretation of the narrative on the most sensitive cool water species for which the necessary thermal tolerance data is available.

When salmonids are present part of the year

Gather information about what portions of the reach support trout use and the timing of this use. Refer to ODFW timing tables (see Figure 1) and identify any data on local surveys, if available. It is important to note that ODFW timing tables apply to an entire timing unit, or catchment. The timing and use may not apply specifically to reaches designated for cool water species use and should be confirmed. DEQ will rely upon an appropriate aquatic life criteria to protect the salmon and trout use that occurs during the time period the use occurs. For example, the 18.0°C target temperature established to protect salmon and trout rearing and migration uses suggested by EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards (2003) and adopted in Oregon's water quality standards (OAR 340-041-0028 (4)(c)) would be applicable in the places and times rearing and migration use occurs within the cool water reach. In general, target temperatures based on fish & aquatic life use to protect salmon, steelhead, and trout will also protect cool water fish.

Figure 1: Temporal distribution of anadromous species in Rickreall Creek. Source: ODFW.



Derive a narrative translator value

DEQ may use one of the following methods to translate the Cool Water Species narrative, or another scientifically valid method, including consideration of natural conditions, depending on available data and site-specific considerations.

In general, DEQ would follow EPA's national temperature recommendations for salmonids and other fish in translating the Cool Water Species narrative (EPA, 1986). These recommendations consist of formulas to calculate the protective temperatures for short-term exposure and a maximum weekly average exposure (7DADM). EPA recommends selecting a temperature value near the warmer end of the optimal range for protection of aquatic life uses. This is primarily for two reasons. First, if the value is met during the period of summer maximum temperature, then water temperatures will be lower than the criterion during the rest of the year. Second, because

the value would apply at the furthest point downstream where the use is designated, temperatures will generally be colder upstream across the full range of the designated use (EPA, 2003).

DEQ will generally use the 7DADM metric to implement the cool water species narrative for consistency with its other, adopted, biologically based numeric temperature criteria.

With sufficient thermal tolerance data

1. EPA Gold Book recommendations

When sufficient thermal tolerance data are available for the applicable species, DEQ may derive narrative translator values based on temperature guidance for EPA's Quality Criteria for Water (1986) or other scientifically justifiable method. Protective weekly average temperature exposure is based on the optimal growth temperature plus 1/3 the difference between the optimal growth temperature and the UILT (50% survival). (EPA,1986).

Equation 1: Calculate maximum weekly average maximum (MWAT)

$$\boldsymbol{MWAT = Optimum\ Growth\ Temp.} + \left[\frac{\boldsymbol{UUILT - Optimum\ Growth\ Temp.}}{\mathbf{3}}\right]$$

Source: (EPA, 1986)

2. High Stress Temperature Threshold
   Alternatively, EPA provides a methodology for determining weekly maximum criteria using UILT or UUILT data for median mortality, often adjusted downward by -2°C to ensure 100% survival, particularly during peak summer conditions. This high stress temperature threshold is based on subtracting 2°C from the ultimate or upper incipient lethal temperature (50% survival at 24 hours). This may be a viable method when optimal growth data are not available. This method was used by U.S. Fish and Wildlife Service when developing recommendations for cool water species narrative interpretation for the Shortnose and Lost River suckers in the Klamath River (NMFS,2015).

Equation 2: Calculate high stress temperature threshold

$$\boldsymbol{MWMT = (UILT\ or\ UUILT) - 2°C}$$

Source: (EPA, 1977) and (EPA, 1986)

3. Maximum daily temperature threshold

If a literature value for maximum daily maximum temperature threshold (MDMT) for the species is provided, this may also be used as a narrative translator.

Converting MWAT to 7DADM

Oregon's water quality criteria for temperature are based on a maximum 7DADM that reflects the highest average of maximum temperatures that fish are exposed to over the warmest weeklong period of the year. Since most laboratory studies of thermal tolerance are based on continuous exposure to a single temperature, translation of the lab results to an equivalent 7DADM value is necessary to determine a temperature target consistent with Oregon's water quality standards.

This is based on the observed difference between weekly mean and weekly maximum temperatures in many Oregon rivers during the summer. When the mean temperature is above the optimal growth temperature, the "mid-point" temperature between the mean and the maximum is the "equivalent" constant temperature. This "equivalent" constant temperature then can be directly compared to laboratory studies done at constant temperatures. For example, a river with a 7DADM value of 19°C and 15°C weekly mean temperature (i.e., diurnal variation of ± 3°C) will be roughly equivalent to a constant laboratory study temperature of 16.5°C (mid-point between 15°C and 18°C) (EPA, 2003).

Following EPA's guidance for temperature standard development for Pacific Northwest States, 7DADM temperatures correspond to a constant lab exposure temperature of +2°C (EPA, 2003). This is based on the observed difference between weekly mean and weekly maximum temperatures in many Oregon rivers during the summer. Therefore, for most rivers in Oregon, MWAT + 2°C = 7DADM (EPA, 2003)

Equation 3: Conversion from MWAT to 7DADM in Pacific Northwest

$$\boldsymbol{7DADM = MWAT + 2°C}$$

Source: (EPA, 2003) and (DEQ, 2008)

With insufficient thermal tolerance data

If sufficient data to calculate criteria using the guidance are not available, a narrative translator may be estimated using the upper thermal tolerance limit (100% survival after 24 hours) and the upper incipient lethal temperature (50% survival after 24 hours). If the difference in these thresholds is greater than 2°C, and the difference between weekly mean and weekly maximum temperatures in the waterbody during the summer is at least 2°C, a narrative translator value may be developed from the upper threshold (100% survival) a +2°C.

Equation 4: Calculate narrative translator value with insufficient thermal tolerance data

$$\boldsymbol{7DADM = 100\%\ survival + 2°C}$$

Exposure to water temperatures greater than the upper threshold for 100% survival for just a few hours a day when maximum temperatures would be experienced by aquatic life will likely not cause significant harm. 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.

DEQ does not recommend using thermal tolerance endpoints for 0% survival after 24 hours, acute or instantaneous mortality, observed thermal preference or range, or sublethal effects such as loss of equilibria or migration blockage.

If no thermal tolerance data is available for this or any other of the methods identified in this guidance document, DEQ may translate the narrative based on another scientifically justifiable method.

Natural Conditions Considerations

It is common for natural stream temperatures in Oregon to exceed those considered optimal for cold or cool water biota in some locations or during certain periods of time. EPA's Region 10 temperature guidance states, *"EPA views numeric criteria that reflect natural background conditions to be protective of salmonid designated uses because river temperatures prior to human impacts clearly supported healthy salmonid populations"* (EPA, 2003). Where stream temperatures under natural conditions exceed numeric translator values established for a waterbody, the natural conditions are presumed to be protective of the local native aquatic species, including cool water species (DEQ, 2008).

DEQ must develop a credible estimate of stream temperatures that have not been measurably altered by human activity. DEQ may apply the natural condition as a narrative translator if sufficient information for a waterbody exists. To apply it, available information must show that:

1) There is a credible estimate of the maximum temperatures during critical periods under natural conditions; and
2) Natural temperatures exceed numeric translator values calculated for the waterbody based on laboratory thermal tolerance data.

In that case, the numeric translator for the Cool Water Species Criterion shall be the 7-DADM that reflects the approximate natural condition temperature in the critical period for the purposes of applying this narrative criterion.

Human Use Allowance

Oregon's temperature standard allows some human use and activities on the landscape that will not cause biologically significant increase in waterbody temperature (OAR 340-041-0028(12). This human use allowance (HUA) provides a margin of thermal load assimilative capacity in streams to accommodate insignificant additions of heat due to anthropogenic activity. While an objective of the standard is to minimize the impact from human activity, a 0.3°C increase would not impair uses and prevents the need to prohibit any activity that could have even a very minor or "de minimis" effect on stream temperature (DEQ, 2008). If applicable, a 0.3°C HUA will be added to the narrative translator value based on biological thermal tolerance for NPDES permitting and TMDL load and wasteload allocations. Therefore, no more than a 0.3°C increase, the human use allowance, shall be permitted when the water temperature is greater than the value of the temperature target designated to each specified reach.

Other temperature criteria provisions

Protecting Cold Water

If 7DADM temperatures trend to always being cooler than the temperature targets year-round, the protecting cold water criterion (OAR-340-041-0028 (11)) shall be applied with the 0.3 °C HUA based on an increase above the cooler ambient temperature.

Thermal Plume Limitations

The mixing zone and thermal plume limitations in OAR 340-041-0053 (2)(E)(d) apply and will provide further protection against potential migration blockages and acute thermal impacts.

Document the narrative translator process in a memorandum

DEQ shall summarize the narrative translator process in a memorandum in accordance with DEQ public document guidelines. The memorandum should include:

- Executive summary with temperature translator values
- Introduction with a description of the waterbody reaches and the geographic area
- A summary of the procedures used to derive the narrative translator
- Identification of trout and seasonal salmonid uses, if applicable
- Evaluation of the cool water species present and thermal tolerance data
- Standards interpretation with details on the derivation of the cool water species narrative translator and human use allowance.
- Instructions for implementing the cool water species criterion

Coordinate review

It is highly recommended to coordinate review of cool water species narrative interpretation memos with ODFW, including a district biologist. ODFW should review for inclusion of all native species present, that the literature review is comprehensive, and that the proposed temperature narrative translator value is reasonable. It is courteous to coordinate internal review with DEQ water quality programs implementing watershed management, permits, and water quality assessment.

References

DEQ 2008. Temperature Water Quality Standard Implementation – A DEQ Internal Management Directive. Oregon Department of Environmental Quality, Portland, Oregon.

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NMFS 2015. Endangered Species Act Biological Opinion on the Environmental Protection Agency's Proposed Approval of Certain Oregon Water Quality Standards Including Temperature and Intergravel Dissolved Oxygen. WCR-2013-76. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. West Coast Region, Portland, Oregon.

USFWS 2015. Formal consultation on the U.S. Environmental Protection Agency action to approve revised Oregon water quality standards for temperature and dissolved oxygen. FWS: 01EOFWO0-2014-F-0087. U.S. Department of the Interior, Fish and Wildlife Service. Oregon Fish and Wildlife Office, Portland, Oregon.

Record of revisions to directive

Revision	Date	Changes	Editor
Creation of implementation guidance	7/29/2026	New guidance	Tatyana Isupov