

provided by the canopy, river geometry, point source inputs, *etc.*) reflecting current conditions. Model performance can then be evaluated by comparing simulated temperatures to measured temperatures. Once the model is thus calibrated, the second step involves changing the system characteristics to represent natural conditions. Examples of these changes are removal of point source discharges from the model inputs, changing the model hydrodynamics from impounded conditions due to a dam to free-flowing conditions, and increasing the riparian shade to represent a natural forest.

Unlike statistical models, process models do not rely upon data from reference locations, so they can be used for rivers that have no suitable natural reference comparisons available. Thus, process models are well suited for estimating natural conditions for larger streams and rivers. Although powerful, process models are by no means infallible. As noted above, there are numerous potential sources of uncertainty in model estimates, and these should be well documented in decision-making.

In addition to estimating natural conditions, process-based models are useful for understanding the basic mechanisms influencing water temperature in a watershed, understanding the relative contributions from different sources at different locations, understanding cumulative downstream impacts from various thermal loads, performing "what if" scenarios for different mitigation options, and setting TMDL allocations.

Historical Fish Distributions: Maps of historic salmonid distributions and their time of use can provide rough estimates of natural temperatures. Areas where salmonids existed historically likely provided temperatures suitable for salmonids and, as described in the Temperature Guidance, EPA has a fairly good understanding of suitable temperatures for various life stages of salmonids.

ii. EPA's Basis for Proposing a Criterion to Protect Waters That Are Currently Cold. One of the important principles in protecting the designated uses proposed in this rule is the

protection of existing high quality habitat. EPA, therefore, believes it is important to have strong regulatory measures to protect waters with ESA-listed salmonids that are currently colder than EPA's proposed numeric criteria. EPA is proposing a narrative criterion specific to waters in which salmonid species that are listed as threatened or endangered under the ESA are present, and where available data and information from ten years prior to the date of the publication of the final rule in the **Federal Register** reflect the temperature in the water body and demonstrate that the warmest summer maximum 7DADM temperature is colder than the applicable numeric criterion. In these cases, the summer maximum 7DADM temperature shall be the applicable water quality criterion, unless a complete data record of ten years is available, in which case the maximum 7DADM temperature for the year with the second highest maximum 7DADM shall be the applicable criterion.

Because the temperatures of many waters in the Pacific Northwest are currently higher than the summer maximum criteria proposed in this rule, the high quality, thermally-optimal waters that do exist are important for the survival of ESA-listed salmonids. Additional warming of these waters will likely cause harm by further limiting the availability of thermally optimal waters. Further, protection of these cold water segments in the upper part of a river basin plays an important role in maintaining temperatures downstream. Thus, in situations where downstream temperatures currently exceed numeric criteria, upstream temperature increases in waters currently colder than the criteria may further contribute to the non-attainment downstream, especially where there are insufficient intervening river miles to allow the river to return to equilibrium temperatures. See "Issue Paper 3: Spatial and Temporal Patterns of Stream Temperature," Prepared as Part of EPA Region 10 Temperature Water Quality Criteria Guidance Development Project. EPA-910-D-01-003, May 2001.; "Technical Synthesis: Scientific Issue Relating to Temperature Criteria for Salmon, Trout, and Char

Native to the Pacific Northwest," A Summary Report Submitted to the Policy Workgroup of the EPA Region 10 Water Temperature Criteria Guidance Project. EPA-910-D-01-007. Finally, natural summertime temperatures in Pacific Northwest waters were spatially diverse, with areas of cold-optimal, warm-optimal, and warmer-than-optimal water. The natural conditions narrative criterion described previously deals with natural conditions reflecting warmer-than-optimal water temperature. EPA believes it is important, however, to balance the effects of these warmer waters by adopting provisions to protect waters that are at the colder end of their optimal thermal range. EPA's proposed rule is intended to do this.

Provisions to protect waters currently colder than numeric criteria can also be important to ensure the numeric criteria proposed today protect salmonid uses. As discussed previously, EPA's proposed criteria are based in part on the judgment that meeting the criteria at the lowest downstream point at which the use is designated will likely result in cooler waters upstream. These proposed cold water protection provisions provide more certainty that this will be true.

EPA requests comment on an alternative that would rely on the State's existing antidegradation policy and EPA's proposed implementation procedures to protect these high-quality waters. In general, antidegradation policies, which are part of water quality standards, prohibit a lowering of water quality in high-quality waters except when specific procedural and substantive requirements are satisfied. Using the antidegradation policy to protect high-quality waters may provide greater site-specific flexibility because it would not be necessary to promulgate a rule change to accommodate a situation where some temperature increase (but still below the applicable criterion) was unavoidable. Also, there may be practical difficulties in determining what the applicable criterion is for high-quality waters under the proposed approach if data is incomplete or implementation resources are limited.

TABLE III-1.—SUMMARY OF TEMPERATURE CONSIDERATIONS FOR SALMON AND TROUT LIFE STAGES

Life stage	Temperature consideration	Temperature and unit	Reference
Spawning and Egg Incubation.	* Temp. Range at which Spawning is Most Frequently observed in the Field.	4-14 °C (daily avg)	Issue Paper 1; pp 17-18.
	* Egg Incubation Studies.		Issue Paper 5; p 81.
	—Results in Good Survival	4-12 °C (constant)	Issue Paper 5; p 16.
	—Optimal Range	6-10 °C (constant).	