



## **Historical Overview of Water Temperature Issues in Idaho**

Water temperature is an extremely important parameter affecting the aquatic environment. Temperature has a profound influence on the types of aquatic communities inhabiting a particular water body. Federal regulations implementing the Clean Water Act require states to develop water quality standards that restore and maintain the chemical, physical, and biological integrity of the nation's waters. Temperature is a critical parameter to consider in the context of water quality standards because it is fundamentally important to aquatic life. Anadromous salmon and steelhead trout, as well as resident bull trout, are among species known to favor cold water, as well as being icons of Pacific Northwest. Because of their declining populations in the mid- to late-1990s, they were listed as threatened or endangered species. This greatly increased the attention given to water temperature in the region.

Idaho has a long history of involvement in and a fairly extensive body of work that examines temperature issues. The following discussion provides an overview of the events that have shaped the temperature landscape over the past 12 years.

### **1994-1997: Temperature criteria come under question**

In July 1994, as part of its regular revision of water quality standards, Idaho submitted its entire compilation of water quality standards, much of which were not revised, to the Environmental Protection Agency (EPA). In 1996, EPA determined that unrevised cold water biota and salmonid spawning temperature criteria were not protective of bull trout and disapproved the criteria in streams within the geographic range of bull trout. In addition, EPA disapproved of the temperature criteria for a segment of the Kootenai River between Bonners Ferry and Shorty's Island, over concern for Kootenai River Sturgeon.

In an effort to stop federal rule promulgation in the state, Idaho adopted a temporary rule in June 1997 that contained revised temperature criteria for bull trout and for a segment of the Kootenai River. EPA determined there was insufficient scientific rationale for the temporary bull trout temperature criteria, disapproved that portion of the temporary rule, and proceeded with federal promulgation of bull trout temperature criteria. EPA provided a conditional approval of the temperature criteria for the Kootenai River segment of concern (62 FR July 1997). In response, DEQ commissioned a review of bull trout temperature requirements (*Review of Bull Trout Temperature Requirements: A Response to the EPA Bull Trout Temperature Rule*). This document critically examined the validity of the federal rule as it applies to juvenile bull trout.

At the same time DEQ was repeatedly discovering in total maximum daily load (TMDL) development that Idaho's temperature criteria did not match reality in terms of effects on fish populations or human-caused alterations of stream temperature. So, DEQ undertook an effort to examine the relationship between documented stream temperatures and fish (salmonid) populations in Idaho (Little Lost River, Owyhee County, and Lochsa River drainages). This study (*The Dilemma of Applying Uniform Temperature Criteria in a*

*Diverse Environment: An Issue Analysis*) found there were many instances where salmonid spawning has occurred coincidentally with measured temperature criteria exceedances.

Regionally, Oregon was finishing up a protracted triennial review of its water quality standards (1992-1996); only to have proposed updates to temperature criteria come under scrutiny for protectiveness of threatened and endangered stocks of salmon, which eventually led to lawsuits and court settlements.

### **1999-2003: DEQ takes a closer look at water temperatures in Idaho**

In 1999, DEQ became involved in a project to conduct aerial thermal infrared imaging of the lower Snake and Clearwater Rivers, below Hells Canyon and Dworshak Dams. This effort was made to examine downstream trends in water temperature, investigate the influence of tributaries, and identify possible cold water refugia for salmon. It was also a test of this emerging technology, and so the imagery was “ground-truthed” against in-stream field measurements. The search for refugia was an attempt to help explain how salmon were surviving in waters that were nominally too warm, with temperatures approaching lethal according to some laboratory studies. The technology proved to be reliable—even temperature differences created by the wake of boats could be detected—yet few refugia could be identified. Heated areas were quite evident, and the dramatic cooling influence of Dworshak releases was easily depicted. Through an accident of timing of duplicated flights, the great responsiveness of tributary inflows to cooling weather was also documented.

DEQ was so impressed with this work that it contracted for two more years of work to examine the distribution of summer water temperature in the Clearwater and Owyhee drainages in 2000 and the Salmon drainage in 2001. Unlike the 1999 imaging, in these two studies each river was imaged twice, once in the morning (corresponding with daily minimum temperatures) and again in late afternoon (corresponding with daily maximum temperatures). The work showed that water temperatures increase downstream, rapidly at first, then more gradually. Superimposed on this general warming trend were some dips as well as localized areas of cooler “refugia,” primarily associated with tributaries. Nevertheless, water temperatures were found to exceed criteria far up into these watersheds, above most anthropogenic heat sources, and even in parts of the watersheds that are largely wilderness. This reinforced the picture that Idaho’s current criteria for “cold water aquatic life” were not realistic, at least for Idaho’s larger rivers and streams.

In late 1999, DEQ submitted the Lochsa River Subbasin Assessment to EPA. In this assessment, DEQ concluded that stream temperatures in the Lochsa River and its tributaries were naturally high during the summer and early fall. Based on the research done as part of this assessment, DEQ recommended that the Lochsa River and Canyon Creek be removed from the §303(d) list. EPA disagreed with DEQ’s conclusion that water temperatures in the Lochsa subbasin were natural, faulting DEQ’s analysis as not rigorous enough. In an effort to demonstrate the validity of its conclusion, DEQ provided EPA with the temperature data used in the Lochsa Subbasin Assessment in early 2000.

This culminated in a meeting in June 2000 to discuss resolution of an impasse on removing the Lochsa River from the §303(d) list. In part, EPA's objection to the removal was procedural: they were not expecting a request to remove a river from the §303(d) list to come in the form of a subbasin assessment report. Actions to change the §303(d) list generally occur only every other year as a new list is prepared, and those actions and the §303(d) list must go through public comment. DEQ responded to the procedural objections by writing a letter to EPA specifically asking that the Lochsa River be removed from the §303(d) list because its temperature, although above criteria during most summers, was a natural condition. To date, this issue has still not been resolved.

DEQ also obtained a consultant to conduct a water temperature modeling study in the Lochsa subbasin to address concerns EPA had regarding use of historical data and the Selway River as a reference to show the Lochsa was not thermally altered. This report (*Water Temperature of the Lochsa River and Selected Tributaries*) was completed in 2002, and results of the model indicated that, although there was a small increment of increased temperature due to human activity, natural disturbances were the dominant factor impacting water temperatures in the subbasin. During this same time period, DEQ became involved in EPA's regional temperature criteria development effort, with members on both technical and policy workgroups. Based on experience with this effort, involvement in a tri-state effort to develop a temperature TMDL for the mainstem Columbia River, and resulting communication with counterparts in Oregon and Washington state environmental agencies, DEQ revised its natural background provision in rule to allow a 0.3 °C increase above natural temperatures.

In 2000 and again in 2001, DEQ conducted water quality monitoring of the Selway and Middle Fork Salmon Rivers and some of their tributaries to document baseline conditions for possible designation as "Outstanding Resource Waters." This included placement of temperature data loggers to obtain year-round records of water temperature. The data obtained showed that even these nearly pristine, "cream-of-the-crop" waters did not always meet Idaho's cold water aquatic life criteria, providing further evidence that the prevailing criteria did not fit with reality (*Wilderness Water Temperatures: A Look at the Selway and Middle Fork Salmon*).

DEQ also undertook literature research to better understand historical temperatures and how they have varied from year-to-year. Temperature data were located and compiled from a series of water temperature studies of major rivers across the Pacific Northwest conducted by the Bureau of Commercial Fisheries (predecessor to the National Marine Fisheries Service) in the mid- to late-1950s. These data show that temperatures higher than Idaho's current criteria existed historically. DEQ also worked with the U.S. Geological Survey (USGS) to obtain long-term records of water temperature across the region, some of it going back decades. These data showed that inter-annual variations in water temperatures on the order of several degrees are common. It also showed that dams often lower water temperatures downstream. (*Year-to-Year Variation in Stream Temperature and Implications for Water Quality Criteria*).

Additional efforts that DEQ participated in to gain better understanding of water temperature issues included sponsoring two research efforts led by the USGS and revisiting the bull trout temperature requirements issue. In 2000, the USGS initiated a study to develop a statistical model that can be used to estimate natural stream temperatures based on a variety of basin characteristics and other readily available data (*A Statistical Model for Estimating Stream Temperatures in the Salmon and Clearwater River Basins, Central Idaho*). None of the sites monitored (183 sites in the Salmon and Clearwater River basins) met the salmonid spawning temperature criteria.

A separate study was initiated by the USGS in 2001 to examine the relationship between water temperature and distribution of aquatic assemblages (*Aquatic Assemblages and Their Relation to Temperature Variables of Least-Disturbed Streams in the Salmon River Basin, Central Idaho, 2001*). Among many findings, this study illustrated that for reference streams (with maximum weekly maximum temperatures up to 23.2 °C), bull trout was the only species whose abundance was significantly inversely related to water temperature. Conversely, for rainbow trout and Chinook salmon abundance, the relationship was actually significantly positive (i.e., higher temperature, more fish). The overall conclusion of this report was that regional and local differences (in response of fish to water temperature) need to be considered when deriving stream temperature criteria.

In 2003, DEQ prepared a final report titled *Update of Bull Trout Temperature Requirements*. The purpose of this report was to use information provided by EPA reviewers after they critically examined the 1998 bull trout report, evaluate new information that was available, and explain a revised temperature criteria to protect juvenile bull trout during summer rearing. This study concluded that a temperature criterion of 13 °C, expressed as a maximum weekly maximum temperature, would be fully protective of bull trout rearing when applied during the months of June, July, and August.

### **1999-2003: Attempts to address the temperature dilemma**

To DEQ it seemed one sensible solution was to recognize more options for classifying waters than simply the “warm” or “cold” classifications that existed at the time. In an effort to recognize additional aquatic life uses, DEQ proposed a seasonal cold aquatic life use category and associated criteria in June 1999. In support of this effort, DEQ retained a contractor to evaluate the temperature requirements of fish species that would likely occur in waters classified as having a seasonal cold water aquatic life beneficial use. This report, *Evaluation of Seasonal Cold Water Temperature Criteria*, concluded temperature criteria of 23 °C maximum daily average temperature and 26 °C maximum daily maximum temperature would be protective of the seasonal cold aquatic life beneficial use. This aquatic life use category and associated criteria were adopted into Idaho water quality standards in spring 2000. To date, EPA has not formally acted on this portion of Idaho’s water quality standards; however, based on independent reviews it has not yet provided to DEQ, EPA has indicated that their view is that the temperature criteria do not appear to be protective of the seasonal cold aquatic life assemblages.

Also in 2000, DEQ completed rulemaking that modified an existing water quality standard that allows natural background conditions to supplant numeric criteria for toxic substances. The revision expanded the scope of the existing provision to include parameters other than toxics, such as dissolved oxygen and temperature, and removed the default table for application of salmonid spawning temperature criteria. Both were moves to provide greater flexibility in dealing with the often encountered “box” of unattainable or unrealistic temperature criteria.

Concurrent with the activities ongoing in Idaho (1996 through 1999), the National Marine Fisheries Service and U.S. Fish and Wildlife Service (“the Services”) were conducting an Endangered Species Act consultation on revised Oregon water quality standards (submitted to EPA by Oregon DEQ in 1996). EPA approved of the standards in 1999 and was subsequently sued by Northwest Environmental Advocates (NWEA) over Endangered Species Act issues. In order to move forward on the approval without objection from the Services, EPA agreed to lead a tri-state interagency effort to develop a regional guidance for water temperature criteria that would be protective of listed species.

Along with Oregon and Washington, Idaho participated in the interagency effort to develop EPA’s Region 10 temperature criteria document. The technical workgroup met more or less monthly over the span of three years (2000-2003). Five technical issue papers were prepared, and two draft guidance documents were released for public review in 2002.

As part of its contribution to the regional project, DEQ funded a pilot study on the Chiwawa River in north central Washington (*Application of New Approaches to Water Quality Temperature Criteria: Chiwawa River Case Study*). One purpose of this study was to examine the application of the draft Region 10 temperature guidance in a relatively pristine watershed supporting a diverse assemblage of fishes, comparing fish distributions with temperature distributions. Results indicated that while most of the proposed temperature criteria were met in the water bodies, the recommended bull trout temperature criteria were exceeded.

As the scientific information on temperature requirements of salmonids was reviewed, the selection of biologically-based criteria gravitated toward the “upper end of optimum” for several key life stages of salmonids. DEQ’s representatives concurred that the temperature criteria selected were nearly optimal for the species and life stages of interest. However, they had reservations about defining optimal conditions as regulatory criteria. Since it is the nature of animals to penetrate into every habitat where they can survive, by nature some fish will naturally be found in sub-optimal but tolerable thermal conditions. Because of these and other reservations, in early 2002 DEQ was asked by EPA to prepare a paper explaining its dissent on the biological threshold numbers proposed by the region temperature criteria development workgroup (*Dissenting Opinion on Biological Threshold Numbers Proposed by Regional Temperature Criteria Development Technical Workgroup*).

Idaho commented on the final proposed guidance in December 2002, pointing out that EPA's proposed criteria failed to adequately allow for natural variability in water temperatures (*State of Idaho Comments on Second Public Review Draft of Proposed EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards*). The primary shortcoming identified in EPA's criteria was the expectation that optimum conditions could occur everywhere salmonid fish are found. The state also believes EPA erred in applying average temperatures in laboratory studies to regulation of maximum temperatures in the field; this requires streams to be 1-3 °C or more cooler (depending on magnitude of diurnal temperature cycles) than associated with effects in the lab.

In April 2003, EPA finalized the *EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards*. Several key compromises regarding application of the recommended criteria numbers were arrived at late in the process to satisfy competing concerns. Meanwhile, in March 2003, the court ruled in favor of NWEA and ordered EPA to promulgate new temperature criteria for the state of Oregon. In a race to beat federal promulgation, Oregon adopted new temperature criteria based on the Region 10 temperature guidance at the end of 2003, and EPA then halted its federal rulemaking.

Based on its accumulating knowledge of water temperature, lessons learned from observing Oregon's dealing with water temperature criteria, and involvement in the EPA-lead regional temperature criteria development effort, DEQ moved forward in 2001 with additional rulemaking that allowed for the stream temperature criteria to be exceeded during unusually hot climatic conditions. The rule was modeled after a similar exemption already adopted in Oregon and was submitted to EPA in August 2002; however, to date, EPA has not acted on it.

#### **2004-2005: Where next?**

The most recent temperature study initiated by DEQ was a pilot application of the final Region 10 temperature guidance in the Lochsa River subbasin (*Lochsa River Basin Temperature Guidance Pilot Project: Clearwater Subbasin*). The Lochsa River subbasin is relatively undisturbed by human activities; however, there have been substantial historic fires in the area. This study found that none of the streams within the Lochsa River subbasin met the regionally recommended bull trout temperature criteria; however, the subbasin is considered to be a stronghold for bull trout populations.

In summary, Idaho has extensive experience in temperature investigations over the past eight years. The temperature issue has been complicated by past litigation, endangered species concerns, and disagreement over what is protective or protective enough. DEQ has employed a variety of ways to address the variability and natural conditions of temperature in the state's waters. Some efforts (such as the Lochsa River de-listing) have been met with opposition by EPA, whereas other efforts have been successful (e.g., §401 water quality certification and various TMDLs employing potential natural vegetation as an application of natural conditions).

Still much disagreement remained about what are “attainable” water temperatures. Some do not want to DEQ to list any more waters, prepare any TMDLs, or designate any more waters for salmonid spawning until more sensible criteria are adopted. Others point to natural background provisions and endangered species listings as reasons to move forward regardless of whether numeric criteria are “right.” And some want DEQ to quickly adopt even more stringent temperature criteria in hopes of driving as much improvement as possible. DEQ sees there are no perfect criteria and seeks a solution that will allow regulated parties to more effectively go about their business, while also improving water temperature to the benefit of fish as much as is possible.