

Water Temperature

Why are we interested in water temperatures?

Stream water temperature is a major aspect of water quality for the streams in our region. Cool, clear water is vital to the health of salmon and trout species and to the aquatic community as a whole. Suitable temperature ranges have been evaluated for all life history stages of salmon and trout – adult migration, spawning, egg incubation, embryo development, juvenile rearing, and juvenile migration. Growth and reproduction in salmon and trout are adversely affected when water temperature is outside of the range to which these organisms are adapted. During summer months, water temperature has the potential to become too high to support healthy populations of fish and other aquatic organisms.

What summer temperatures are allowed for salmon and trout?

A standard of 64.4° Fahrenheit (18.0° Celsius) calculated as the 7-day moving average of maximum temperatures, has been adopted by the state of Oregon as the maximum temperature that will still allow for healthy rearing of juvenile salmon and trout. The federal Clean Water Act requires the Oregon Department of Environmental Quality (ODEQ) to list stream segments that exceed the 64.4° F standard. This is referred to as the “303(d) List” and designates water bodies that do not meet water quality standards. The Rogue MAP project is designed to measure and report summertime stream temperature relating to the 303d-listed streams and generally to fish health.

How do temperatures vary by location and by time?

Stream water temperature varies naturally by both location (spatial) and time (temporal), and is affected by a number of factors. Temporally, stream temperature varies on a seasonal and daily cycle. Generally, high temperatures occur in the summer months (July and August) while winter months (December and January) produce the coolest water temperatures. Daily fluctuation also occurs with maximum temperatures in the afternoon and minimum temperatures in the late night or early morning. Stream temperatures vary spatially within the watershed. Generally water is cooler in the upper reaches of a watershed and warms as it progresses down to lower elevations. Water in deep parts of the stream channel is usually cooler than water at the surface or in shallow areas of the stream.

What factors affect stream water temperature?

Temperature is controlled by the amount of heat energy that enters or exits a body of water. Heat energy enters the stream through direct solar radiation, by heat exchange between the air above and streambed below, and through interaction with objects near the stream. Groundwater inflow and outflow, precipitation, runoff and evaporation to the atmosphere are also responsible for heat energy exchange. Direct solar radiation, or sunlight, has the largest effect upon stream water temperature. The amount of sunlight that reaches a stream is directly affected by the amount of shading provided by streamside vegetation. For small streams, streamside vegetation provides shade that does not cool the water, but blocks the sun from warming the stream further. Stream flow also has a large effect upon temperature change. As stream flow increases more energy is

needed to change the temperature of the larger volume of water. Streams with low flow are more susceptible to temperature change because less energy is needed to change the temperature of the smaller volume of water. The sediment load of a stream also plays a role in stream temperature. When sediment load in a stream increases, the water in the stream tends to spread out over a larger area (aggradation). Shallow, wide channels provide more surface area for solar energy to enter the stream, potentially increasing water temperature.

How is stream temperature measured?

To monitor water quality in the Rogue and South Coast Basins, water temperature data has been gathered by local organizations, volunteers and government agencies.

Temperature is measured and recorded by using electronic thermometers that read and record water temperature at programmed intervals (usually every 30 minutes). Locations for measuring sites are chosen to provide the most valuable data and be representative of stream temperature throughout the watershed. Thermometers are placed at the stream bottom in the center of flow for most accurate readings. Summertime temperature measurements are recorded between mid-June and mid-September. When summarizing temperature data from a summer season, a statistic known as the “7-day moving average of the daily maximum temperatures” is calculated. This average is the basis for Oregon’s stream water temperature standards, including the requirement that salmon and trout rearing streams are cooler than 64.4° F (18.0 °C).

How is the quality of water temperature data rated?

DEQ has established a rating system for water quality data, to provide information about the credibility or quality of the measurements. Temperature data is rated from A+ to F, with A+ being the highest level. High quality, accurate and representative (A grade) data that meets DEQ quality control limits is vital in making informed decisions regarding stream health and 303(d) listing status and policy. To receive a high rating, data must meet quality control limits through development and adherence to an approved quality assurance project plan. The Rogue MAP project will utilize only grade A and B data for analytical purposes. Measurements obtained from DEQ that are rated as C through F will be categorized as “E” or educational. These temperatures may be of interest but cannot be used for analysis since quality control limits may not have been met. For additional definitions and discussion of data quality levels, see Water Temperature metadata.

What are the temperature conditions in the Rogue and South Coast Basins?

Some streams and stream segments exceed the 64.4° standard for summertime temperatures. Of these streams some are naturally warmer than the standard, and others have been modified by human practices that increase or decrease flow, shade, or sediment input.

Boyd, M. and Studevart, D. 1997. The Scientific Basis for Oregon’s Stream Temperature Standard: Common Questions and Straight Answers. Oregon Department of Environmental Quality.

