

Temperature

Fact Sheet

What is Water Temperature?

Temperature is a measure of the average kinetic energy of water molecules. It is measured on a linear scale of degrees Celsius or degrees Fahrenheit.

Why is it Important?

It is one of the most important water quality parameters. Temperature affects water chemistry and the functions of aquatic organisms. It influences the:

- amount of oxygen that can be dissolved in water
- rate of photosynthesis by algae and other aquatic plants
- metabolic rates of organisms
- sensitivity of organisms to toxic wastes, parasites and diseases
- timing of reproduction, migration, and aestivation of aquatic organisms

How is Stream Temperature Measured?

- Bulb Thermometers with colored alcohol (avoid mercury thermometers)
- Temperature probes and meters

Conversion between Fahrenheit and Celsius is: $\text{deg C} = (\text{deg F} - 32) \times 5/9$.

What Factors Affect Temperature?

Natural Factors

- Sunlight Energy: Seasonal and daily changes, shade (cover), air temperature
- Color and turbidity of water: suspended sediment absorbs heat
- Flow
- Depth of water
- Inflow of groundwater: Usually colder than stream
- Inflow of surface water into stream which is at a different temperature than the stream (Example: A drainage ditch or another stream)

Human Influence

- Removal of riparian vegetation enabling direct sunlight
- Alterations to stream morphology (e.g., pool depth)
- Water diversions decreasing flow
- Accelerated soil erosion, increase in turbidity and heat absorption
- Increased storm water runoff
- Cooling water discharges from power plants

Temperature

Fact Sheet (continued)

What are Acceptable Ranges?

Acceptable ranges cannot be assigned without understanding the aquatic ecosystem. The maximum temperature tolerated by organisms depends on the species.

Maximum weekly average temperature for growth and short-term maximum temperatures for selected fish (degree C or F) Adapted from *EPA's Draft Volunteer Stream Monitoring: A Methods Manual*.

Species	Growth	Maxima	Spawning**	Embryo Survival**
Bluegill	32 C (90 F)	35 C (95 F)	25 C (77 F)	34 C (93 F)
Carp		21 C (70 F)	33 C (91 F)	
Channel catfish	32 C (90 F)	35 C (95 F)	27 C (81 F)	29 C (84 F)
Largemouth bass	32 C (90 F)	34 C (93 F)	21 C (70 F)	27 C (81 F)
Rainbow trout	19 C (66 F)	24 C (75 F)	9 C (48 F)	13 C (55 F)
Sockeye salmon	18 C (64 F)	22 C (72 F)	10 C (50 F)	13 C (55 F)

* The optimum or mean of the range of spawning temperatures reported for the species.

** The upper temperature for successful incubation and hatching reported for the species.

What are the Water Quality Objectives?

The water quality objectives for freshwater ecosystems protect coldwater ("COLD") or warm water ("WARM") fishes. In general, the water quality objective does not allow temperature of any water supporting these fishes to be increased by more than 5°F above natural receiving water temperature. However, the water quality objectives vary from region to region in California. Therefore, you should check with the Regional Water Quality Control Board in your area. Water quality objectives are included in their Basin Plan.

For bays, estuaries, and ocean waters, elevated waste discharges cannot cause surface water temperatures to rise greater than 4°F above the natural temperature.

Sources and Resources

This Fact Sheet is implemented by the Clean Water Team (CWT), the Citizen Monitoring Program of the California State Water Resources Control Board. This fact sheet has been revised by CWT from an original document authored by Gwen Starrett, former State Coordinator for Citizen Monitoring. Please contact your Regional CWT Coordinator for further information and technical support. For an electronic copy, to find many more CWT guidance documents, or to find the contact information for your Regional CWT Coordinator, visit www.swrcb.ca.gov/nps/volunteer.html. If you wish to cite this FS in other texts you can use "CWT 2004" and reference it as follows: "Clean Water Team (CWT) 2004. Temperature Fact Sheet, FS-3.1.2.0(Temp). in: The Clean Water Team Guidance Compendium for Watershed Monitoring and Assessment, Version 2.0. Division of Water Quality, California State Water Resources Control Board (SWRCB), Sacramento, CA."