

## Temperature and Alberta Streams and Rivers

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### Highlights

- Temperature is a key variable in shaping aquatic habitats.
- Temperature affects the amount of dissolved oxygen in water.
- Human activities can affect the temperature of stream or river.

### What is a temperature test?

A measurement of the temperature of the water.

For the temperature test in the Alberta Water Quality Monitoring Day kit, a sticker thermometer is attached to the side of the testing container (to make it easier to grasp). Then it is placed 4 inches below the water surface for one minute. Once the thermometer is removed from the water the temperature should be recorded immediately.

### What is normal temperature?

Temperature will range greatly depending on the time of year, time of day, weather conditions and the flow rate of the stream or river.

### Why is temperature important?

Temperature is very important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants and the sensitivity of organisms to toxic waste, parasites, and disease.

Water temperature is a key variable responsible for shaping the ecology of aquatic habitats. Temperature can both directly and indirectly impact inhabitants of aquatic environments. Temperature indirectly affects animals by controlling dissolved oxygen concentrations (the capacity of water for holding dissolved oxygen decreases with increasing water temperature). Temperature directly affects the physiology of plants and animals controlling, among other things, activity, metabolism, growth and reproduction. As lakes and streams become warmer, the activity, growth and reproduction of their inhabitants increase and the water becomes teeming with life.

It is important to realize, however, that plants and animals are adapted to survival in specific environmental conditions. For some organisms the tolerable range of environmental conditions might be wide, yet for others, the range might be quite narrow. If conditions, in this case temperature, are too low, the physiological response of an organism decreases and as a result activity slows and growth and reproduction cease. Excessively high temperatures may also have the same effect. When organisms experience environmental temperatures above their normal range, more energy is used to compensate for physiological changes including increased respiration and metabolic rate. Consequently, less energy is available for growth and reproduction in plants and animals suffering from this environmental stress. In addition to seasonal changes, water temperatures in streams and lakes usually follow a daily pattern with warmer

temperatures during the day and cooler temperatures at night. Large changes to the extent of seasonal and daily temperature patterns, may affect the life cycles of many aquatic organisms.

### **What influences temperature in rivers and streams?**

#### Riparian Vegetation

Sun shining directly on a small water body, causes the water to warm up very quickly and potentially to very high temperatures. Riparian vegetation, or trees and plants growing along the banks of a river or creek, provides shade and prevents excessive heating.

#### Flow Rate

The rate of water flow directly impacts water temperature. During dry seasons, such as mid-summer, less water usually exists in a river or creek. As a result, it flows more slowly allowing the water to warm up more quickly and to higher temperatures.

#### Paved Surfaces

Urban and industrial developments cover the land with impermeable surfaces such as buildings and pavement. This reduces the amount of precipitation that can soak or infiltrate into the ground and increases the volume of surface runoff, via drainpipes, directly into nearby surface waters. The “pulse” of water to streams and rivers during large storms rapidly increases their volume and velocity. Stream and river channels become scoured and widened. During dry weather following storms, a widened channel becomes shallow with reduced flow, causing it to heat up much more quickly than would a more natural narrow, deep one.

#### Industrial Coolant Discharge (Thermal Pollution)

Some industries use surface water for cooling purposes in its processes. This cooling water is often discharged back into a “receiving” surface water body, usually a nearby stream or lake. This water is much warmer than that of the receiving water body and the temperature of the stream or lake increases. This “thermal pollution” can have numerous impacts on the chemical, physical and biological properties of a water body including: reducing the period of winter ice cover, increasing the metabolic, growth and reproductive rates of aquatic plants and animals, and producing an overall increase in oxygen demand.

#### Sewage Outflow

Thermal pollution can also come from sewage treatment plants in the form of warm sewage effluents. Sewage effluents can have the same impacts as other types of industrial cooling waters discussed above.

### **What can we do to minimize or avoid increases in water temperature?**

Restricting livestock access to small streams preserves riparian habitat that shades the stream and also buffers the impact of surface runoff during storm events. Providing alternative watering sites for livestock ensures that stream banks remain deep and narrow

and that livestock entering the stream to water do not widen streambeds. Riparian vegetation can be re-established in areas where natural habitat has been lost in the past. This has been shown to be an effective rehabilitation measure for establishing previously destroyed fish habitat.

In addition to agriculture, recreational activities can also drastically impact water temperature in small streams and creeks. Limiting areas used for streambed crossing, particularly by off-road vehicles and horses, is another important measure that can minimize both the destruction of riparian habitat and stream banks.