

What Do Fish Do in the Winter?

Rivers and streams like the Elbow and its many smaller tributaries are highly variable environments. Some areas of a stream can remain stable year-round, while others can change rapidly with the onset of snowfall, droughts and storms. In lakes, overwintering fish struggle with low-oxygen conditions caused by surface ice and still waters. In rivers and streams, the turbulent conditions constantly mix the water column and maintain uniform water temperatures and dissolved oxygen levels throughout; however, this comes with a complication: ice.



Variable conditions in Elbow River tributaries like Bragg Creek, pictured above, can create challenges for overwintering fish. Photo by Ann Sullivan

When stream reaches are vertically mixed, the water column can become supercooled. This occurs when water cools below 0°C but retains its liquid state. The exact mechanism behind supercooling is still contested amongst scientists, but in this context, supercooling is common when there is little to no surface ice, flowing water and below-freezing air temperatures. Once the water is supercooled, all it takes is a few tiny ice crystals to be pulled from the surface by the current and pushed into enough supercooled water molecules that they crystallize as well, forming a suspended slush known as frazil ice. Frazil ice can stick to any cold, underwater object, like rocks and wood, and when it sticks to the bottom of the stream, it is called anchor ice. In shallow areas with a fast current and a lot of cobble, the anchor ice can become so thick that it forms a dam, temporarily blocking and flooding some of the stream.

Another ice formation in flowing waters is stationary ice cover. This is a floating ice sheet on the top of the water, and it forms when moving ice is stopped by obstacles like log jams, a sudden construction in the river channel, bridges and dams. Once the ice stops moving, it spurs the formation of more ice cover upstream. Ice formation usually stops when it hits an area of high flow, as the turbulent movement does not allow ice crystals to aggregate into sheets, and instead breeds frazil ice. The current will shove frazil ice deposits under stationary ice sheets, which can become so large that they form hanging dams.

Overwintering riverine fish have a drastically lower body temperature and metabolic rate than they do in the summer. As a result, they have reduced swimming, feeding and defensive abilities. Many fish still hunt for food, but prey densities are very low in the winter, so they rely



Unstable environments caused by ice formations can force fish to move during the winter, depleting their energy reserves. Photo by Ann Sullivan

heavily on their stored fat reserves to get through the cold. Thus, it is important for river fish to grow as much as they can over the summer and fall. Small fish cannot store as much energy in their bodies and require relatively more energy to maintain vital bodily functions. To conserve energy, most fish minimize their winter movements by holding in slow, deep pools. Some smaller fish and fry can survive in other reaches of the river, finding cover between the spaces of coarse rock substrates and boulder gardens.

The unstable environment caused by ice formations can force fish to move out of their holding pools, which quickly eats away at their energy reserves. When anchor ice dams and hanging ice dams form, they restrict the current to a single or a couple of points of high-velocity flow that push through pools. Fish cannot maintain their position at these velocities and are forced to move. When winters are warm and dynamic, the frequent thawing and freezing events increase ice formation and movement, forcing the fish to move more often. Eventually, they can become so exhausted by all this movement that they die or become more vulnerable to predation attempts by warm-blooded animals like mink.

Beaver ponds are a vital overwintering habitat because of their stability. Beaver dams halt the movement of frazil and anchor ice, and the pools that form as a result of these dams are deep, with consistent water levels and slow-moving water. These conditions, along with the physical barrier of the dam, allow stationary ice cover to form and prevent the ice from breaking and moving as often. Many trout species preferentially overwinter in beaver ponds for this reason.

Areas with groundwater inputs are another important overwintering habitat for fish and their eggs. These reaches are much warmer than the rest of the river during the winter (a balmy 4°C compared to 0-1°C), maintain a consistent water velocity and are ice-free. Bull Trout lay their eggs over groundwater inputs, where the stable conditions provide a perfect incubation environment. However, groundwater inputs can cause dynamic conditions downstream, because the water cools unevenly as it moves away from the groundwater source and contributes to the frequent freezing and melting of frazil and anchor ice.

Since stream and river environments are so dynamic, it is vital that we maintain diverse, interconnected habitats for fish to utilize during the winter. If you want to help protect and restore these areas in important watersheds like the Elbow River, keep your eye on the Trout

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