

NATURE NOTES

WINTER WATER — the "WHITE MAGIC" of SNOW and ICE

Water is necessary to all life on earth, even in the form of snow and ice in winter.

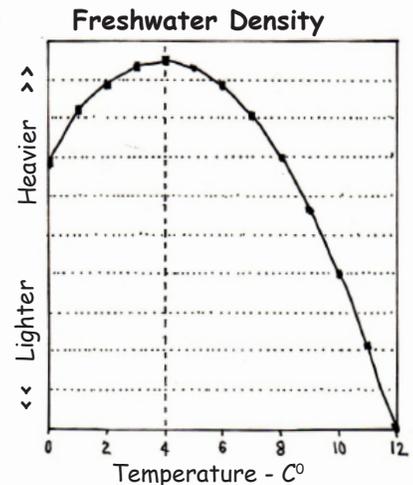
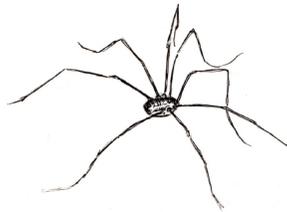
In summer, the water in Kennebec Lake is layered, with warm water near the surface and colder water below. By late fall, lake turnover has thoroughly mixed the layers, resulting in a water temperature of around 4 degrees C from top to bottom.

Water at 4°C is more dense (heavier) than water at 0°C. This means that the lighter, colder water floats above the denser water. If water were heaviest at the freezing point, in winter the very cold water developing at the surface of lakes would sink. The lake would freeze from the bottom up, and all life in the lake would be killed!

Snow is a good insulator. How good depends on the amount of air trapped in the snow layer. One measurement showed a ground temperature of plus 0.5°C under a metre and a half of snow, when air temperature above was minus 30°C. Ground that was frozen in early winter may no longer be frozen under the snow blanket of later winter!

Heat radiating from the earth's core is trapped on the surface of the ground under the snow. Snow touching the ground melts and reforms as crystals on the underside of the snow, producing a thin, snow-free space between snow and ground.

Lots of activity goes on in this space: daddy-long-legs walk around, sometimes upside down on the underside of the snow; springtails jump; wolf spiders chase their prey. Studies have shown insects and arthropods from over 40 different families are active under the snow. And after snowmelt in spring, you have all seen leftover mouse and vole tunnels and germinated maple seedlings.



Ice differs from snow in several ways. It is not a good insulator, rather it conducts heat. Whereas snow is opaque, ice is generally transparent.

After ice covers the surface of a lake, the water below can no longer absorb O_2 from the air. And when snow covers the ice, blocking sunlight, plants can no longer photosynthesize and contribute O_2 to the water.

Fish require O_2 dissolved in the water, so enough must be in the water before ice-over. Too much dead plant material decomposing in the water can use up O_2 , leaving less for animal life.

Water lacking oxygen makes insoluble phosphorus compounds in bottom sediments lose O_2 molecules to the water; the compounds become soluble and phosphorus moves into the water, contributing to the aging of the lake.

Warmer winters have given us snow cover made of layers of snow and ice from freezing rain, producing a less effective winter blanket. Icy layers can make it difficult for animals such as deer to move around. With less insulation, the leaf litter is colder, restricting movement of small creatures also.

- **Ruffed grouse** take advantage of snow's insulation — they fly into soft snow to find shelter for a winter night.
- **Snow on branches** can disappear by evaporating directly into the air without first melting into water. Called sublimation, this process removes much snow from trees and ground long before spring.
- **A warmer climate** that produces more **freezing rain** will result in less sublimation and more broken branches.
- **Flowing water** can become supercooled without freezing, so rapids stay open. Water currents under ice can erode the ice, making it unsafe for winter travel.
- **Where was your snowbank** last month? It could have been part of the water in the Great Lakes or the sea, evaporated by the sun and carried to you in the clouds. When you see snow falling, enjoy the "White Magic" of winter!