

# THE LINK BETWEEN LAKE TURN OVER & ALGAE BLOOMS

by Lynne Bisagno

An interesting phenomena happens to many lakes in climates such as ours in southern Minnesota. They typically demonstrate a pattern of spring turn over, summer stratification and fall turn over. The term "turn over" refers to complete mixing of all the water in the lake from top to bottom. When the water in a lake is not turning over, it tends toward thermal stratification or formation of water layers of different temperatures. Here's a quick overview of how it works.

Of the many unique characteristics of water, the key fact here is that water is most dense at 4° C (Celsius) and becomes less dense at warmer or colder temperatures. Density of a material is a measure of how tightly the molecules are packed together, and more molecules packed in the same space make the material heavier. It can be said that water is heaviest at 4° C.

During winter, water near the bottom of the lake will be at 4° C (greatest density) and water temperature above that will gradually decrease to 0° C just under the ice. As the ice melts in the spring, the upper waters heat up (increase in density) until water temperature approaches 4° C and lake water is now of uniform temperature (and density) from bottom to top. Add a bit of wind to stir it all up and the water at the bottom of the lake mixes easily with the upper water. This is referred to as spring turn over of the lake. As spring warm-

ing progresses into summer, the upper waters continue to warm up and "lighten" up, until the upper waters can no longer mix completely with the cold, dense bottom water. This is summer stratification where the density differences due to different water temperatures are very effective at preventing top to bottom mixing of the lake for several months during the summer. Swimmers feel it and fishing enthusiasts are aware of it. In autumn, as the upper water temperatures cool toward 4° C, the cold, dense water trapped at the bottom of the lake all summer long, mixes easily with upper water and fall turn over of the lake occurs.

*Lake Turn Over Provides a Fresh Supply of Phosphorus* This bi-annual mixing of lake water explains why we may note algae blooms on the lake in the spring and fall. Algae are always present in the lake, but are mostly unseen until conditions are favorable for their growth. Like other plants, algae need sunlight and nutrients (their food source) to proliferate. Both nitrogen and phosphorus are nutrients necessary for algae growth, but phosphorus appears to limit the intensity and length of their growth. Phosphorus in the lake is chemically attached to the bottom sediments as long as oxygen is present in the water. But during the summer, when the deep waters normally become depleted of dissolved oxygen, the chemical bond is no longer present and phosphorus is released into the isolated bottom waters. This newly released phosphorus is then distributed throughout the lake during spring and fall turn over and made available for algae to feast and 'bloom' on.

