Understanding Lakes

GENERAL LAKE CHEMISTRY

In the absence of any living organisms, a lake contains a wide array of molecules and ions from · weathering of soils in the watershed, the atmosphere, and the lake bottom. Therefore, the cher composition of a lake is fundamentally a function of its climate (which affects its hydrology) an basin geology. Each lake has an ion balance of the three major anions and four major cations (se Table 4).

Table 4. ION BALANCE FOR TYPICAL FRESH WATER			
Anions	Percent	Cations	Percent
HCO_3^-	73%	Ca^{+2}	63%
SO_4^{-2}	16%	Mg^{+2}	17%
Cl^-	10%	Na^+	15%
		K^+	4%
other	< 1%	other	< 1%

Ion balance means the sum of the negative ions equals the sum of the positive cations when expressed as equivalents. These ions are usually present at concentrations expressed as mg/L (per million, or ppm) whereas other ions such as the nutrients phosphate, nitrate, and ammoniun present at μg/L (parts per billion, or ppb) levels.

Humans can have profound influences on lake chemistry. Excessive landscape disturbance cause higher rates of leaching and erosion by removing vegetative cover, exposing soil, and increasing runoff velocity. Lawn fertilizers, wastewater and urban stormwater inputs all add micronutrients as nitrogen and phosphorus, major ions such as chloride and potassium, and, in the case of high and parking lot runoff, oils and heavy metals. Emissions from motorized vehicles, fossil fuel-burr electric utilities and industry, and other sources produce a variety of compounds that affect lak chemistry.

Perhaps the best understood ions are H^+ (hydrogen ion, which indicates acidity), SO_4^{-2} (sulfate) NO_3^- (nitrate) which are associated with acid rains. Mercury (Hg) is another significant air pollut affecting aquatic ecosystems and can bioaccumulate in aquatic food webs, contaminating fish a causing a threat to human and wildlife health (see also the Minnesota Pollution Control Agency's section on Hg).

Lakes with high concentrations of the ions calcium (Ca^{+2}) and magnesium (Mg^{+2}) are called har lakes, while those with low concentrations of these ions are called softwater lakes. Concentratic other ions, especially bicarbonate, are highly correlated with the concentrations of the hardness especially Ca^{+2}. The ionic concentrations influence the lake's ability to assimilate pollutants and maintain nutrients in solution. For example, calcium carbonate ($CaCO_3$) in the form known as ma precipitate phosphate from the water and thereby remove this important nutrient from the wat

The total amount of ions in the water is called the TDS (total dissolved salt, or total dissolved s concentration). Both the concentration of TDS and the relative amounts or ratios of different ic influence the species of organisms that can best survive in the lake, in addition to affecting mai important chemical reactions that occur in the water. One example of particular interest in the (Lakes region involves the calcium requirement of the exotic zebra mussel that is causing profou changes in Lake Erie (see National Aquatic Nuisance Species Clearinghouse or Sea Grant Nonindi Species Site). Lake Superior appears to be relatively immune to infestation by this invader beca low calcium concentration. Its bays, however, such as the lower St. Louis River and Duluth-Supe Harbor, may not be immune to zebra mussel infestation.

Back · Index · Forward

Home · What's New · About Us · Contact Us
Frequently Asked Questions · Site Map

Search