

Low pH Simple Diagram Narrative

pH is a measure of hydrogen ion concentration in an aqueous solution: pH decreases as hydrogen ion concentration increases, and these acidic conditions can adversely affect aquatic biota. Certain human activities can result in increased input of hydrogen ions into aquatic systems, including sources associated with agriculture (e.g., animal feedlots), urbanization (e.g., vehicles), industry (e.g., coal-fired power plants) and mining (e.g., acid mine drainage). Natural sources of hydrogen ions include acid-generating geologies and lithologies subjected to weathering and natural organic acids (e.g., humic acids). Hydrogen ions from these sources can be introduced into aquatic systems via four main transport pathways (or transport-defined sources)—stormwater runoff, leakage or leachate into groundwater sources and subsequent transport, atmospheric emissions and deposition, or direct effluent discharges—each of which can contribute to increased hydrogen ion inputs into surface waters.

Whether inputs of hydrogen ions to aquatic systems lead to decreases in pH depends upon buffering capacity, or the ability of the system to neutralize those inputs. Nutrient (especially nitrogen) concentrations also play a significant role in pH dynamics, because nitrification and respiration both produce hydrogen ions. Decreases in pH can in turn affect other stressors, such as by increasing free metal ions, increasing the bioavailability and toxicity of toxic substances, and increasing ionic strength.

Decreases in pH and associated increases in pH fluctuation can contribute to decreased condition, decreased growth, altered behavior, and increased susceptibility to other stressors in affected biota. Ultimately, these effects may result in increased mortality, decreased reproductive success, and changes in population and community structure and ecosystem function. For example, taxa sensitive to low pH (e.g., certain mayfly and stonefly taxa) may decrease, while more tolerant taxa such as tipulids (crane flies), megaloptera (alderflies, dobsonflies, fishflies and hellgrammites), and spike rushes may increase; sensitive life stages (e.g., eggs in fish) also may decline.