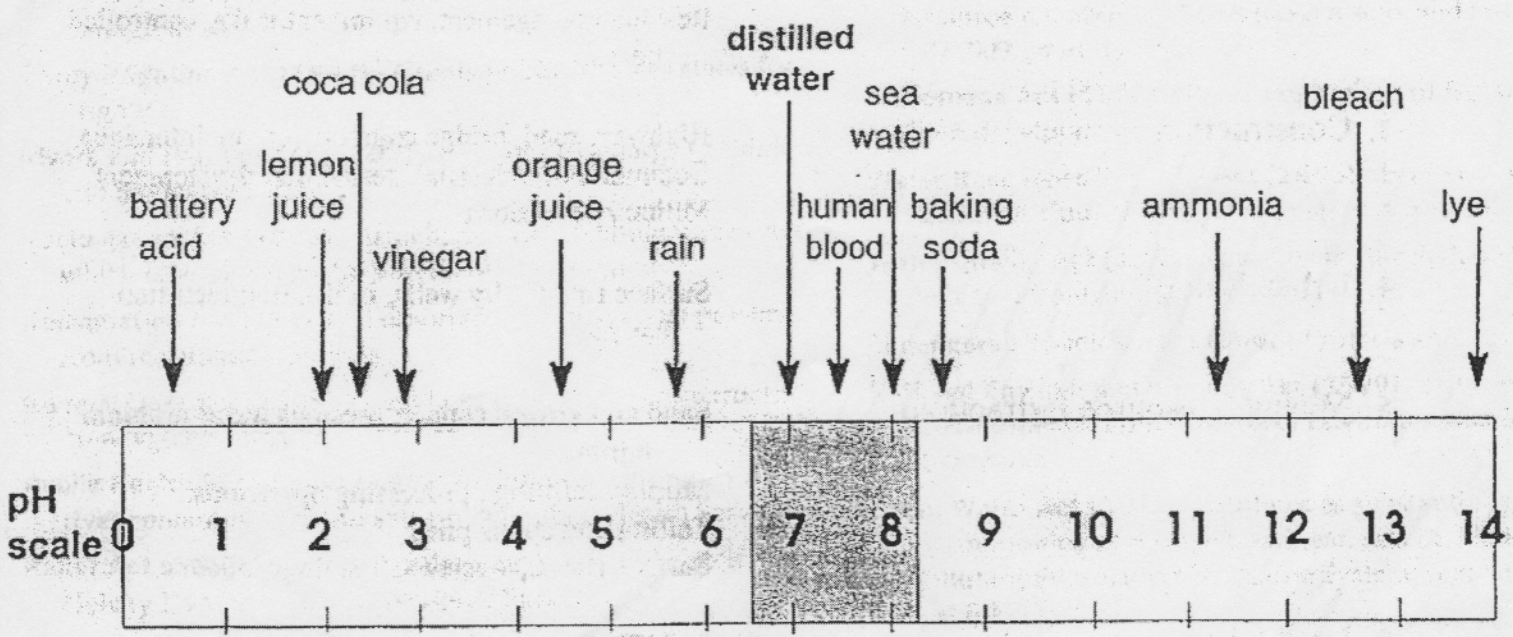
pH OF COMMON SUBSTANCES AND LETHAL pH LIMITS FOR AQUATIC ORGANISMS



all fish dead (begin to die 4.0-4.5)

bass, trout, and tadpoles dead (begin to die 5.5-6.0)

caddisflies, mayflies dead (begin to die 4.5-5.0; decline at 6.5)

prolonged exposure harmful to salmonids & perch

all fish dead (begin to die 11-11.5)

salmonids dead (begin to die 10.5-11.0)

- salmonid eggs & alevin dead (reduced salmonid egg production 5.0-6.5)
- bottom dwelling bacteria (decomposers) begin to die (5.0-5.5) detritus accumulates, locking up essential nutrients
- sediments release metals into water in forms toxic to aquatic life
- snails & tadpoles begin to die (6.0-6.5)

Compiled from Campbell, G, and Wildberger, S. 1992. *The Monitor's Handbook*. LaMotte Company, Chertertown, MD and MacDonald. L.H. with Smart. A.W. and Wissman, R.C. 1991. *Monitoring Guidelines to Evaluate Effects of Forestry*

Water Quality Parameters for Stream Ecosystems

Parameter	Description	Acceptable Value	Impacted by:	What does it affect?
Alkalinity	Measure of the buffering capacity of water	• U.S. streams range from 50-1500 µs/cm • 150-500 µs/cm good range for most aquatic life	• Stream geology (leaching of carbonate/bicarbonate from rocks)	• pH of stream
Biological Oxygen Demand (B.O.D.)	Measure of the oxygen consumed by microbes for decomposition & oxygen required for oxidation of inorganic matter	• Levels of 1-2 ppm are very good	• Organic matter • Effluent • Runoff	• High B.O.D. can result in oxygen depletion and kill aquatic life
Chloride	Measure of the concentration of chloride ions in the water	• Low levels of chloride may be found naturally (<16 mg/L is normal)	• Soil & rocks • Decomposition & wastes • Street salt • Wastewater & effluent	• Conductivity • Survival of aquatic life
Chlorine	Measure of the concentration of chlorine atoms in the water	• Should not be present	• Input from municipal water or sewage	• Conductivity • Survival of aquatic life
Conductivity	Ability of water to conduct an electrical current (directly related to amount & types of ions)	• 150 - 500 µs/cm • (microsiemens/cm) • U.S. streams range from 50-1500 µs/cm	• Geology of stream • Discharges to stream (ex: sewage) • Chemicals in stream	• Survival of aquatic life
Dissolved oxygen (D.O.)	The amount of oxygen freely available in water for aquatic life	• Most aquatic life requires levels of 5 - 6 ppm to thrive • Levels < 3 ppm are stressful	• Temperature • Stream flow • Turbidity • Photosynthesis & Respiration • Decomposition • Organic material	• Survival of aquatic life • Oxidation of organic materials • Decomposition

Parameter	Description	Acceptable Value	Impacted by:	What does it affect?
Nitrates	One measure of nitrogen found in aquatic ecosystems (nitrogen is also found in nitrite and ammonia)	• Natural levels in water < 1 mg/L	• Decomposition & wastes • Wastewater • Run-off (waste & fertilizers)	• Growth of plants and algae • High levels can lead to eutrophication
pH	Measure of the alkalinity or acidity of the water	• Varies based on species • Optimal range for most aquatic life is a pH of 6.5 - 8.0	• Stream geology • Alkalinity • Acid precipitation • Wastewater discharges • Mining of coal or metals	• Biological and chemical processes • Solubility of elements & compounds • Survival of aquatic life
Phosphorous	Measure of phosphorous, usually found as part of phosphate (PO_4), in water	• Should be < 0.03 mg/L • Critical level is 0.1 mg/L • Usually in short supply	• Soil & rocks • Decomposition • Wastewater • Run-off (fertilizers & wastes)	• Growth of plants and algae • High levels can cause eutrophication
Stream Flow	Volume of water moving across a specific point over a period of time (ft^3/sec)	• Varies based on stream order	• Weather • Seasons • Water withdrawal	• Ability to dilute pollution • Types of organisms living in stream
Temperature	Measure of the heat energy in the water of the stream.	• Depends on species in stream • Temp. of lower order streams is usually < 20°C	• Weather & seasons • Riparian vegetation • Water sources & discharges	• Rate of biological & chemical reactions • Dissolved oxygen levels • Sensitivity of aquatic life to toxins
Turbidity	Measure of water clarity based on suspended material in water (soil, plankton, microbes, etc.)	• Increases with stream order • Low order steams should have very clear water	• Weather • Stream flow & velocity • Erosion • Run-off & discharge • Excessive algal growth	• Water color • Light penetration • Temperature & D.O. • Aquatic life (particles may smother invertebrates or eggs of fish & amphibians)

Indicators--Water Appearance

Green: may indicate an overabundance of algae caused by enrichment of the stream. Fertilizer runoff from fields, inadequate sewage treatment, and animal wastes are common sources

Orange/Red: may indicate acid mine drainage, oil well runoff, natural staining due to source headwaters in swamps rich in tannin or iron, or blood from processing plants

Foam: if white and higher than 7-8 cm. above water surface, foam is generally caused by detergents. Thinner surface foam may be a mixture of natural oils and soil particles or pollen.

Muddy/Cloudy: may indicate erosion and sedimentation in those streams and rivers that are not naturally muddy. Construction sites, dredging activities, activity of bottom feeders like carp, farmland erosion, logging, and road-building are common contributors.

Milky/White: may indicate glacial sources of water, pulp and paper mill discharges, or dairy operations.

Multi-Color: may indicate oil floating on the surface from human dumping or oil well operations

Dark reds, purples, blues, and blacks: may indicate dyes from leather tanning, printing operations, clothing manufacturing, etc.

Indicators--Odors

rotten egg (sulfur): indicates sewage pollution

musky: indicates the presence of untreated sewage, livestock waste, or excess algal growth and decay

harsh/bitter/acrid: indicates industrial wastes

chlorine: the smell of chlorine may indicate excessive chlorination of waste effluent