

RELATIONSHIPS BETWEEN STREAM ACIDITY AND BACTERIA, MACROINVERTEBRATES, AND FISH: A COMPARISON OF NORTH TEMPERATE AND SOUTH TEMPERATE MOUNTAIN STREAMS, USA

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Abstract: A comparative study of relationships between stream acidity and bacteria, macroinvertebrates, and fish in the Adirondack Mountains of upper New York state and in the Southern Blue Ridge Mountains of eastern Tennessee, USA, was conducted. Although the study sites in both regions spanned a pH range from approximately 4.5 to 6.4, considerably greater seasonal variability in pH and higher monomeric Al concentrations characterized the Adirondack sites. Relationships between several biological characteristics and stream water acidity were similar in both regions, including lower production of epilithic bacteria and bacteria on decomposing leaves, lower leaf decomposition rates, lower density and generic richness of scraper/grazer macroinvertebrates, particularly Ephemeroptera, and lower fish abundance and survival in more acidic streams. Densities of total macroinvertebrates and densities of macroinvertebrates and bacteria inhabiting or closely associated with stream sediments were generally not related to stream water acidity.

Regional differences occur in some of the relationships between biological characteristics and stream water acidity. Negative correlations between bacterial production on rocks and pH, between bacterial production on decomposing leaves and pH, and between densities of Ephemeroptera and scrapers and pH were stronger in the Adirondacks than in the Southern Blue Ridge. Higher Al concentrations in the Adirondacks may be responsible for the stronger relationships with pH there. The steeper slopes of the relationships between Ephemeroptera density and all forms of Al in the Adirondacks compared with the Southern Blue Ridge suggests that there may be some adaptation among a few acid/aluminum-tolerant species in the seasonally more constant acidic Southern Blue Ridge streams. Fish bioassays indicated longer survival times in acidic streams in the Adirondacks compared with the Southern Blue Ridge, but these results may be an artifact associated with the use in the Southern Blue Ridge of rainbow trout as the test species which is known to be more acid sensitive compared with brook trout, the test species used in the Adirondacks.

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