Evidence for nutrient enrichment of high-elevation lakes in the Sierra Nevada, California

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Limnol. Oceanogr., 48(5), 2003, 1885-1892 | DOI: 10.4319/lo.2003.48.5.1885

ABSTRACT: Long-term measurements (1983-2001) of nutrients and seston in Emerald Lake (Sierra Nevada, California) have revealed ecologically significant patterns. Nitrate, both during spring runoff and during growing seasons, declined from 1983 through 1995. Declining snowmelt nitrate was caused primarily by changes in snow regime induced by the 1987-1992 drought: years with shallow, early melting snowpacks had lower snowmelt nitrate concentrations owing to less labile N production in catchment soils and longer plant growing seasons. However, nitrate declines during growing seasons carried through the wetter years of 1993-2000 and are likely the result of increased P loading to the lake and the release of phytoplankton from P limitation. Contemporaneous with these changes was an increase in algal biomass and a shift from P limitation toward more frequent N limitation of phytoplankton abundance. Particulate carbon concentrations in the late 1990s were two- to threefold greater than in the early 1980s. These trends were reflected in a larger set of Sierra Nevada lakes sampled as part of synoptic surveys (n = 28). Between 1985 and 1999, nitrate decreased and total P increased in .>0% of the lakes sampled. Our data suggest that lakes throughout the Sierra Nevada are experiencing measurable eutrophication in response to the atmospheric deposition of nutrients.

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