



## Climatic forcing and primary productivity in a subalpine lake: Interannual variability as a natural experiment

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**ABSTRACT:** We analyzed a 42-yr record of primary productivity in small, subalpine Castle Lake to determine how climatic variability might influence lake primary productivity. A Pacific Decadal Oscillation (PDO) polarity reversal in 1977 significantly affected winter air and summer water temperatures in Castle Lake. The timing of lake ice-out was explained by spring air temperature and winter total precipitation ( $r^2 = 0.72$ ) and significantly affected water temperature ( $r^2 = 0.74$ ). Primary productivity was negatively correlated with ice-out date and positively correlated with primary productivity during the previous year ( $r^2 = 0.47$ ). Alternatively, primary productivity was positively correlated with water temperature and primary productivity during the previous year ( $r^2 = 0.49$ ). Ammonium availability immediately after ice-out was significantly related to primary productivity from the previous and the current year, suggesting that nutrient availability is an important mechanism for the serial correlation. *Daphnia* and cyanobacteria biomass also increased during warmer years. Our results suggest that variability in air temperature and precipitation from global warming, PDO, and the El Niño Southern Oscillation (ENSO) influence primary productivity and plankton communities in North American dimictic lakes.

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