



The summer metabolic balance in the epilimnion of southeastern Quebec lakes

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ABSTRACT: On the basis of data collected in Quebec lakes, del Giorgio and Peters (1994) and Carignan et al. (2000) have come to opposite conclusions regarding the metabolic balance between heterotrophy and autotrophy in lakes in general. In the present study, epilimnetic oxygen and carbon dioxide saturation was measured in 33 lakes from the St. Lawrence Lowlands region of Quebec to examine the extent of epilimnetic net heterotrophy (i.e., $O_2:CO_2$ balance) in lakes of different characteristics. We found that ~75% of the lakes were undersaturated with oxygen and supersaturated with CO_2 . There was a strong negative relationship between the departures of O_2 and CO_2 from saturation. What has not been noted elsewhere is that oxygen concentrations were negatively related to dissolved organic carbon (DOC) concentration, and, therefore, metabolic gas balances could be predicted from DOC; a value between 4 and 6 $mg\ L^{-1}$ DOC corresponds to metabolic equilibrium. Because most of the lakes in del Giorgio and Peters (1994) had DOC concentrations above this threshold and most lakes in Carignan et al. (2000) were below, their apparently contradictory conclusions can be reconciled within a larger general theory. Contrary to studies elsewhere, however, we found that the degree of oxygen undersaturation increased with lake trophic status, expressed either as total phosphorus or nitrogen concentrations.

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