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HOW DO METABOLIC STOICHIOMETRIC RATIOS INFLUENCE WHOLE-STREAM METABOLISM ESTIMATES FROM DISSOLVED OXYGEN AND CARBON DIOXIDE SIGNALS?

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Models of dissolved oxygen (DO) dynamics in streams typically quantify metabolic rates in terms of oxygen transformation alone, without consideration of ties to carbon dynamics. To understand the influence of primary production (GPP) and respiration (ER) on oxygen and carbon together, some understanding of the associated stoichiometric ratios is required. Our past inverse modeling efforts have suggested that signals of dissolved inorganic carbon (DIC) and DO lead to substantially different estimates of GPP when the ratio of DO production to DIC consumption is assumed to be unity. To better understand this phenomenon, we performed a sensitivity analysis to assess the stoichiometric ratios necessary to rectify the information about metabolism available from DIC and DO. Based on data collected in the Upper Clark Fork River (Montana, USA), these sensitivity analyses suggest that reconciliation of metabolism estimates occurs when the ratio of dissolved inorganic carbon consumed to oxygen produced by GPP is 0.31 and when the ratio of inorganic carbon produced to oxygen consumed by ER is 1.1. Further research on metabolic stoichiometry is a critical step toward using DIC to increase the amount of information available about metabolism from DO alone.