

Significant fraction of CO₂ emissions from boreal lakes derived from hydrologic inorganic carbon inputs

Gesa A. Weyhenmeyer¹, Sarian Kosten², Marcus B. Wallin^{1,3}, Lars J. Tranvik¹, Erik Jeppesen^{4,5} and Fabio Roland⁶

¹*Department of Ecology and Genetics/Limnology, Uppsala University, Norbyvägen 18D, 752 36 Uppsala, Sweden*

²*Department of Aquatic Ecology and Environmental Biology, Institute for Water and Wetland Research, Radboud University Nijmegen, Nijmegen, The Netherlands*

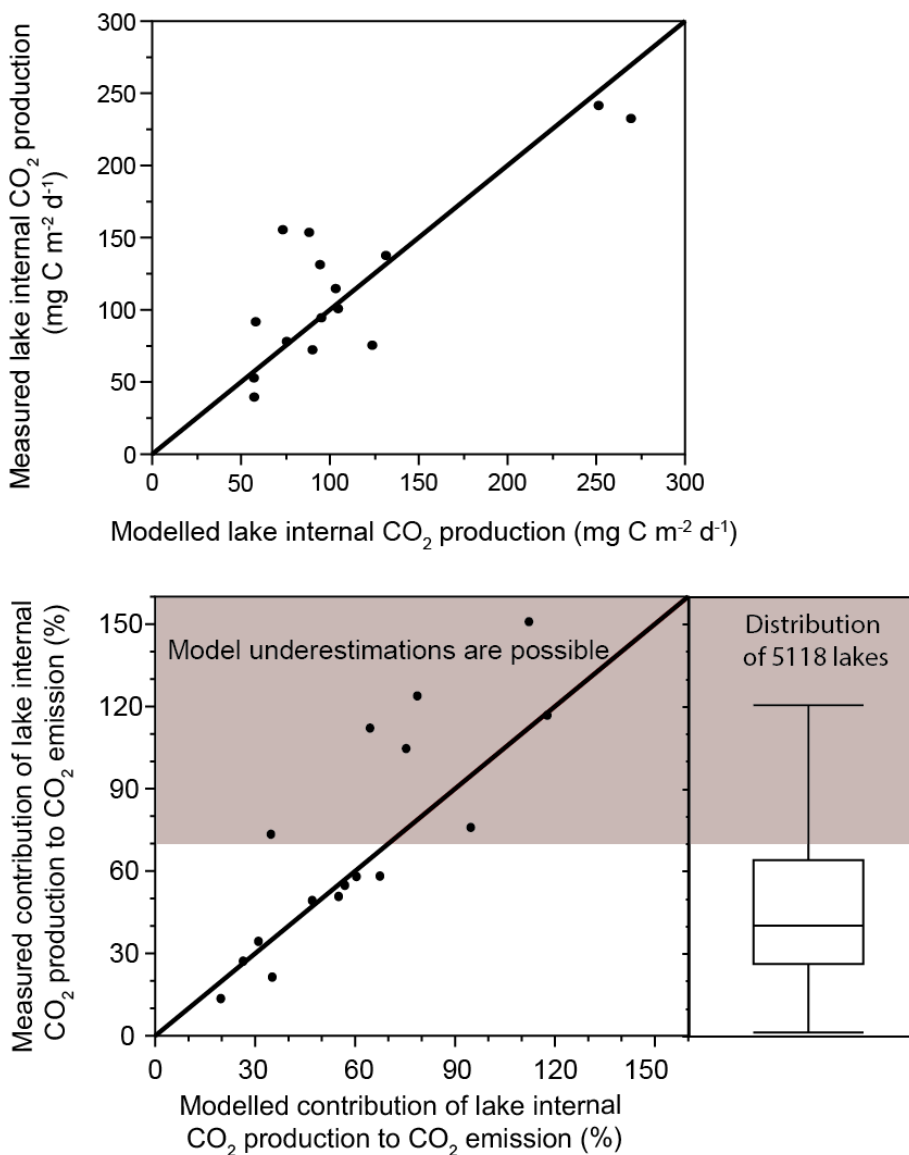
³*Department of Earth Sciences, Uppsala University, Villavägen 16, 752 36 Uppsala, Sweden*

⁴*Department of Bioscience and Arctic Research Centre, Aarhus University, Vejlsovej 25, 8600 Silkeborg, Denmark*

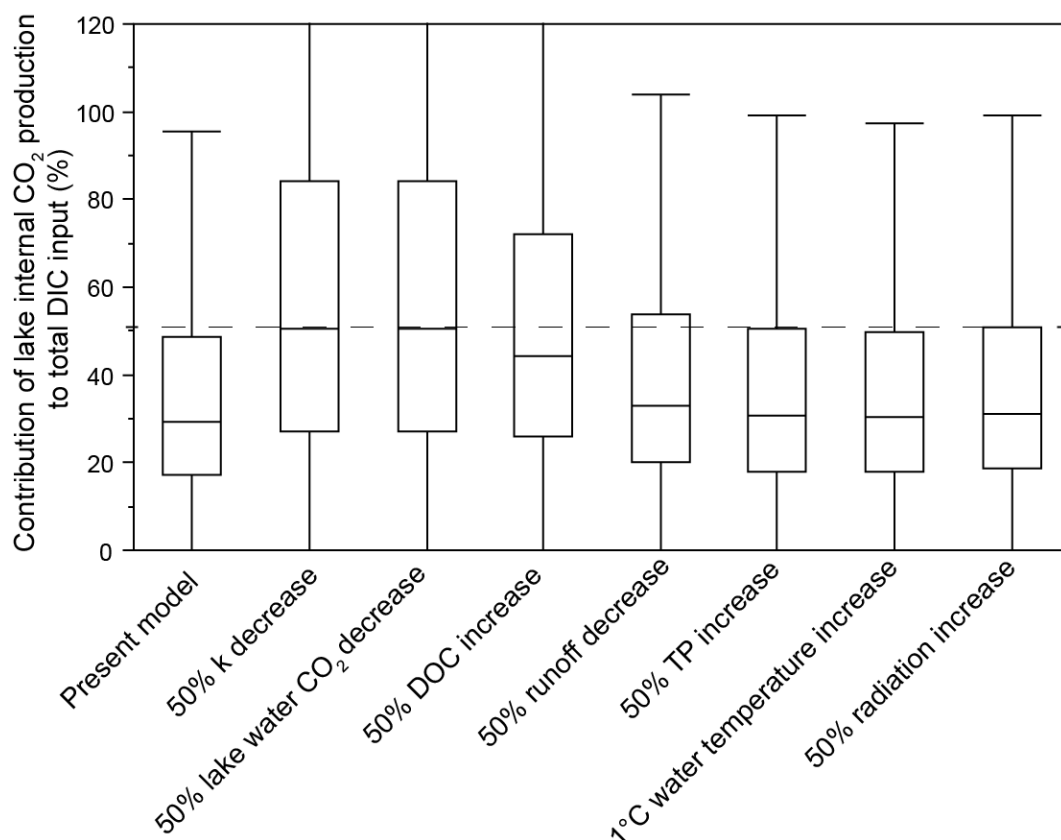
⁵*Sino-Danish Centre for Education and Research (UCAS), Beijing, China*

⁶*Department of Biology, Juiz de Fora Federal University, 36.036-900, Juiz de Fora, Brazil*

Corresponding author: Gesa.Weyhenmeyer@ebc.uu.se



Supplementary Fig. 1. Modelled versus measured CO₂ fluxes in lakes. Using published data on total phosphorus concentrations, water temperatures and dissolved organic carbon concentrations from 16 lakes located in the northern part of Sweden (taken from Jonsson A, Karlsson J, Jansson M. Sources of carbon dioxide supersaturation in clearwater and humic lakes in northern Sweden. *Ecosystems* **6**: 224-235 (2003)) and using a global radiation of 1000 kWh m⁻² yr⁻¹ we estimated the total lake internal CO₂ production using eqs. 3-5 (see Methods) and compared them with measured lake internal CO₂ production (sum of measured benthic respiration and net CO₂ production in the pelagic). Our modelled data correspond well to measured data (data points are close to the 1:1 regression line, in black). In some lakes we underestimated lake internal CO₂ production but these are the lakes with a clear dominance of lake internal CO₂ production for CO₂ emissions (lower panel). Since most of our boreal lakes do not have a dominance of lake internal CO₂ production (lower right panel) our model seems to work reasonably well for the majority of boreal lakes.



Supplementary Fig. 2. Model sensitivity analyses. The sensitivity of the contribution of lake internal CO₂ production to the total input of dissolved inorganic carbon (DIC) assessed for 5118 boreal lakes (present model, see Methods) is examined for changes in the gas transfer velocity (k), CO₂ concentrations in lake waters, dissolved organic carbon concentrations (DOC), runoff, total phosphorus concentrations (TP), water temperatures and global radiation. The model is most sensitive to variations in the gas transfer velocity but a 50% decrease still results in a majority of the 5118 lakes having a source other than lake internal CO₂ production sustaining most of the DIC input. The dashed line indicates a 50% contribution of lake internal production.