# Exploring the nitrogen cycle of Lake Tanganyika from an isotopic perspective

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Lake Tanganyika is the world's second largest freshwater lake by volume and characterized by an anoxic, nutrient rich hypolimnion and an oligotrophic epilimnion. The latitudinal and seasonal changes in upwelling intensities offer the opportunity for studying the effects of vertical mixing on nitrogen cycling. We collected vertical profiles for chemical and bulk isotopic analyses of oxygen, particulate organic matter and nutrient species in lake-wide surveys during two seasons at Lake Tanganyika. Interpreting the profiles with a simplified vertical mixing model indicates that the systematic loss of reactive nitrogen via denitrification and anammox requires substantial nitrogen fixation in the epilimnion to maintain steady state conditions. The $\delta^{15}N$ of the particulate fraction shows a clear vertical zonation of N sources for the phytoplankton community. In the nitrate-free surface 30-50 m, the $\delta^{15}N$ of particulate organic matter varied around 0 ‰, revealing N fixation as the primary N source. The $\delta^{15}N$ of particulate organic matter increased sharply in the underlying nitrate rich zone, resembling the $\delta^{15}N$ of nitrate (~ 2-3 ‰). Thus, assimilation of regenerated nitrate must have been the primary N source in this zone. Anomalies between the $\delta^{15}N$ and $\delta^{18}O$ of nitrate indicate differences in nitrate production pathways via epilimnetic remineralization and nitrification of hypolimnetic ammonium.