



Global baseline data on phosphorus pollution of large lakes

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Lakes are exposed to harmful eutrophication which is the most concerning water quality issue on global scale. Eutrophication is caused by phosphorous pollution in most lakes. Hence, global consistent base line data on phosphorus loadings are needed to assess future sustainable development. We used the modeling framework WaterGAP3 to calculate present total phosphorus loadings to the world's largest lakes. Estimates of modeled total phosphorus (TP) loadings as well as the contributions of different sectors were successfully validated against measured data. Based on these findings, annual total phosphorus loadings to lakes were calculated for diffuse and point sources according to the different sectors domestic, manufacturing, urban surface runoff, agriculture and background for the time period 1990 to 2010. Our results show high phosphorus loadings into lakes in southern latitudes. On global average, industrial fertilizer is the main anthropogenic source while background loadings are low in comparison. Nevertheless, both features indicate a high potential to reduce the exposure to eutrophication in lakes which are faced with high phosphor inputs. The global average of TP loadings was 7% higher in the time period 2005-2010 than in the period 1990-1995. The global average in 2005-2010 results from an increase in TP loadings of 79% in South America, which was dampened by a decrease in Europe, North America, and Asia. Chinese lakes were exposed to massive increasing phosphorus loadings, too. Both increasing and decreasing trends are caused primarily by changing industrial fertilizer application rates. In conclusion, this study provides a consistent and model based synopsis of global trends and sources of phosphorus loadings to large lakes. The estimates of phosphorus pollution of lakes present a basis for assessing and managing the global eutrophication problem.