Appendix A

Nutrient status of Lake Volkerak

To investigate the nutrient conditions for *Microcystis* growth in Lake Volkerak, concentrations of nitrogen and phosphorus in the surface water of station F were measured using standard analytical procedures (Wetzel & Likens 2000).

Both dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) reach very high values in Lake Volkerak. The DIN concentration is lowest in autumn, and rises to a maximum in late winter/early spring (Fig. A.1 A). For comparison, in the same graph we plotted an estimate of the half-saturation constant for nitrogen uptake of *Microcystis* ($K_N = 60\ \mu$ g l^{-1}; Nicklisch & Kohl 1983). This indicates that DIN in Lake Volkerak never reaches values that limit the nitrogen uptake. The SRP concentration is lowest in summer, and reaches maximum values in late autumn/early winter (Fig. A.1 B). In the same graph, we plotted an estimate of the half-saturation constant for phosphorus of *Microcystis* ($K_P = 6\ \mu$g l^{-1}; Holm & Armstrong 1981). This indicates that the SRP concentrations are depleted to limiting values only occasionally in summer.

The concentration of total phosphorus (TP) ranges from 100 to 250 μg l^{-1} P (Fig. A.1 C). Data from Olsen (1989) predict a C:P mass ratio of 43:1 for nutrient replete *Microcystis*. For nutrient replete cells, the mass ratio of C:chl *a* is quite similar, in the order of 40:1 (Kirk 1994). Hence, the P:chl *a* mass ratio of nutrient replete cells is ∼1. The measurements in Lake Volkerak show that the TP concentrations exceed the chlorophyll concentration (i.e., TP:chl $a > 1$), except during late summer when TP:chl $a \approx 1$. This shows that the concentration of total phosphorus in the lake is sufficient to support the dense blooms of *Microcystis* without any severe phosphorus limitation.

The light extinction coefficient in Lake Volkerak varies from 1 m^{-1} to 3.5 m^{-1} (Fig. 5.5 A, Chapter 5). This implies that light is reduced to less than 1% of the surface levels within a few meters depth.

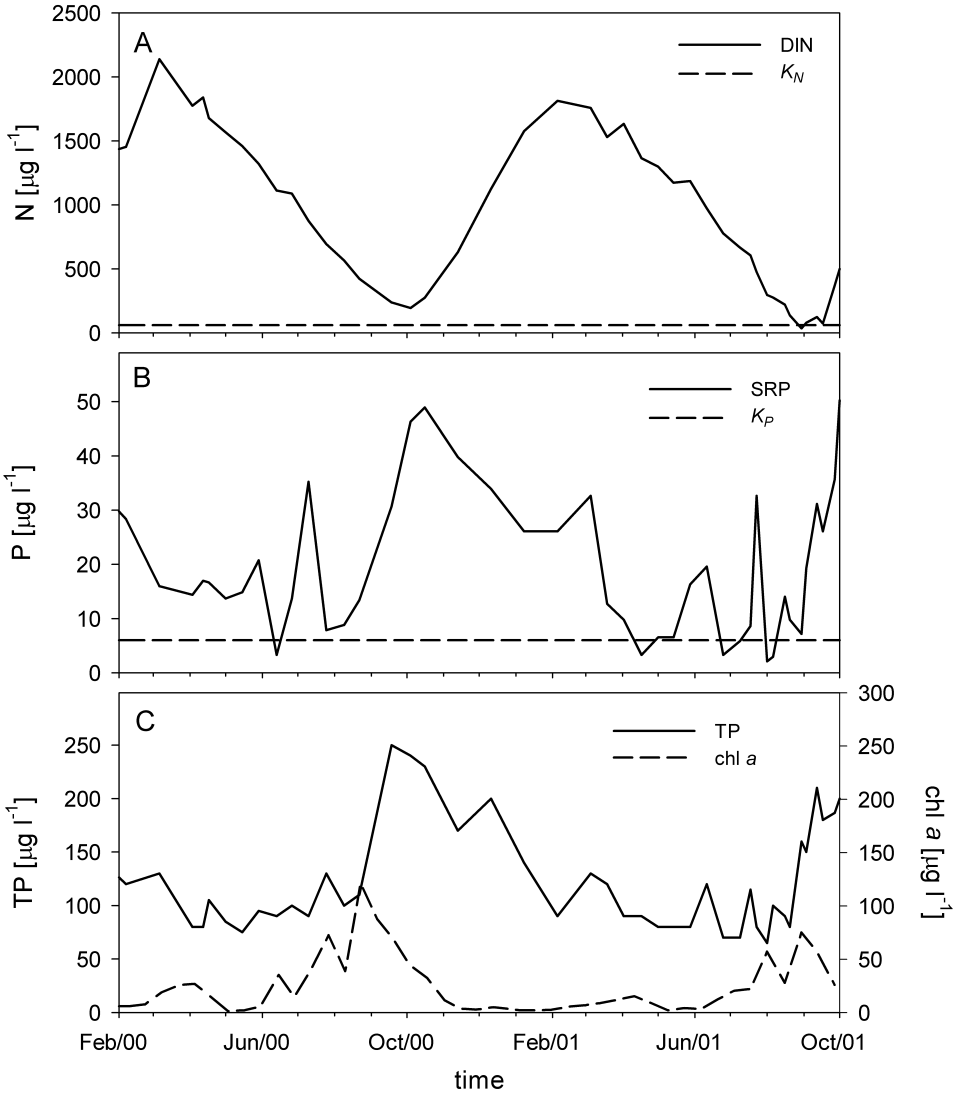

Figure A.1 – Nutrient status of Lake Volkerak in the period February 2000 – October 2001. (A) Dissolved inorganic nitrogen (DIN). For comparison, the half-saturation constant for nitrogen uptake (K_N) of *Microcystis* is also indicated. (B) Soluble reactive phosphorus (SRP). For comparison, the half-saturation constant for phosphorus uptake (K_P) of *Microcystis* is also indicated. (C) Total phosphorus (TP) and chlorophyll *a* concentration.

In conclusion, in comparison to other lakes (Wetzel 2001), Lake Volkerak can be classified as a highly eutrophic but very turbid lake. *Microcystis* growth in Lake Volkerak will be largely governed by the light conditions, while nutrient limitation of *Microcystis* in this lake is most likely negligible.