Abstract:
In contrast to extensive studies of phosphorus, widely considered the main nutrient limiting phytoplankton biomass in freshwater ecosystems, there have been few studies on the role of nitrogen in controlling phytoplankton populations. This situation may be due partly to the complexity in estimating its utilization and bioavailability. In an attempt to provide a novel tool for this purpose, we fused the promoter of the glutamine synthetase-encoding gene, P glnA, from Synechococcus sp. strain PCC7942 to the luxAB luciferase-encoding genes of the bioluminescent bacterium Vibrio harveyi. The resulting construct was introduced into a neutral site on the Synechococcus chromosome to yield the reporter strain GSL. Light emission by this strain was dependent upon ambient nitrogen concentrations. The linear response range of the emitted luminescence was 1 mM to 1_M for the inorganic nitrogen species tested (ammonium, nitrate, and nitrite) and 10- to 50-fold lower for glutamine and urea. When water samples collected from along a depth profile in Lake Kinneret (Israel) were exposed to the reporter strain, the bioluminescence of the reporter strain mirrored the total dissolved nitrogen concentrations determined for the same samples and was shown to be a sensitive indicator of the concentration of bioavailable nitrogen.