

# Assessing phytoplankton lysis in Lake Kinneret

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ABSTRACT: We determined lysis rates of phytoplankton cells in Lake Kinneret and in lake-water microcosms by measuring the activities of particle-associated and dissolved esterases and the decay rate of the latter. Over a 2-yr period from May 2002, dissolved esterase activity (DEA) in epilimnetic lake water, corrected for nonenzymatic hydrolysis of the assay substrate, fluorescein diacetate (FDA) averaged 39 nmol FDA $L^{-1}$ $h^{-1}$, (range 6-120 nmol FDA $L^{-1}$ $h^{-1}$) and particulate esterase activity (PEA) averaged 93 nmol FDA $L^{-1}$ $h^{-1}$ (range 20-244 nmol FDA $L^{-1}$ $h^{-1}$). Algal cell esterase content normalized to chlorophyll (Chl), PEA $Chl^{-1}$, averaged 6.9 nmol FDA (μg Chl)$^{-1}$ $h^{-1}$, range 0.4-18.7 nmol FDA (μg Chl)$^{-1}$ $h^{-1}$. In monoalgal cultures, levels of PEA Chl21 also varied widely both with algal species and growth phase. Most (>90%) of the PEA in the lake was associated with algal cells, thus bacteria, protozoa, and zooplankton were insignificant sources of DEA. Decay rates of DEA in lake water averaged 0.16 (SD ± 0.13) $h^{-1}$ and were much faster than those previously reported for marine waters. Based on these data, calculated phytoplankton lysis rates (LR) in Lake Kinneret averaged 0.91 (SD ± 0.59) $d^{-1}$, with more rapid rates roughly corresponding to seasons of lower Chl concentrations. Because of the high variability in the measured key method parameters (DEA, PEA $Chl^{-1}$, DEA decay rates) and uncertainty of extrapolation to daily values, we prefer to regard these rates of phytoplankton lysis as apparent and suggest that they may be overestimates. Nevertheless, our results indicate a sizable flux of PEA from phytoplankton to DEA in this lake and emphasize the potential importance of phytoplankton cell lysis as a dynamic process for transferring material from the particulate phase of the primary producers to the soluble phase in aquatic environments.

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