

## LIMNETIC HERBIVORY: EFFECTS ON PHYTOPLANKTON POPULATIONS AND PRIMARY PRODUCTION<sup>1</sup>

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*Abstract.* Population-level and ecosystem-level responses of phytoplankton to grazing by zooplankton were determined in nutrient-enriched and unenriched enclosures in Peter Lake, Michigan. Species-specific net growth rates were determined, and chlorophyll *a*, primary production (PPR), and alkaline phosphatase activity (APA) were determined for each of three size categories of phytoplankton: <22  $\mu\text{m}$ , 22–75  $\mu\text{m}$ , >75  $\mu\text{m}$ . Thirteen of 16 dominant algal taxa were nutrient limited. Zooplankton reduced APA, an indicator of nutrient deficiency. Growth rates of grazed, nutrient-limited algae (<30  $\mu\text{m}$ ) increased at low levels of zooplankton biomass, but decreased at higher biomass levels. Growth rates of larger (>30  $\mu\text{m}$ ) nutrient-limited algae increased or did not change as zooplankton biomass increased. These species-specific responses resulted in four- to fivefold changes in chlorophyll concentration and PPR. Overall, the stimulatory effect of nutrient regeneration by zooplankton overrode losses due to grazing, and caused net increases in phytoplankton biomass and productivity.

*Key words:* algal growth rates; alkaline phosphatase activity; grazing; herbivory; Michigan; nutrient cycling; primary production; size-structure; zooplankton.