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RESILIENCE AND RESISTANCE OF A LAKE PHOSPHORUS CYCLE BEFORE AND AFTER FOOD WEB MANIPULATION

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Abstract.—Parameters of a phosphorus cycling model were estimated for two configurations of a lake ecosystem. The piscivore-dominated configuration had one more trophic level than the planktivore-dominated configuration. We derived four main conclusions from analysis of the model. (1) Results support the argument of DeAngelis et al. that turnover rate of a limiting nutrient is directly related to ecosystem resilience. (2) Results support the hypothesis of Pimm and Lawton that longer food chains are less resilient. (3) Inputs of phosphorus to the pelagic system derived from inshore feeding by fishes were a large flux, which is comparable to inputs from physical-chemical fluxes. (4) Algal (seston) standing crops, unlike all other compartments, were less sensitive to phosphorus inputs in the piscivore-dominated system. Consistent with the trophic cascade hypothesis, the piscivore-dominated system had higher herbivore standing crops and lower algal standing crops than the planktivore-dominated system. Changes in trophic structure that derive from trophic cascades can be viewed as changes in the phosphorus cycle driven by fishes.