

Abstract (Document Summary)

Growth and survival in fishes are strongly governed by size-dependent mechanisms. In piscivores, the ontogenetic transition from invertebrate to fish prey is critical to growth. This dissertation describes the effects of size-dependence and prey availability on growth and consumption of juvenile largemouth bass (*Micropterus salmoides*) using whole-lake fish manipulations and individual-based simulations.

The individual-based model simulated the feeding and growth in largemouth bass stocked into Tuesday Lake, a system dominated by small-bodied prey fishes (minnows). The length frequency of bass was strongly skewed after one growing season. The model adequately simulated the observed size distribution of bass at the end of the growing season but did not fully predict rapid growth in the first 40 days after stocking. Prey encounter rates were correlated to the expression of rapid growth and skewness in the length frequency distribution. Growth rate of bass was inversely related to initial minnow length. Variance in the length frequency produced at the end of the first growing season was maximized at intermediate prey-size. Cannibalism was positively correlated to variance in length frequency distribution.

Functional responses of bass to density of fish prey were simulated at daily and seasonal time scales. Daily simulations were done for fixed predator-prey size ratios and fixed capture probability. Seasonal simulations permitted growth and prey depletion to alter the expression of functional responses. Functional responses of bass at the daily scale fit Holling Type II curves with half-saturation densities dependent on probability of capture. Over a growing season, variance in the length frequency of bass increased and survival of bass decreased for increased prey density. Consumption by the bass cohort positively accelerated with prey increases. Growth in larger bass increased but decelerated with increasing prey density.

The bass cohort experienced no detectable mortality in the winter of 1990-1991. The biomass of bass increased dramatically from late May to July of 1991. Minnows were eliminated from the lake by mid-July. Biomass of large-bodied zooplankton increased as minnows declined. The model successfully simulated the minnow decline and shifts in bass diets and growth.

