Ecology, 75(5), 1994, pp. 1265–1281

EFFECTS OF AN OMNIVOROUS CRAYFISH (*ORCONECTES RUSTICUS*) ON A FRESHWATER LITTORAL FOOD WEB[1]

DAVID M. LODGE, MARK W. KERSHNER,[2] AND JANE E. ALOI[3]
Department of Biological Sciences, University of Notre Dame, Notre Dame, Indiana 46556 USA

ALAN P. COVICH[4]
Department of Zoology, University of Oklahoma, Norman, Oklahoma 73019 USA

Abstract. Cascading trophic interactions are important in many freshwater pelagic food webs, but their importance in more complex, omnivore-rich littoral-zone food webs is less well known. We tested the existence of a trophic cascade involving omnivorous crayfish (*Orconectes rusticus*), macroinvertebrates, periphyton, and macrophytes using 9-m^2 cages in the littoral zone of Plum Lake, Wisconsin, USA. Treatments in the replicated (N = 4) experiment were crayfish enclosures, crayfish exclosures, and cageless references. During June–September, we measured macrophyte shoot numbers, macroinvertebrate numbers, and periphyton (on plastic strips) chlorophyll *a*, and dry mass (DM). We expected that crayfish foraging would directly reduce abundance and change species composition of macrophytes and macroinvertebrates and would indirectly enhance periphyton abundance by reducing the abundance of grazing snails.

In enclosures, macrophyte and snail (but not nonsnail macroinvertebrate) densities declined significantly throughout the experiment, whereas densities of macrophytes, snails, and nonsnail macroinvertebrates increased in exclosures and cageless references. Some of the reduction in macrophytes resulted from nonconsumptive fragmentation of macrophytes by crayfish. Consistent with the cascading trophic interactions model, periphyton chlorophyll *a* per unit surface area increased in enclosures, but declined in exclosures. Periphyton quality (as indexed by chlorophyll *a*/DM) also increased in enclosures relative to exclosures and cageless references. However, because of large reductions in macrophyte surface area (which periphyton colonizes) in enclosures, total amount of periphyton chlorophyll *a* in enclosures (relative to exclosures) probably declined while periphyton quantity per unit surface area and periphyton quality increased. Thus, the impacts of crayfish omnivory on periphyton, expressed in two conflicting indirect effects, confirm the possibility that omnivory can complicate cascading trophic predictions. Overall, results support the existence of strong trophic interactions in the littoral zone, in which omnivorous crayfish control abundance of macrophytes, snails, and periphyton.

Key words: benthos; crayfish; littoral zone; macroinvertebrates; macrophytes; omnivory; Orconectes rusticus; *periphyton; snails; trophic cascade.*