REPLACEMENT OF RESIDENT CRAYFISHES BY AN EXOTIC CRAYFISH: THE ROLES OF COMPETITION AND PREDATION

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Abstract. Exotic species are often a threat to native biodiversity. In northern Wisconsin lakes, the invading crayfish Orconectes rusticus is replacing O. virilis, the native, and O. propinquus, a previous invader. We tested the impacts of interspecific competition for food and of nonconsumptive effects of predation by largemouth bass, Micropterus salmoides, on growth and mortality of these three species. In competition experiments, O. virilis grew less, and O. propinquus suffered increased mortality in the presence of O. rusticus relative to single-species treatments. Orconectes rusticus was unaffected by the presence of congeners. In experiments testing nonconsumptive effects of predation, O. virilis growth declined substantially in the presence of largemouth bass, O. rusticus growth declined slightly, and O. propinquus growth was unaffected. Mortality of all three crayfishes increased in the presence of largemouth bass, with O. virilis experiencing the greatest and O. rusticus the least mortality.

To explore how competition, predation, and their interaction influence species replacements, we compared a fitness index (mortality/growth = μ/g) among species across biotic interaction domains: no interaction, intraspecific competition, interspecific competition, predation by fish, fish predation with competition, and predation risk with competition. In three of six domains, O. virilis and O. propinquus had somewhat similar μ/g, but reversals in μ/g rank between O. virilis and O. propinquus among domains occurred. These reversals are consistent with lack of unidirectionality of species replacements observed where O. virilis and O. propinquus distributions overlap. In all four interspecific interaction domains, O. rusticus had the lowest μ/g (indicating greatest fitness), which is consistent with observed unidirectional replacement of O. propinquus and O. virilis by O. rusticus. Whereas some fish management strategies might reverse the replacement of O. virilis by O. propinquus, no realistic interaction domain is likely to reverse replacement of the native species by O. rusticus.

Key words: competition; crayfish; exotic; fitness; growth; invasion; mortality; nonconsumptive effects; Orconectes; predation risk; predation; survival.