Plenary Presentation

Efficacy of Predator Control: Importance of Space, Time, and Predator Diversity

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ABSTRACT: Despite having been used for centuries to protect livestock and manage game populations, lethal predator control remains controversial. Several recent reviews of effects of predator control on prey populations concluded that in most cases predator reduction benefited prey populations (e.g., increased prey survival, abundance, or reproduction). However, each review reported a number of cases in which predator reduction had no discernible impact on monitored prey. We suggest that most predator removal efforts can be considered as a spatially structured harvest with non-harvested areas surrounding the predator removal area. As a result, immigration from non-harvested areas permits rapid recovery of predator populations and can potentially reduce efficacy of removal efforts. We used predator harvest and track-count data collected at the Joseph W. Jones Ecological Research Center to calculate the annual finite rate of population growth (λ) over a 14-year period. Removal data yielded an average $\lambda = 1.33 \pm 0.67$ ($\pm$ SE). Because λ did not differ from 1.0 ($N = 13$, $t = 1.17$, $P = 0.27$), predator removals occurring during 1 year clearly did not result in reduced removals following year. Moreover, during this same period track counts of all mesomammal predators yielded an average $\lambda = 1.06 \pm 0.22$ that also did not differ from 1.0 ($N = 13$, $t = 0.44$, $P = 0.80$), providing further evidence of stable predator populations. We also reviewed 119 published studies to determine if similar predator population growth rates were observed. Of the reviewed studies, 20 contained sufficient information (i.e., at least 2 removal periods and number of removals reported) to calculate estimates of λ. Because these studies often had multiple study sites and removal periods, we were able to calculate 84 λ estimates. The average λ was 1.15 ± 0.14 and did not differ from 1.0 ($N = 84$, $t = 1.15$, $P = 0.25$). Our analyses provide evidence that predators recover quickly following harvest and suggest that adjacent non-harvested areas serve as a source of immigrating predators as would be expected under a spatially-structured harvest model. We argue that efficacy of predator control is increased when the area being managed is large and prey species are temporally vulnerable. We also suggest that predator diversity affects outcome of predator control efforts and predict that predator control is more likely to be effective when there are few predator species due to decreased opportunity for compensatory predation. We postulate that effective predator control becomes increasingly difficult as deviations from these criteria increase, and in some cases these deviations may be responsible for misinterpreting the role of predators on prey populations. Prior studies of effects of predator control on prey populations either did not collect or did not report sufficient data to evaluate our predictions. Future research should report sufficient data to allow evaluation of our criteria. Of particular importance are data concerning efficacy of the removal effort (i.e., what proportion of the predator population was removed).

Key Words: predation management, predator, predator control, predator manipulation, prey, population response

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