

## Temporal variation in wolf predation dynamics in the multi-prey system of northern Yellowstone National Park

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### Abstract

Predation is a fundamental ecological process that shapes ecosystem structure and biodiversity. For large carnivores preying on large ungulates, predation dynamics are influenced by many factors, including climatic conditions, prey abundance, and prey body size. Evaluating the factors that influence how large carnivore predation varies among different-sized prey, both among and within prey species, is critical for understanding how large carnivores influence prey species population dynamics. Here, in the wolf-multi-prey system of northern Yellowstone National Park, we assess how temporal variation in prey abundance and vulnerability affect seasonal wolf predation patterns. More specifically, we characterize wolf predation patterns during four seasons of the year (early winter [mid-November to mid-December], late winter [March], spring [May], summer [June, July]) and evaluate the influence of inter-annual variation in the abundance of the two, primary, year-round ungulate prey (elk [*Cervus elaphus*], bison [*Bison bison*]) from 1995-2015. Our results highlight how the wolf-prey system of northern Yellowstone National Park has shifted from a wolf-elk system to a wolf-elk-bison system. That is, although elk are still the primary prey for wolves, the proportion of wolf kills that are elk has declined over the last twenty years. Now, bison are more commonly preyed on by wolves, and possibly most importantly, are increasingly scavenged. This change has occurred due to the decline in the northern Yellowstone elk population and concurrent increase in the northern Yellowstone bison population. Although wolf predation of bison is minimal and likely has no influence on bison population abundance, increased use of bison by wolves has a potential effect on wolf population abundance, and as a result, elk population abundance. Our results highlight the importance of considering how subsidies provided through preying on and scavenging secondary prey affect predator-primary prey dynamics.