Effects of White-tailed Deer Expansion and Cougar Hunting on Cougar, Deer and Human Interactions

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Introduction

Mule deer (*Odocoileus hemionus*) are declining in many western states and provinces, and the reasons are presently unclear. Within Washington, mule deer have declined, but white-tailed deer (*Odocoileus virginianus*) have increased. For example, white-tailed deer were historically rare in Washington, but now comprise 73 percent of deer in the Selkirk Mountains, 82 percent of deer in Kettle Falls, 56 percent of deer in Republic and, as yet, 0 percent in our Cle Elum study areas.

Cougar (*Puma concolor*) populations appear to have increased in Washington. Confirmed cougar complaints have increased from about 250 per year in 1995 to about 400 per year in 2005. Might these problems (white-tailed deer increase, mule-deer decrease, and increases in cougars and cougar complaints) be related?

To answer this question, we studied cougar, deer and human interactions in four Washington study areas (Selkirk Mountains, Kettle Falls, Republic, Cle Elum) from 1997 to 2007.

Effects of White-tailed Deer Expansion on Cougar Predation of Mule Deer

Selkirk Mountains

We captured and radio-monitored both white-tailed deer and mule deer in the Selkirk Mountains of British Columbia, Idaho and Washington from 1997 to 2000. We estimated deer survival, fecundity and population growth for both species using Leslie matrix models. We also estimated population growth by comparing annual aerial surveys. Our results indicated that cougars were responsible for the majority of deer deaths. Cougar predation rates were 17 percent on mule deer and 9 percent on white-tailed deer. As a result of this disparate predation, white-tailed deer were increasing at 2 percent per year, but mule deer were decreasing at 12 percent per year. Predation rates were directly density dependent (predation increased as deer density increased) for white-tailed deer but inversely density dependent (predation increased as deer density decreased) for mule deer. These results suggested that mule deer were declining because of apparent competition (Robinson et al. 2002), whereby increasing alternate primary prey (white-tailed deer) resulted in increased predators, increased predation and population decline for sympatric secondary prey (mule deer).

Kettle Falls and Republic

We tested the apparent competition hypothesis in two, new, independent study areas (Kettle Falls and Republic) by capturing and radio-monitoring cougars from 2002 to 2004. We determined white-tailed deer and mule deer prey availability by year-round ground counts and annual winter-aerial surveys. We determined prey selection by cougars by comparing deer use (kills) versus availability. Our results indicated that white-tailed deer were much more abundant than mule deer in both study areas; in Kettle Falls, white-tailed deer equaled 82 percent of deer, and, in Republic, white-tailed deer equaled 56 percent of deer. White-tailed deer comprised the primary prey (60 percent of kills) and mule deer the secondary prey (40 percent of kills) in both areas. However, cougars selected for mule deer (observed kills exceeded expected kills based on availability) in both study areas; selection ratios were 1.61 in Kettle Falls and 1.36 in Republic. Cougar selection for mule deer (of disproportionate predation) only occurred during the summer season when white-tailed deer moved into higher

elevation, mule-deer ranges (Cooley et al. 2007). These results again suggested the presence of apparent competition in three of three separate study areas (Selkirk Mountains, Kettle Falls, Republic). Expansion by white-tailed deer into traditional mule-deer ranges appeared to result in increased numbers of cougars, increased cougar predation on mule deer and subsequent population declines for mule deer.

Effects of Cougar Hunting on Cougar-Human and Cougar-Mule Deer Conflicts

Selkirk Mountains

The increased numbers of white-tailed deer and cougars also resulted in increased cougar-human conflicts in the Selkirk Mountains. We tested for the effects of increased hunting of cougars to reduce such conflicts from 1998 to 2003. We captured and radio-monitored 52 cougars during this 5-year period. During that time complaints increased dramatically, suggesting that cougar numbers were increasing as well. We estimated cougar maternity rate (kittens per adult female per year), sex (male, female) and age-specific survival rates, and we entered those vital rates into a dual-sex Leslie matrix model to estimate cougar population growth. Annual survival rates of cougars were extremely low—only 33 percent for adult males and 77 percent for adult females. Contrary to popular belief, the cougar population was not increasing but was declining at about 15 to 20 percent per year. Trends of cougar density corroborated our Leslie matrix results, showing a cougar population decline of about 13 percent per year. There were very, very few adult males left in the population with virtually no males older than 4 years. Harvest statistics also corroborated our results with a peak in cougar harvest during 1998, followed by a steep decline. Increased cougar complaints did not correspond with increased cougar numbers but did appear to correspond with a decrease in the age of cougars in this heavily hunted population (Lambert et al. 2006). Our results suggested that heavy hunting resulted in a decrease in the age of resident cougars and could have resulted in increased cougar-human conflicts because subadults are believed to be the age class responsible for most such conflicts.

Did heavy hunting result in decreased predation on mule deer? Yes! Cougar-predation rates on mule deer in the Selkirk Mountains declined dramatically following the cougar population decline. However, predation on

white-tailed deer declined as well, resulting in a white-tailed deer population increase of more than 30 percent per year (Wielgus, unpublished data 2007). It appears that very heavy hunting of cougars will result in decreased predation on mule deer, but it also results in dramatically increased white-tailed deer population growth and subsequent expansion into traditional mule-deer ranges. The expected long-term implications of a 30-percent increase per year in white-tailed deer numbers is troubling for mule deer due to resource competition, disease and, perhaps, genetic introgression. You can't win for losing!

Kettle Falls

Were our results in the Selkirk Mountains a fluke? A one-off? A bad analysis? How could increased cougar hunting with a younger age structure possibly result in increased human-cougar conflicts? Was our reduction in age hypothesis a plausible answer? We tested for effects of heavy hunting in a separate study area in Kettle Falls by radio-monitoring 34 cougars from 2002 to 2006. That area also saw an increase in cougar complaints attributed to increased numbers of cougars. We estimated cougar population growth by estimating the vital rates (fecundity, age and sex-specific survival) and by entering them into a dual-sex Leslie matrix. We also compared the Leslie matrix stable-age distribution (estimated from the vital rates) to the observed standing age distribution to test for deviations in age class. For example, were there more subadult males than expected?

Similar to the Selkirk Mountains, our Leslie matrix results indicated a population decline of about 10 percent per year, contrary to the increased number of cougar complaints. The female component of the population was declining; however, the standing-age distribution and observed growth rates showed a male population increase of about 10 percent per year. Overall (both sexes) the population was stable, but the numbers and proportions of young males were increasing. We estimated a cougar immigration rate (observed growth rate minus expected growth rate) of about 15 percent per year. Heavy hunting did not reduce the overall numbers of cougars but simply shifted the sex and age structure to younger immigrant males (Robinson et al. 2007). Now we were two for two (Selkirk Mountains and Kettle Falls); heavy hunting appeared to coincide with increased, not decreased, cougar-human conflicts, perhaps, because of increased numbers or proportions of subadult immigrant males. What happens in

an area without white-tailed-deer expansion and very little cougar hunting (e.g., where prey densities are lower and lack of hunting or killing resident cougars discourages immigration)?

Cle Elum

The Cle Elum study area has not yet been exploited by white-tailed deer. Cougar complaints are few and far between, and cougar hunting is very low compared to our other study areas. We captured and radio-monitored over 33 cougars from 2002 to 2006. Similar to Selkirk Mountains, Kettle Falls and Republic, we estimated fecundity and sex and age-specific survival and entered these vital rates into a dual sex Leslie matrix to estimate expected population growth. We also estimated the standing age distribution and observed growth rate by documenting sex, age and number of cougars in the study area. Our preliminary data indicate that survival rates were much higher than in the Selkirk Mountains and Kettle Falls. The survival and fecundity growth rate appears to be about 10 percent per year and the observed growth rate to be about 0 percent per year (stable). Emigration rate is estimated at about 10 percent per year. Both the stable and standing age distributions show a much older population than in the Selkirk Mountains and Kettle Falls (Wielgus et al., unpublished data 2007). There were no problems here with declining mule deer or with increasing cougar complaints.

Conclusions

Our results suggest that increased numbers of white-tailed deer results in an increased number of cougars. The increased number of cougars results in increased cougar predation on mule deer and possibly increased cougar complaints. The increased cougar complaints result in increased cougar hunting. Increased cougar hunting results in increased subadult male immigrants. Increased immigrants results in increased cougar complaints. Repeat. . .until such time as the female component of the cougar population collapses and cougars are functionally extirpated. At that time, the white-tailed deer population really explodes. Mule deer are then susceptible to further decline due to resource competition or genetic introgression.

We recommend experimental reductions of invading white-tailed deer to forestall such a scenario.

Reference List

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