OREGON DEPARTMENT OF FISH AND WILDLIFE
SUMMARY OF COUGAR POPULATION MODEL AND EFFECTS OF LETHAL CONTROL

ODFW is authorized to reduce human-cougar conflict, livestock depredation, and benefit native ungulate populations through the use of lethal removal of cougars in localized areas (hereafter, target area). Target areas are typically conducted on the scale of a Wildlife Management Unit (WMU; ~ 1,000 – 2,500 km^2), and reductions of cougar populations typically occur for 3 consecutive years with a goal of increasing adult female mortality to 40-45% of total cougar mortality, which should result in a 50-60% decline in the population. Since the implementation of the Oregon Cougar Management Plan in 2006, ODFW has completed 3 target areas in northeast Oregon to benefit declining elk populations. The effect of intensive, lethal management actions on the viability of local cougar populations is not well understood. Furthermore, it is unknown how quickly cougar populations recover to previous densities, and recovery times will influence the longevity of the effect of cougar removals, if any, on ungulate populations.

To address these concerns, vital rate estimates obtained in Oregon or other western states were used to parameterize a Leslie projection matrix to estimate population growth rates of cougars in northeast Oregon when hunting cougars with dogs was illegal. Under current management regulations without intensive lethal control, researchers found that a simulated cougar population increased at a mean rate of 17% per year, but ranged from approximately 0 – 36% annually (Figure 1). Based on harvest information, cougar populations in northeast Oregon have likely stabilized and are currently limited by available prey. The excess cougars produced in northeast Oregon likely disperse, which indicated that the cougar population was serving as a source to surrounding areas. To create a cougar population with a growth rate of 1.0 (i.e. stationary population), the mean annual survival rates of both sexes and all age classes of cougars could be reduced an additional 12% compared to current survival estimates.

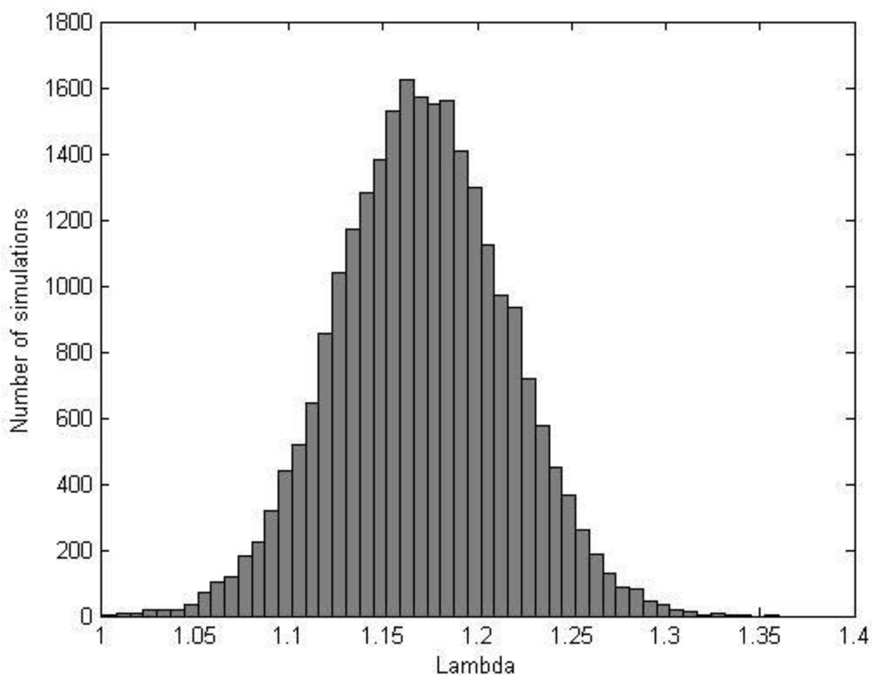

Figure 1. Distribution of annual population growth rates of cougars for 5,000 simulations of population growth over 5 years for a cougar population in northeast Oregon, that was subjected to hunting but dogs were not allowed as hunt method.

After addressing issues associated with conducting scat surveys on a large spatial scale, the potential exists to develop a statewide sampling scheme to estimate cougar densities. SCR models can be modified to incorporate the effects of habitat, prey density, or any other relevant landscape features on cougar densities. Developing a statewide sampling scheme where sampling areas are placed in a variety of habitats, with a mixture of prey populations will allow us to directly test for effects of these variables on cougar density. This approach would allow ODFW to develop a predictive map of cougar densities across the state. After any potential relationships between cougar density and landscape variables have been developed, integrated population models could be developed that could incorporate estimates of cougar density, demographic rates, and harvest rates to predict population dynamics of cougars over time.

ODFW researchers conducted a second set of simulations to determine the percentage of a local cougar population that needed to be removed annually to achieve a 50% population reduction over 3 years within a localized area (e.g., a Wildlife Management Unit). Immigration from surrounding Wildlife Management Units, where target areas are not occurring, could influence the level of lethal control required to reduce the population and the time it takes the population to recover. Consequently, movement was incorporated in and out of the target area in the simulation to assess the effects of lethal control on local cougar populations. The level of immigration was varied from none (i.e., geographically closed), low, and high across simulations. Results showed that 28 and 48% of the population would need to be removed annually to achieve a 50% population reduction after 3 years assuming a closed population and a population subjected to maximum immigration rates, respectively (Figure 2). To maintain the starting population size, between 13 and 27% of the population would need to be removed annually, if the population was geographically closed or received a high number of immigrants, respectively. Researchers also determined that a hypothetical cougar population would return to the pre-removal population size in 2 – 6 years assuming the population would receive a maximum number of immigrants or the population was geographically closed, respectively (Figure 3).

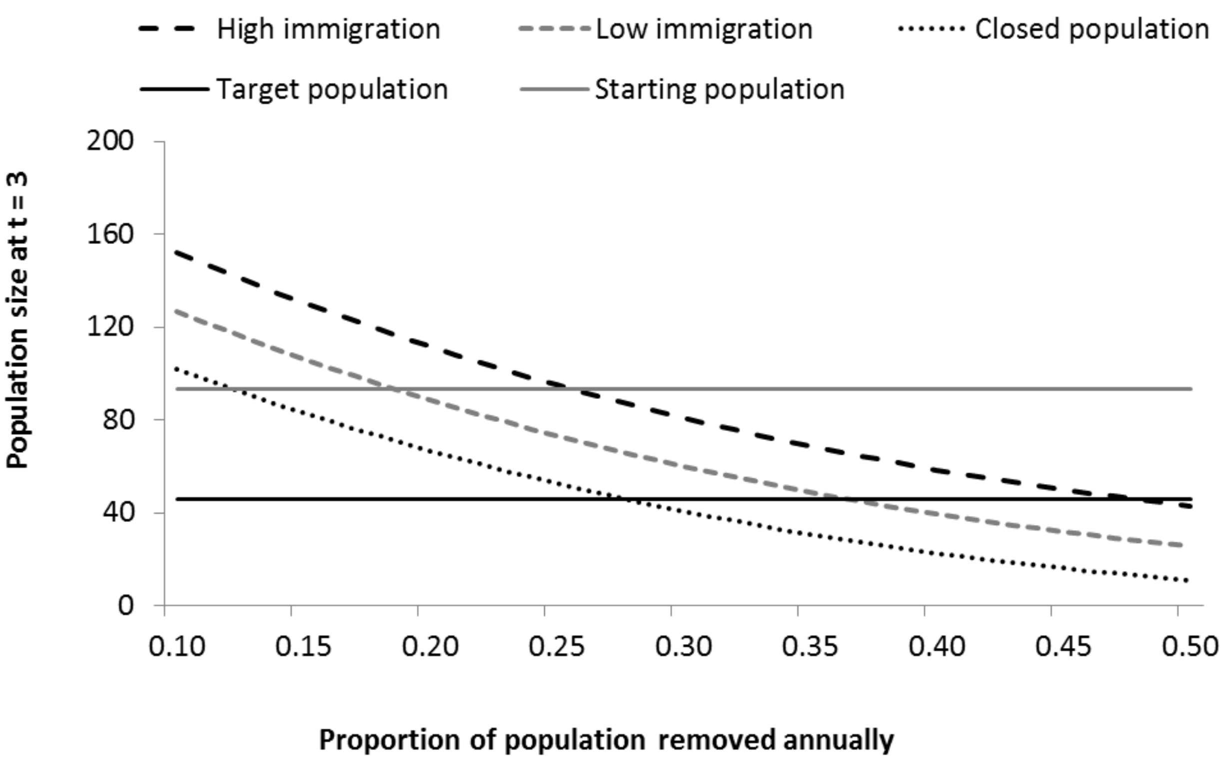

Figure 2. The estimated size of a hypothetical cougar population in northeast Oregon during the third year of lethal control efforts. Three separate simulations were conducted where it was assumed the population was geographically closed or subjected to a minimum or maximum level of immigration. Estimates were generated using a deterministic Leslie matrix where the proportion of the population removed annually was allowed to vary between 0.10 and 0.50. All simulations had a starting population of 93 individuals and estimated populations sizes represent the mean population size after 3 years of removals. Population sizes that were greater than the starting population size by year 3 had increased since implementation of control efforts because lethal control was not sufficient to reduce population size. Horizontal lines represent the starting (93 individuals) and desired (46 individuals) population size after a 50% population reduction.

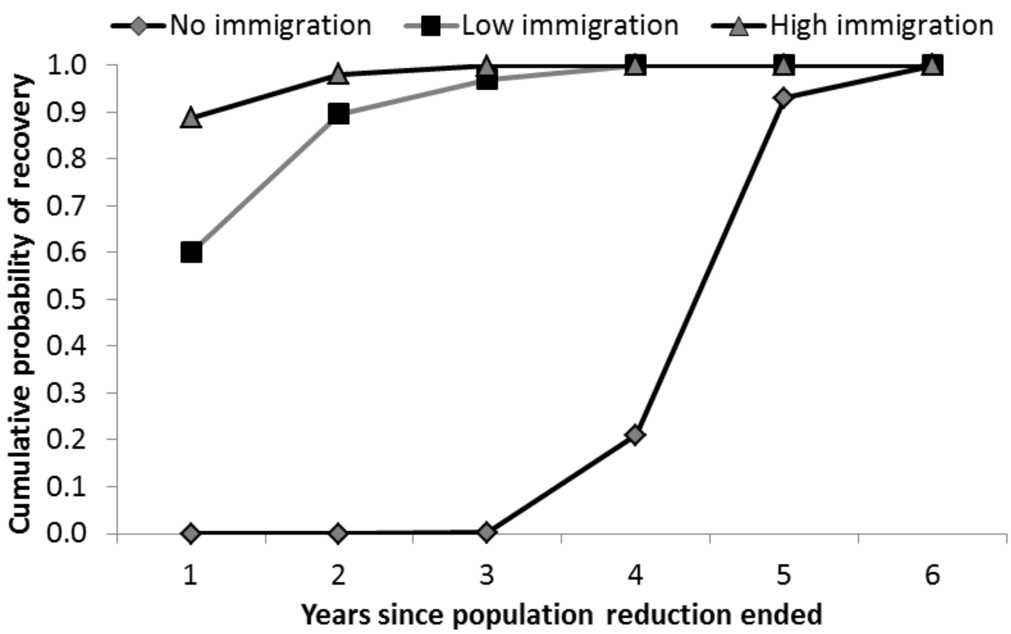

Figure 3. Mean cumulative distribution functions of recovery times of a hypothetical cougar population in northeast Oregon. Cumulative probabilities represent the proportion of simulated populations that recovered from a 50% population reduction in each year following cessation of lethal control actions. Three separate simulations were conducted where it was assumed the population was geographically closed or subjected to a minimum or maximum level of immigration.

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Summary of Key Findings

All results generated from this exercise were developed from population simulations and have not yet been validated with field data collected from target areas. Until results of this model are validated with field data, this model should be viewed as an exploratory exercise to provide a framework for implementing target areas. The ideal approach to determine the effect of intensive lethal control on cougar populations would be through direct monitoring of cougar population dynamics before, during, and after lethal control efforts. Until the simulations models are validated with monitoring data, all results should be viewed in a cautionary light.

The ODFW simulation results indicated cougar populations are capable of high rates of growth attributable to high survival rates and reproductive rates. Simulation results indicated that current management practices (i.e., hunting cougars without the use of dogs) are an ineffective method to manipulate cougar population size. Cougar populations in northeast Oregon have likely stabilized and are likely limited by available prey resources. Excess cougars produced in northeast Oregon likely disperse, allowing the northeast Oregon cougar population to serve as a source population for surrounding areas. Restoration of the ability to hunt cougars with dogs would allow managers to more effectively manage cougar populations by manipulating hunter numbers and harvest quotas to affect population growth and meet management objectives. This would also allow more flexible management of prey populations by allowing effective manipulation of cougar populations to benefit ungulates.

The ODFW simulation results indicated cougar populations are highly resilient to lethal control and substantial efforts are required to reduce a local population particularly when immigration occurs. Local managers should carefully monitor lethal control to ensure efforts are sufficient to meet the objectives of removal and also not excessive where the viability of the local population is threatened. Where intensive control of cougars is used to benefit ungulate populations, the intensity of control should be reduced and control efforts terminated once population objectives for ungulates have been obtained. Simulation results indicated that intensive localized reductions of cougar populations will not negatively affect long-term population viability so long as cougar populations are not reduced by more than 50%. Increasing the spatial scale (i.e., larger than a WMU) may reduce the effort required to reduce cougar populations at a localized scale because *in situ* reproduction and number of immigrants would be reduced. However, the analysis did not explicitly model the effect of varying spatial scales on cougar population dynamics.

<u>For a full description of methods and model results please refer to:</u>

Clark, D. A. 2014. Population growth rates and simulated responses of cougar populations to density reduction under variable immigration and emigration. Pages 96-137 in D. A. Clark, author. Implications of cougar prey selection and demography on population dynamics of elk in northeast Oregon. Dissertation. Oregon State University, Corvallis, OR.
http://www.dfw.state.or.us/wildlife/research/docs/ClarkDarrenA2014.pdf