

Success of the Colorado Division of Wildlife's lynx reintroduction program

Background

In 1997, the Colorado Division of Wildlife undertook what was to become one of North America's most high-profile carnivore reintroductions to date. The goal of DOW's lynx reintroduction program was to establish a self-sustaining lynx population within Colorado, where biologists felt quality lynx habitat still existed. The observations and lessons from this program – the latest in a long line of successful DOW reintroductions – may be helpful in planning future carnivore reintroductions such as wolverines in Colorado and elsewhere.

Benchmarks for “success”

To evaluate the near-term success of lynx reintroduction efforts, the DOW established a set of benchmarks for tracking the progress towards Colorado's lynx population becoming self-sustaining:^{1,5-7}

- ✓ reintroduced lynx demonstrate a high rate of survival in the critical first months after release;
- ✓ released adult lynx demonstrate low mortality rates over the longer term, particularly in good habitat;
- ✓ lynx remain in good habitat at densities sufficient for breeding;
- ✓ reintroduced lynx successfully reproduce;
- ✓ lynx born in Colorado survive and also successfully reproduce (“recruitment”); and
- ✓ on balance, lynx recruitment equals or exceeds mortality over an extended period of time.

Reintroduced lynx have been monitored by the DOW for over a decade to track the population's progress toward reaching these benchmarks. As of summer 2010, all of the DOW's benchmarks for successful lynx reintroduction have now been met. The details and highlights follow.

Defining a core area & optimizing release protocols

The DOW's strategy for lynx reintroduction was to first release a number of lynx within a “core reintroduction area” in southwestern Colorado that biologists regarded as the best potential lynx habitat available in the state.¹ Biologists hoped that over time lynx would not only remain in this area long enough to survive and reproduce, but also disperse on their own into other tracts of suitable habitat throughout the state.

To this end, DOW biologists began releasing lynx back into southern Colorado in 1999 (Fig. 1). During 1999–2006, a total of 218 wild-caught lynx from Canada and Alaska were released in this core area.

The DOW monitored lynx after their release and used these early observations to refine protocols to improve the initial survival of translocated individuals.^{2,3,5,6} Biologists quickly discovered that holding lynx in captivity for several weeks after their arrival dramatically improved their monthly survival rate over the first year after their release from about 80 percent for lynx held only seven days to over 97 percent for lynx held over 45 days before release.² The release protocol ultimately adopted by DOW biologists called for holding lynx in captivity and feeding them a high quality diet for at least three weeks before release, which was timed to coincide with annual snow melt in late March or April. Using this protocol, lynx were released in good body condition and enjoyed high initial post-release survival.

Long-term survival & habitat fidelity of lynx in Colorado

Two important benchmarks for the success of Colorado's lynx reintroduction attempt were for adult lynx to establish home ranges that provided sufficient prey and to remain in habitat suitable to facilitate breeding. As expected, survival was lowest in the first

month after lynx were released but improved thereafter.² Over the first 10 years of reintroductions and monitoring, lynx that remained in the core release area had somewhat higher annual survival than those leaving the core area (about 93 percent vs. 82 percent, respectively).² As some lynx ended up in completely unsuitable habitat, this finding was not altogether surprising (Fig. 1). Vehicle collisions, gunshot, starvation, and disease were the most common sources of mortality for reintroduced lynx, although in many cases a cause of death could not be determined.^{2,7}

In addition to estimating adult lynx survival, monitoring showed that lynx moved out of and back into the core reintroduction area with nearly equal frequency from month to month for the first year after release. This meant that most of the released lynx remained in or near the core reintroduction area, helping ensure animal densities sufficient for breeding to occur when conditions were right. These data on survival and dispersal helped DOW biologists understand the factors influencing the reintroduced lynx population in Colorado, and also may be useful to other agencies planning lynx reintroductions elsewhere. Overall, the relatively high survival rates of adult lynx in suitable habitats throughout Colorado provided a solid foundation for establishing a self-sustaining lynx population.^{2,3,7}

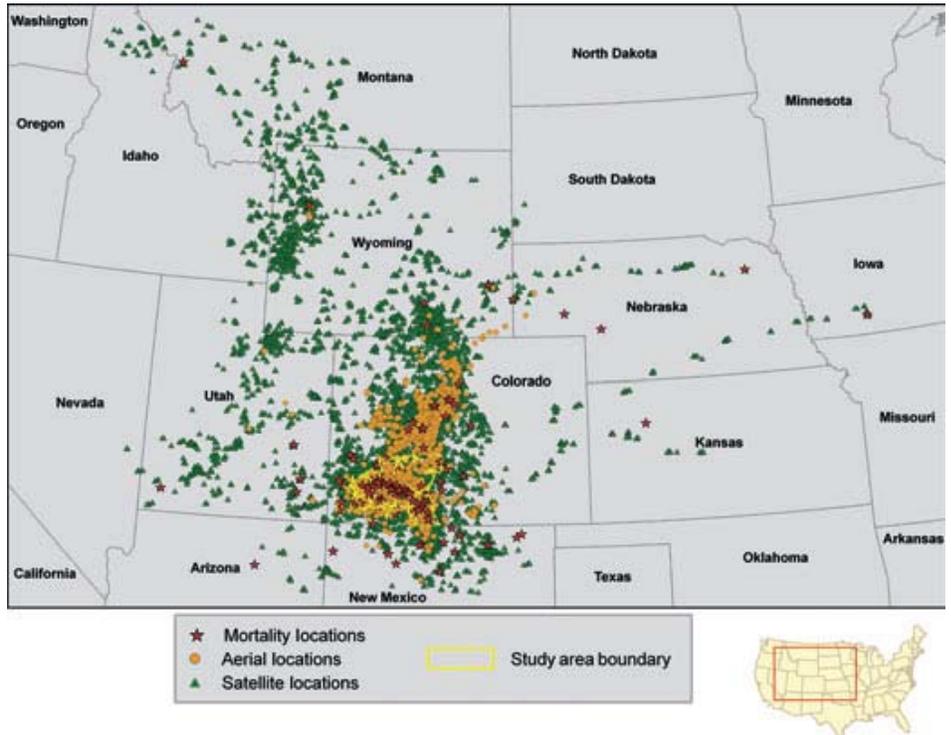


Figure 1. Map outlining the core reintroduction and main monitoring area, and showing locations obtained by either satellite or aerial radio telemetry for the 218 Canada lynx reintroduced into Colorado from February 1999 to November 2007. Figure reproduced from Devineau *et al.* (2010).

Reproduction & recruitment among Colorado's lynx

Biologists regarded reproduction and recruitment as the keys to Colorado's lynx population becoming self-sustaining. DOW researchers first documented litters among reintroduced lynx in the spring of 2003, and reproduction also was documented in 2004, 2005 and 2006 (Fig. 2)⁷. In 2006, a Colorado-born female that gave birth to two kittens represented the first documented recruitment of Colorado-born lynx into the breeding population. Litter sizes have averaged 2–2.8 per female.⁷ As of 2010, the breeding population included a number of Colorado-born male and female lynx that have established territories and now produce litters.

Observations of lynx reproduction in Colorado has thus far demonstrated a pattern of several years of higher reproductive success followed by several years of lower reproductive followed by an apparent return to better years.⁷ Variation in prey abundance is one potential explanation for this pattern. Fluctuating reproduction has occurred among Colorado lynx in both the core reintroduction area and outside the reintroduction area (Fig. 2). Whether the pattern of variable reproduction among Colorado's lynx repeats as predictably as the classic Canadian lynx-snowshoe hare cycle⁴ remains to be determined.

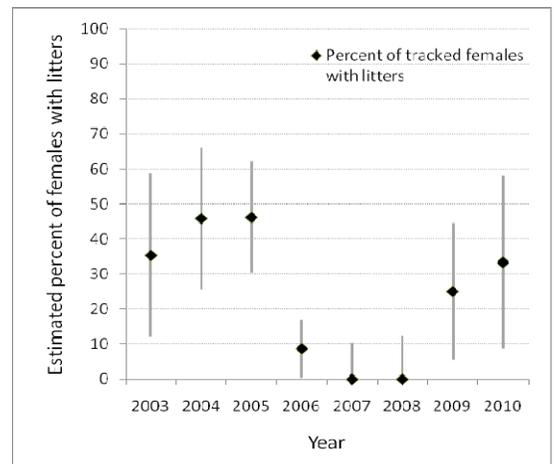


Figure 2. Percent of tracked female Canada lynx with kittens in Colorado in May or June from 2003 through 2010. Bars are 95% confidence intervals.

Status & forecasted trends for Colorado's lynx population

Today, Colorado's lynx population includes surviving reintroduced adults, lynx born to reintroduced animals, the offspring of first- and perhaps second-generation, native-born lynx, and possibly some naturally occurring lynx that were here before DOW's reintroduction program began. In order for Colorado's lynx population to remain self-sustaining, enough kittens need to be born and survive to breeding age to at least offset and preferably exceed the annual losses which inevitably occur among adult lynx. Based on patterns observed to date for lynx residing in Colorado's core reintroduction area, DOW biologists and researchers predict that the lynx population in the core area should be able to sustain itself at existing densities into the foreseeable future with no further augmentation, assuming the patterns of annual reproduction and survival observed to date repeat themselves during the next 20 or more years.⁷

Synopsis & looking to the future for Colorado's lynx population

Based on the results from reintroduction and monitoring efforts to date, Colorado's lynx reintroduction has successfully achieved the program's original goals and benchmarks. The release protocols developed by DOW biologists and researchers afforded reintroduced lynx a good chance of survival during the critical first year after their release. Data collected during a decade of monitoring by DOW demonstrates that individual lynx can survive long-term in at least some parts of Colorado. Reintroduced lynx have for the most part remained in good habitat, have engaged in breeding behavior and have produced kittens that were recruited into the Colorado breeding population. Estimated rates and trends in survival and recruitment seen over the first decade after reintroduction began – if sustained over the coming decades – should be sufficient to maintain a lynx population of some reasonable size in Colorado in at least the core reintroduction area without the need for additional augmentation.

Although the results thus far are encouraging, no one knows to what extent Colorado will still be a good home for lynx in the more distant future. Changes in land use, forestation, and climate all will likely play a role in shaping the future of lynx in Colorado and elsewhere. One challenge facing the DOW is how to most effectively track long-term trends in lynx occurrence and distribution in Colorado. Accurately estimating the actual number of lynx in Colorado has been and will continue to be problematic because the habits and habitats of lynx do not lend themselves to inventory via established methods for wildlife population estimation. Instead, DOW biologists and researchers are currently working to develop reliable ways of estimating habitat occupancy and lynx distribution as indices of occurrence, and to strike a proper balance between monitoring the persistence of lynx within the core reintroduction area and lynx that may be pioneering and expanding into other portions of the state.

Acknowledgements

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