The Canadian Field-Naturalist

Gray Wolf (*Canis lupus*) recolonization failure: a Minnesota case study

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Mech, L.D., F. Isbell, J. Krueger, and J. Hart. 2019. Gray Wolf (*Canis lupus*) recolonization failure: a Minnesota case study. Canadian Field-Naturalist 133(1): 60–65. https://doi.org/10.22621/cfn.v133i1.2078

Abstract

During the past few decades, Gray Wolves (*Canis lupus*) have recolonized many areas in the United States and Europe. In many other cases, however, although dispersing wolves reached areas with adequate prey, a population failed to recolonize. Herein, we provide a case study detailing how a wolf pack attempted for three years to recolonize an area 55 km from a long-established population and within 25 km of Minneapolis and St. Paul, Minnesota, but failed. The pack produced three litters of pups and at one time included 11–19 members, but it preyed on livestock and dogs and, consequently, was lethally removed. The history of this pack's attempt to recolonize an area long devoid of wolves exemplifies the issues that have prevented earlier recolonizations in non-wild lands in Minnesota and elsewhere and that promise to do so well into the future.

Key words: *Canis lupus*; depredation; distribution; Gray Wolf; livestock; recolonization

Introduction

During the past several decades, Gray Wolves (*Canis lupus*) have been recolonizing many areas of the world (Boitani 2003; Chapron *et al.* 2014; Mech 2017). In the contiguous United States, they have recolonized Wisconsin, Michigan, the northwestern USA, and new areas of Minnesota, and are dispersing into adjacent states (Mech 2017). Biologically, wolves are prolific and can survive anywhere with sufficient food. Because they can subsist not only on prey but also on carrion and even garbage, the only constraints on where they recolonize are anthropogenic factors, including vehicle strikes, legal harvest, illegal killing (including poisoning), and legal livestock-depredation control.

Humans persecuted wolves throughout much of their original range; thus, those that survived lived primarily in wilderness or areas with low human density. That gave some biologists the impression that wilderness was required for their survival, and early models to predict potential wolf habitat in the Upper Midwest made that assumption (Mladenoff *et al.* 1995, 1999, 2006), although it was later challenged (Mech 2006a,b). Eventually the models were refined (Mladenoff *et al.* 2009) to reflect the fact that wolves do not require wilderness (Mech 2015). However, to survive and repopulate a new location for multiple generations, wolves do need to avoid areas and behaviours that bring them into conflict with human activities (Erb and Don Carlos 2009; Mech 2017).

In Minnesota, wolves have been expanding their range from a wilderness reservoir in the northeastern part of the state. Since the early 1970s, they have been gradually recolonizing westward and southward toward semi-wilderness, agricultural areas, and a major metropolitan area (Fuller *et al.* 1992; Erb and Don Carlos 2009; Erb *et al.* 2017). As their numbers and distribution have increased, so have depredations of livestock and the number of wolves killed for livestock-depredation control (Mech 1998; Harper *et al.* 2005; Ruid *et al.* 2009). By 1997–1998, the annually estimated Minnesota wolf population of 2445–2856 had reached the extent of its current distribution (Figure 1) and has since failed to further recolonize the state (Berg and Benson 1999; Erb *et al.* 2017).

Individual maturing male and female wolves have dispersed far and wide from their northern Minnesota reservoir to all parts of the state and have entered nearby states including Wisconsin, Michigan, South Dakota, and North Dakota (Fritts and Mech 1981; Gese and Mech 1991; Merrill and Mech 2000). To recolonize a new area, unrelated males and females

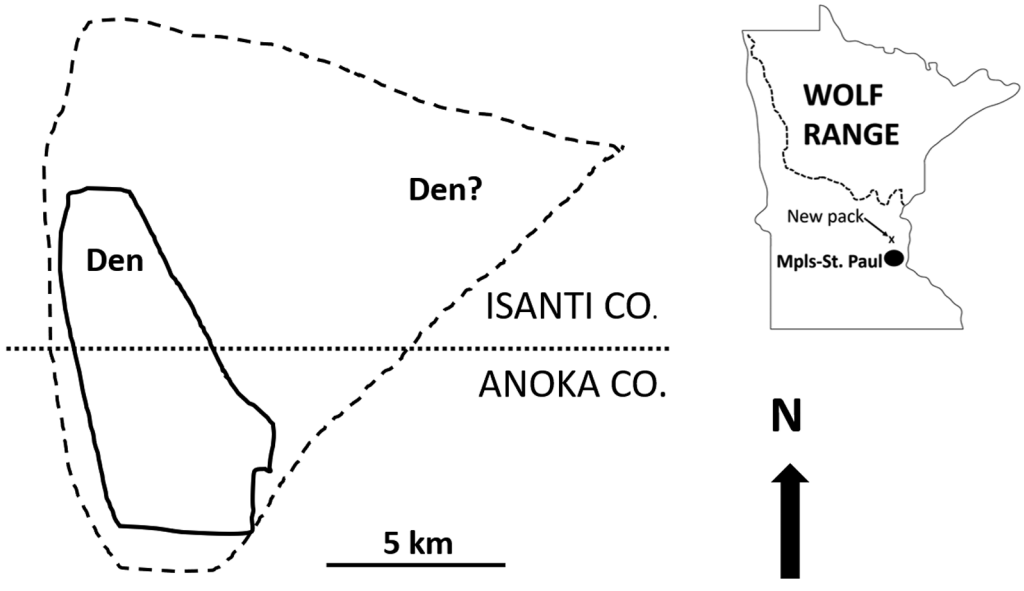

FIGURE 1. Study area where the Isanti Gray Wolf (*Canis lupus*) pack attempted to recolonize. Dashed line connects outermost locations where wolf signs were found and represents the minimum area the pack used from 2014 through 2017. Solid line represents approximate boundary of the Cedar Creek Ecosystem Science Reserve.

must find each other in a suitable location, establish a territory there, pair bond, produce pups, and survive for several years. If pets or livestock are available locally, resident wolves often begin preying on them. Such depredations decrease human tolerance of wolves (Williams *et al.* 2002; Karlsson and Sjostrom 2007; Olson *et al.* 2015), and state and/or federal wolf depredation control agencies often lethally remove them or translocate them depending on applicable laws. Thus, wolves are only able to recolonize areas with low human presence.

In Minnesota, wolves have attempted to recolonize and establish a breeding population southward ~25 km north of the Minneapolis–St. Paul suburbs, at about 45°43′N (Erb and Don Carlos 2009; Erb *et al.* 2017). During 1997, a pack or pair was recorded about 45 km west of there near the Sherburne National Wildlife Refuge (Berg and Benson 1999), but by 2004 that pack no longer existed for reasons unknown (Erb and Benson 2004). In 2010–2011, a new pack survived for two years about 25 km south of the current wolf range, but two adults, a yearling, and four pups were then lethally removed for depredation control.

In 2014, a new pack (the Isanti pack) formed 55 km south-southeast of the current wolf range, and within 25 km of the Minneapolis–St. Paul suburbs in an area with 0–10% chance of wolf recolonization according to the latest wolf habitat models, which consider road density and agriculture (Mladenoff *et al.* 2009). This article details the 3-year attempt by wolves to recolonize that area.

Study Area

The study area (at about 45°27′N, 93°08′W) comprises ~80 km^2 in northern Anoka and southern Isanti counties in east-central Minnesota (Figure 1). Most of the area is rural residential and agricultural, interspersed with patches of uninhabited lowland and woodlots, the largest being the University of Minnesota Cedar Creek Ecosystem Science Reserve (CCESR) covering about 21 km^2. Roughly 50–60% of the study area is open agricultural fields, and the area is heavily roaded; the most remote location in the area is 1.54 km from the nearest road. Much of the known territory of the Isanti pack fell in Athens township, which had a 2016 population density of 24 people/km^2 (Towncharts 2018) and Linwood township with a density of 62 people/km^2 (calculated from the township area of 84.992 km^2 and the 2016 total population of 5284; American Factfinder 2019). Estimated pre-fawning White-tailed Deer (*Odocoileus virginianus*) density for this area of the state in 2016 was 8.5 deer/km^2 (D'Angelo *et al.* 2016), and Wild Turkeys (*Meleagris gallopavo*) were common. Small herds of cattle are widely scattered throughout the study area. Some 9452 cattle, including calves, occupied Isanti County (1157 km^2) in 2012 (USDA 2012). Domestic dogs are common, and some are free-ranging.

Methods and Results

The first record of wolves having bred in the study area was a trail camera photo of three and possibly four adult-sized wolves during winter 2014–2015. Although a pair of wolves can form at any time, a pair with at least one other adult-sized wolf in winter would almost certainly indicate that the pair had established a territory and produced at least one pup, most likely in the previous spring (Mech and Boitani 2003). There was also a report of a Coyote (*Canis latrans*) trapper catching a wolf in the area in winter 2014–2015.

During summer 2015, wolves denned on the CCESR within 1.4 km of an occupied residence and produced at least eight pups that were observed and photographed several times. Throughout summer, researchers associated with the reserve frequented areas within 100 m of the den multiple times a week during the course of their previously established research. During autumn 2015, nine wolves were seen twice on CCESR property and, in November 2015, 11 (which could indicate that nine pups were produced). In mid-January 2016, a Coyote trapper captured and released a wolf from a snare just outside the CCESR.

In mid-winter 2015–2016, L.D.M. drove the roads throughout the study area and found several places where, between 1 January and 6 February 2016, up to eight wolves had crossed. The greatest distance between locations where wolf tracks, or in one case wolf fur on a barbed-wire fence, were found was 14 km, with the centre of that area being 5.5 km from the 2015 den (Figure 1). By calculating the area enclosed by all the locations where such wolf sign was found, we estimated that the minimum area used by this wolf pack was 80 km^2.

From August 2015 to April 2016, within the area covered by these wolves, three cattle were killed and one wounded, and three dogs were killed by wolves (Table 1). Thus, in April 2016, Wildlife Services, the federal government's depredation control agency (Ruid *et al.* 2009), lethally removed three male wolves, weighing 35, 42, and 47 kg.

Trail cameras on the CCESR continued to record wolf presence throughout summer 2016. In June, wolves killed a 91-kg calf, and Wildlife Services lethally removed a 36-kg male wolf, a 27-kg yearling female, and a 32-kg breeding female from the study area; sign of additional adult wolves remained. Four pups were captured alive during depredation control in late June and released on site according to United States Fish and Wildlife Service requirements that all young of the year be released before 2 August when wolves are protected by the *Endangered Species Act* as they were in 2016. One pup was dead in a snare so could not be released.

Local residents had reported seeing up to eight pups nearby before this. Because the 2015 den at the CCESR was unused in 2016, and trail cameras on CCESR failed to indicate concentrated wolf use of the CCESR, the 2016 den was very likely off CCESR property. Based on where the five pups were caught in late June 2016, on reports of local residents, and on the nearest remote area, we judged that the 2016 den was about 10 km east-northeast of the 2015 den.

During autumn 2016, trail camera photos indicated that at least one wolf still used the study area, and, in May 2017, wolves killed another calf in the same area as the 2016 depredations; Wildlife Services lethally removed a 32-kg male wolf and a 26-kg, non-breeding female. Since 2015, all but one complaint of wolves attacking livestock or dogs in this area were verified by authorities. As of February 2019, CCESR trail cameras have recorded only a single wolf.

Table 1. Estimated numbers of Gray Wolves (*Canis lupus*), verified complaints, and numbers of wolves removed by year for the Isanti pack, Minnesota.

	2014	2015	2016	2017
Estimated number of wolves in Isanti pack				
Adults/yearlings	2	3	11	3
Pups	≥1	8	8	0
Total	≥3	11	19*	3
Number of verified complaints				
Dog complaints	0	2	1	0
Livestock complaints	0	1	2	1
Total	0	3	3	1
Number of wolves removed				
Adults/yearlings	0	0	6	2
Pups	0	0	1	0
Total	0	0	7†	2

*Assumes eight pups were born in early April before three adults were lethally removed later in that month.
†In addition to the seven wolves removed, four wolf pups were captured and released on site according to United States Fish and Wildlife Service guidelines because they were caught before 2 August.

Discussion

Although wolves have recolonized much of the northern half of Minnesota as well as many areas of Wisconsin and Michigan over the last few decades, they have failed to recolonize many other adjacent areas with adequate natural prey. These latter areas are those with considerable populations of people and domestic animals. However, it is not for lack of trying (Mech 2017).

This case history illustrates the details of how and when wolves begin to establish in areas with livestock and dogs, they may begin treating these domestic animals as natural prey. This usually happens soon after the wolves start reproducing, especially when a third age class is present. Domestic animals are easy targets because they can nearly always be found in the same place, unlike most natural prey, which require hunting down. The increase in domestic animal depredations with the presence of a third age class or a larger pack (Bradley *et al*. 2015) may result from reduced natural local food resources and more dependent wolves to feed.

Regions similar to our study area were predicted to have probabilities of wolf recolonization of 0–10% (Mladenoff *et al.* 1995, 1999, 2006), and our findings explain why. Wolves can and do inhabit these areas (Mech 2006a,b) but tend to persist longer in wilderness and wild lands where they conflict much less with human interests (Mech 2017). Given the great variation in land use across large areas, gradients of wolf-recolonization suitability exist; thus, along the frontiers of established wolf populations, wolves will continue to attempt to expand into areas with higher predicted probabilities of recolonization, with varied results.

The large body masses of the wolves captured in this study area showed that their lack of success in recolonization and their predation on domestic prey were not because they were desperate for food. All the wolves caught were in excellent condition. Four of the eight were above average for wolves feeding on all-natural prey (Mech 2006c), including the 47-kg male that weighed more than all but two of 873 captures of Minnesota wolves on a natural-prey diet (L.D.M. and S.B. Barber-Meyer unpubl. data).

Despite living among people and livestock close to the suburbs of Minneapolis and St. Paul, the Isanti wolf pack was able to use small areas away from humans to den and raise their young and, in that way, persist for at least three years. Like so many other wolf attempts to recolonize similar areas of Minnesota and other states, this one nevertheless failed because of the conflict that often results from wolves living close to areas with high densities of people, livestock, and pets. Wolf survival in the long term requires large areas of extensive wild lands (Young and Goldman 1944; Mech 1970, 2017; Ruid *et al*. 2009). This case study details why.

Author Contributions

Writing – Original Draft: L.D.M.; Writing – Review & Editing: L.D.M., F.I., J.K., and J.H.; Conceptualization: L.D.M. and F.I.; Investigation: L.D.M., F.I., J.K., and J.H.; Methodology: L.D.M., F.I., J.K., and J.H.; Formal Analysis: L.D.M.; Funding Acquisition: L.D.M. and F.I.

Acknowledgements

Funding for this project was provided by the United States Geological Survey (USGS), the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources, and the United States Department of Agriculture Wildlife Services. We thank Larry Hogie for cooperating with the study, S.B. Barber-Meyer of the USGS for use of unpublished data, and Quinn Harrison, University of Minnesota, for critiquing an earlier draft and offering helpful suggestions for improving it.

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Received 13 April 2018
Accepted 19 February 2019