

MINNESOTA WOLF POPULATION UPDATE 2026

John Erb and Carolin Humpal, Forest Wildlife Populations and Research Group

INTRODUCTION

Since the late 1970's, Minnesota has monitored its statewide wolf population using an approach that combines attributes of territory mapping with an *ad hoc* approach to determine the total area of the state occupied by wolf packs. The methods employed have changed only slightly during this time. Initially, surveys were conducted at approximately 10-year intervals (1978, 1988, 1997), thereafter at approximately 5-year intervals (2003, 2007, 2012). Results indicated a geographically and numerically expanding population through the 1997-98 survey, with little geographic expansion from 1998 to 2007 (Erb and DonCarlos 2009). These results were generally consistent with separate wolf population trend indicators (annual scent station survey, winter track survey, and number of verified depredations) in Minnesota.

In 2012, wolves in the Western Great Lakes Distinct Population Segment were removed as a listed species under the federal Endangered Species Act. The delisting coincided with the normally scheduled (every 5th year) wolf survey as well as survey timeline specifications in the 2001 Minnesota Wolf Management Plan (i.e., first and fifth year after delisting; Minnesota Department of Natural Resources 2001). The 2012-13 survey (Erb and Sampson 2013) concluded that overall wolf range had expanded along its south and west edge, but with only minor change in the total amount of land occupied by wolf packs; similar patterns were found 5 and 12 years later as part of the winter 2017-18 and 2024-25 surveys (Erb et al. 2018, Erb and Humpal 2025).

After federal de-listing in 2012, wolf harvest seasons were established, and population abundance surveys became annual. In the first three years after de-listing (i.e., when wolf hunting and trapping seasons occurred), post-harvest wolf population point estimates varied from approximately 2,200 to 2,400 (Erb et al. 2014). In December 2014, following the third consecutive wolf harvest season, a court ruling returned wolves in Minnesota to the list of federally threatened species. Since that time, wolf surveys have continued on an annual basis. Herein we provide an update of population status from the 2025-26 winter survey.

METHODS

The methodology used to estimate wolf population size in Minnesota utilizes three primary pieces of information: 1) an estimate of the total area of land occupied by wolf packs; 2) an estimate of average wolf pack territory size; and 3) an estimate of average mid-winter pack size. It is likely that pack-occupied range changes on a comparatively slow timescale compared to fluctuations in average territory and pack size. As such, pack-occupied range is estimated at approximately 5-year intervals, with the last being during winter 2024-25. Results from that survey were believed to be biased low resulting from reduced snow tracking opportunity and effort (Erb and Humpal 2025), leading to increased uncertainty on whether the winter 2017-18 (73,972 km²; Erb et al. 2018) or 2024-25 (67,464 km²; Erb and Humpal 2025) pack-occupied range estimate provides a more accurate representation for winter 2025-26. Hence, for comparison we provide population estimates for this winter using both estimates of pack-occupied range.

To track pack movements, we and various collaborators captured wolves using foothold traps (LPC # 4, LPC #4 EZ Grip, or LPC #7 EZ Grip) approved as part of research conducted under the Association of Fish and Wildlife Agencies Best Management Practices for trapping program. Some wolves are

also captured with the use of live-restraining neck snares (Gese et al. 2019), and occasionally by helicopter dart-gun. Wolves were typically immobilized using a mixture of either Ketamine:Xylazine or Telazol:Xylazine. After various project-specific wolf samples and measurements were obtained, an antagonist (Yohimbine or Atipamezole) and an antibiotic (if warranted) are typically administered prior to release. Various models of tracking collars were deployed depending on study area and collar availability. Most GPS collars were programmed to take a minimum of 3-6 locations per day, and any wolves fitted with VHF-only collars (or those that fail to transmit to satellite) are relocated at approximately 7- to 10-day intervals throughout the year, or in some cases, primarily from early winter through spring.

For consistency with previous surveys, estimation of average territory size is based on territories of collared packs delineated using minimum convex polygons (MCP). Prior to delineating wolf pack territories, we remove 'outlier' locations using the following guidelines, though subjective deviations are made in some cases as deemed biologically and methodologically appropriate: 1) for wolves with approximately weekly VHF locations only, locations > 5 km from other locations are generally excluded as extraterritorial forays (Fuller 1989); 2) for GPS collars that provided temporally fine-scale movement information, we removed obvious movement paths if the animal did not travel to that area on multiple occasions and if use of the path would have resulted in inclusion of obviously unused areas in the MCP; and 3) for consistency with the way in which the data is used (i.e., to estimate number of packs), locations that result in notable overlap with adjacent territories are removed.

In past surveys where all or the majority of territories were delineated using comparatively few VHF locations, raw territory sizes were increased 37% to account for the average amount of interstitial space between delineated wolf pack territories, as estimated from several Minnesota studies (Fuller et al. 1992:50) where the number of VHF locations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior but can also be an artifact of territory underestimation when there are fewer locations. Hence, for packs with < 100 locations ($n = 1$ with 77 locations), we multiplied the estimated territory size by 1.37 as in the past. For packs with > 100 locations ($n = 37$; mean number of locations = 3,553), territories were assumed to be fully delineated and not re-scaled.

To estimate average mid-winter pack size, collared wolves were repeatedly located via aircraft during winter to obtain visual counts of pack size. In cases where visual observations were limited, we also rely on any estimates of pack size based on tracks observed in the snow and trail camera images from within the pack's territory. If any reported count produced uncertain estimates (e.g., 4 to 5 wolves), we used the lower estimate. Overall, counts are assumed to represent minimum known mid-winter pack size.

The estimated number of packs within occupied wolf range is computed by dividing the area of pack-occupied range by average scaled territory size. The estimated number of packs is then multiplied by average mid-winter pack size to produce an estimate of pack-associated wolves, which is then divided by 0.85 to account for an estimated 15% lone wolves in the population (Fuller et al. 1992:46, Fuller et al. 2003:170, also see data in Gable et al. 2025). Specifically,

$$N = ((\text{km}^2 \text{ of occupied range} / \text{mean scaled territory size}) * \text{mean pack size}) / 0.85.$$

Using the accelerated bias-corrected method (Manly 1997), the population size confidence interval (90%) was generated from 9,999 bootstrapped re-samples of the pack and territory size data and does not incorporate uncertainty in estimates of occupied range or percent lone wolves. For purposes of discussion, we base our informal assessments of significant differences in results across years on visual comparison of the degree of confidence interval overlap (Cumming and Finch 2005).

RESULTS AND DISCUSSION

Pack and Territory Size

We obtained sufficient location data on 38 packs (Figure 1) that were monitored during all or part of the survey period (April 2024 to April 2025). Both territory and winter pack size data were available from 23 of the marked wolf packs. Fifteen additional wolf packs had adequate location data to delineate territories, but we were unable to obtain a reliable mid-winter pack count. In addition, we used reliable pack count data for 10 packs on which we did not have a collared wolf to delineate a territory.

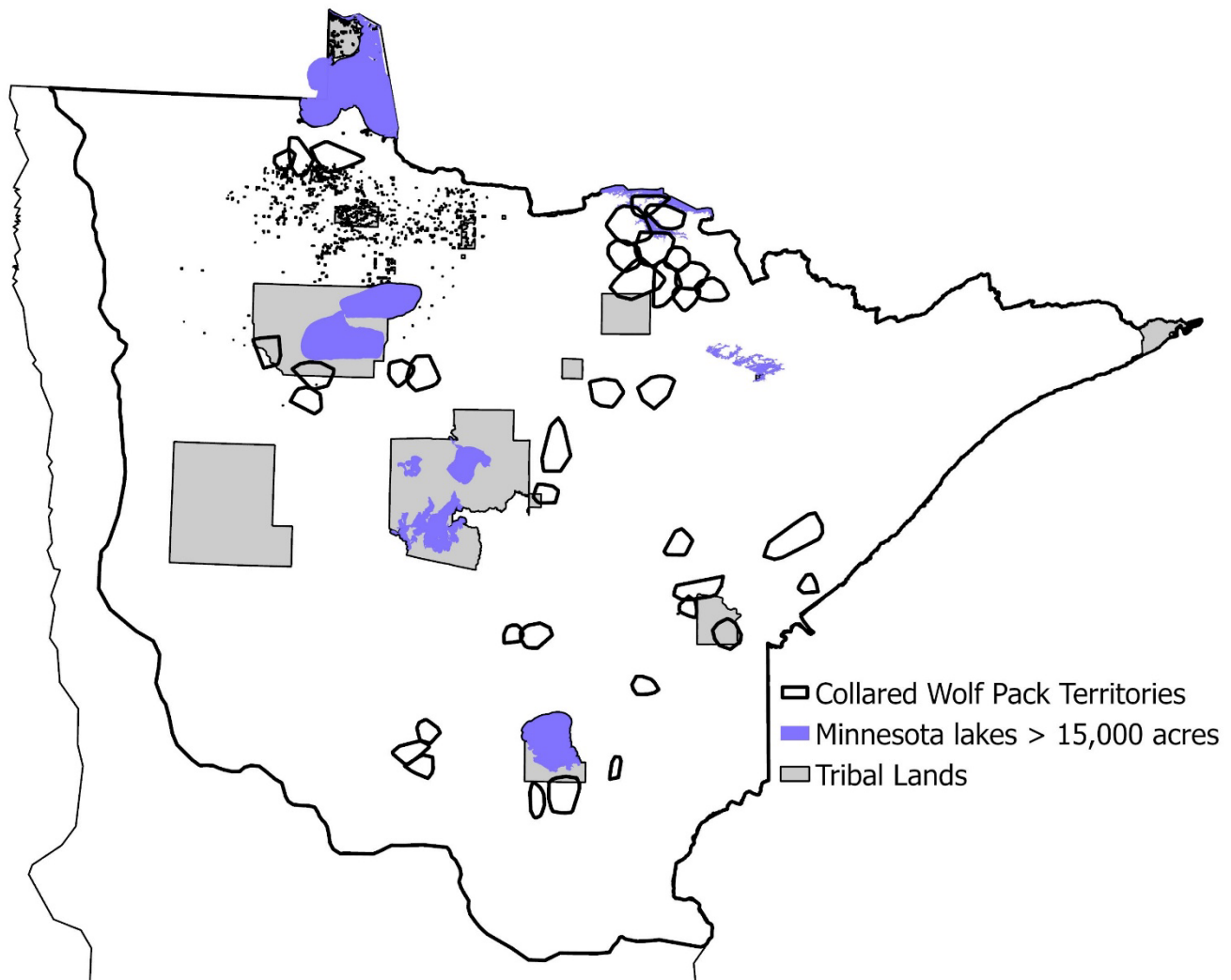


Figure 1. Location of territories for marked wolf packs during the 2025-26 survey.

A land cover comparison using the 2019 National Land Cover Database suggests that land cover in territories of collared packs reasonably reflected habitat in overall pack-occupied wolf range, with the largest percentage differences being slight underrepresentation from evergreen forest and slight overrepresentation from deciduous forest (Table 1).

Table 1. Comparison of land cover^a in territories of radio-collared wolf packs with land cover in all pack-occupied wolf range in Minnesota.

Land Cover Category	Overall Occupied Wolf range	Radio-collared Wolf Territories
	% Area	% Area
Woody Wetlands	38.2	37.7
Deciduous Forest	17.5	22.0
Emergent Herbaceous Wetlands	10.9	9.0
Mixed Forest	11.3	13.2
Evergreen Forest	5.3	3.6
Open Water	4.8	4.3
Shrub/Scrub	1.8	2.4
Pasture/Hay/Grassland/Crops	7.8	5.7
Developed, All	2.3	2.1

^a Land cover data derived from the 2019 National Land Cover Database

Although some point estimates of average territory size over the past 7 years had been the lowest yet recorded, the current and previous year’s point estimates were near the best-fit long-term trend line (Figure 2). Average estimated territory size for radio-marked packs during the 2025-26 survey was 146.3 km² (range = 41 – 317 km²).

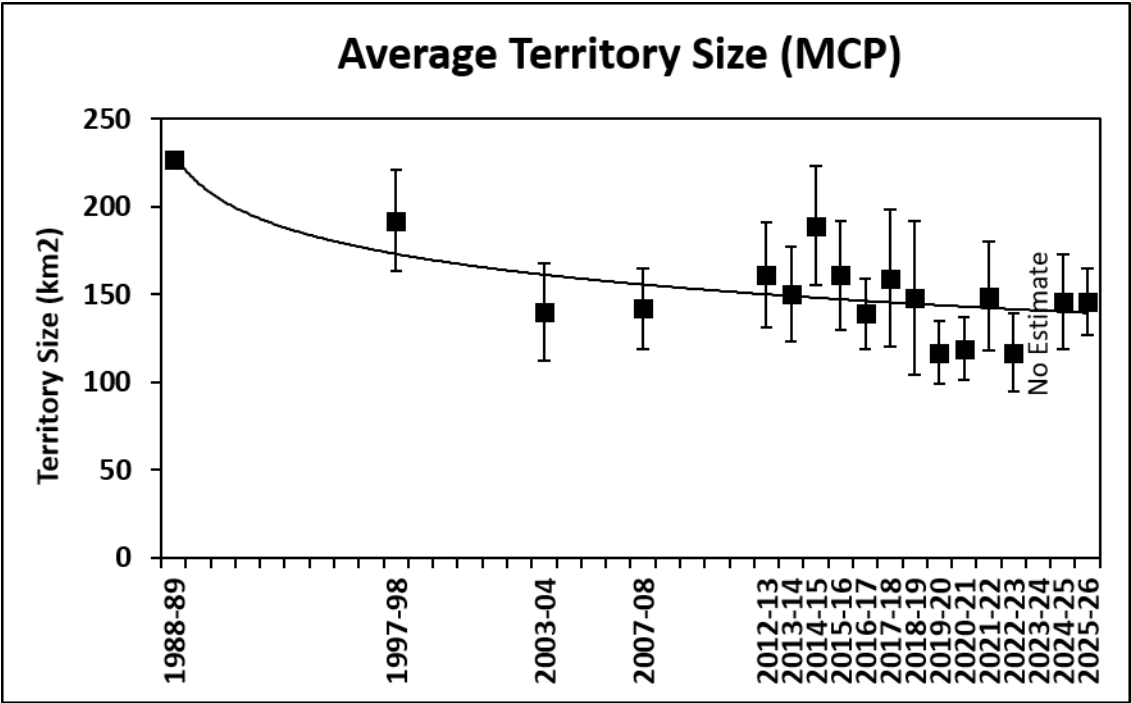


Figure 2. Average scaled territory size for marked wolf packs in Minnesota from winter 1988-89 to 2025-26.

Estimated average pack size was also near the best-fit long-term trend line (Figure 3); average winter pack size in 2025-26 was estimated to be 4.48 (pack size range = 2 – 8). Though previous data (2020-2022) had suggested the population had become composed of more but smaller packs, the most recent data suggests a return to fewer but larger packs, though parameter confidence intervals typically overlap.

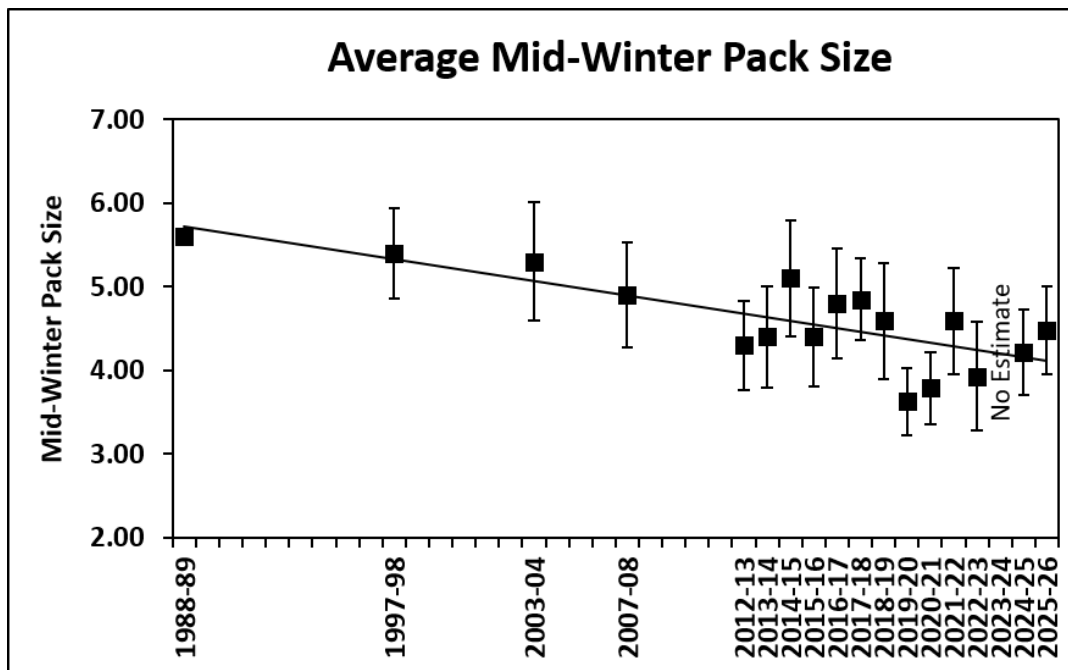


Figure 3. Average mid-winter pack size for marked wolf packs in Minnesota from winter 1988-89 to 2025-26.

Wolf Abundance

Using the average territory size of $\sim 146 \text{ km}^2$ and the 2025 occupied range estimate (67,464 km^2 , which we believe to be biased low; Erb and Humpal 2025), we estimate a total of 461 wolf packs in Minnesota during winter 2025-26 (Figure 4). For comparison, using the 2018 estimate of pack-occupied range, the current estimated number of packs would be 506. Although also influenced by the estimated amount of pack-occupied range, trends in the estimated number of packs are inversely correlated with trends in estimated territory size (i.e., for a given amount of occupied range, increases in average territory size yield lower estimates of the number of packs within the state).

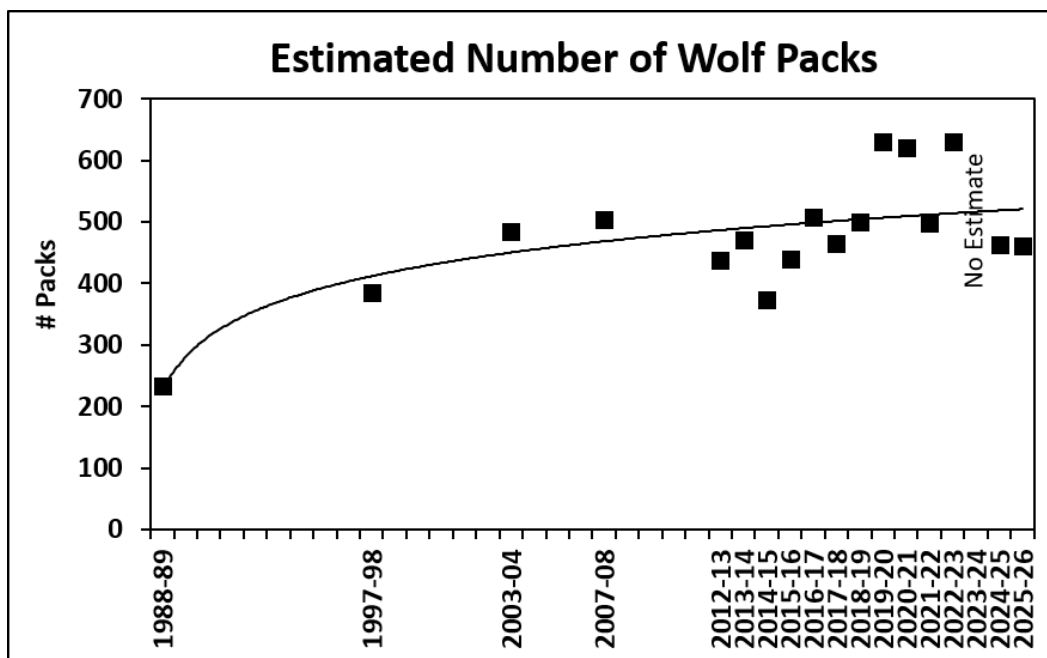


Figure 4. Estimated number of wolf packs in Minnesota at periodic intervals from winter 1988-89 to 2025-26.

After accounting for the assumed 15% lone wolves in the population and using the 2025 estimate of pack-occupied range, we estimate the 2025-26 mid-winter wolf population to be 2,431 wolves, or 3.6 wolves per 100 km² of occupied range (Figure 5). The 90% confidence interval was approximately +/- 425 wolves, specifically 2,028 to 2,884. For comparison, use of the 2018 estimate for pack-occupied range yields a current population estimate of 2,665 wolves. In either case, the degree of confidence interval overlap suggests the statewide population has not significantly changed in recent years.

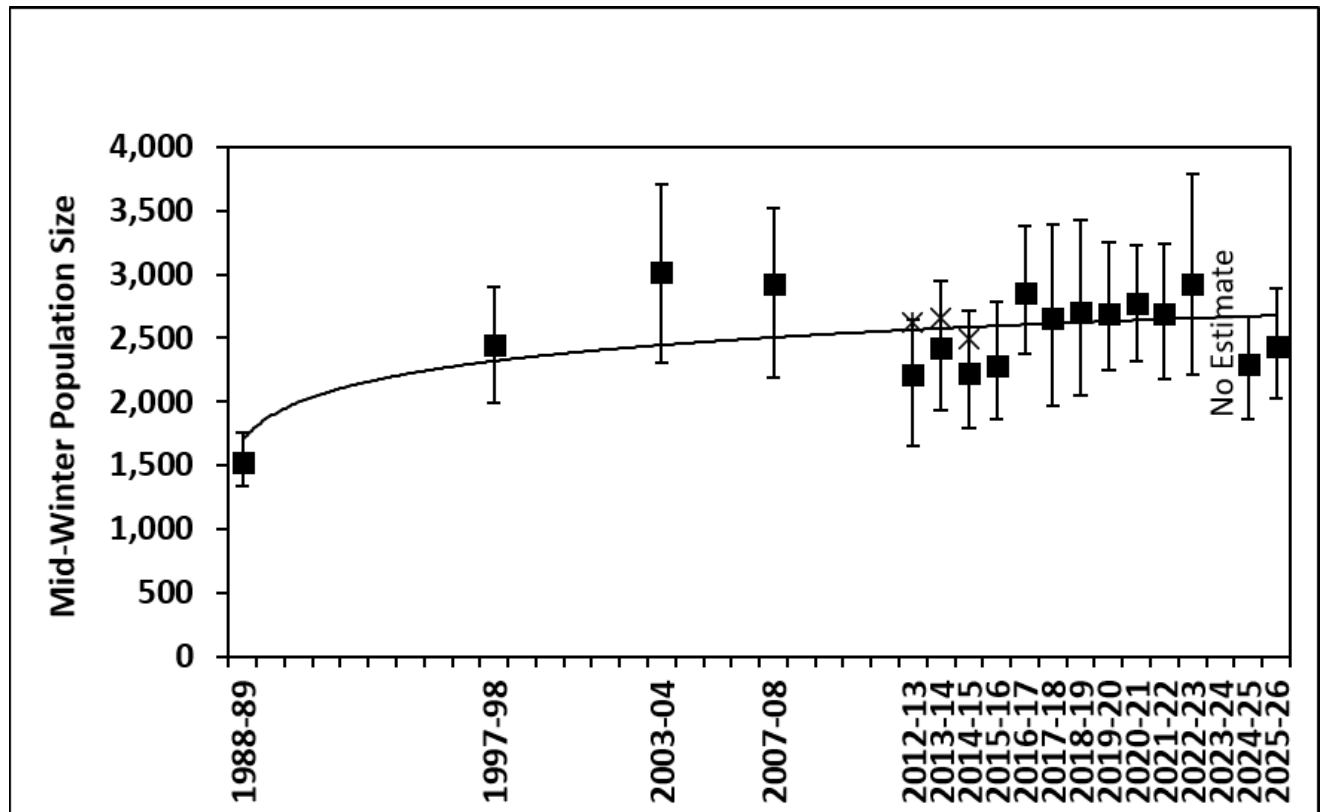


Figure 5. Wolf population estimates from periodic standardized surveys in Minnesota from winter 1988-89 to 2025-26. "X" on the graph for 2012-2014 represents a pre-harvest population estimate.

ACKNOWLEDGEMENTS

We thank the staff with USDA-Wildlife Services and John Hart (Custom Wildlife Capture and Consulting, LLC) for assistance with wolf capture and radio-collaring. We are grateful for the critical contributions of MNDNR pilots during wolf telemetry and pack counts. We thank numerous collaborators for assistance or sharing of radio-telemetry data utilized in this survey, including Joseph Bump, Tom Gable, and Austin Homkes (Voyageurs Wolf Project), Jay Huseby and Dave Price (Red Lake Band of Chippewa), Mike Schrage, Terry Perrault, John Goodreau, Eli Goodreau, Shaun Himango, Jeff Reynolds, Makenzie Henk, Bonnie Newman, and Liam Petra (Fond du Lac Resource Management Division), Morgan Swingen and Sammi Shimota (1854 Treaty Authority), and various staff at Camp Ripley Military Reservation. This project was funded in part by the Wildlife Restoration Program (Pittman-Robertson).

LITERATURE CITED

Cumming, G., and S. Finch. 2005. Inference by eye: confidence intervals and how to read pictures of data. *American Psychologist* 60:170–180.

- Erb, J., and M. DonCarlos. 2009. An overview of the legal history and population status of wolves in Minnesota. Pages 49-64 in A. P. Wydeven, T. R. Van Deelen , and E. J. Heske, editors. *Recovery of gray wolves in the Great Lakes Region of the United States: an endangered species success story*. Springer. New York, New York.
- Erb, J., and B. Sampson. 2013. Distribution and abundance of wolves in Minnesota, 2012-13. Minnesota Department of Natural Resources, St. Paul.
- Erb, J., C. Humpal, and B. Sampson. 2014. Minnesota wolf population update 2014. Minnesota Department of Natural Resources, St. Paul.
- Erb, J., C. Humpal, and B. Sampson. 2018. Distribution and abundance of wolves in Minnesota, 2017-18. Minnesota Department of Natural Resources, St. Paul. 105.
- Erb, J., and C. Humpal. 2025. Distribution and abundance of wolves in Minnesota, 2024-25. Minnesota Department of Natural Resources, St. Paul.
- Fuller, T. K. 1989. Population dynamics of wolves in north-central Minnesota. *Wildlife Monographs*
- Fuller, T. K., W. E. Berg, G. L. Radde, M. S. Lenarz, and G. B. Joselyn. 1992. A history and current estimate of wolf distribution and numbers in Minnesota. *Wildlife Society Bulletin* 20:42-55.
- Fuller, T. K., L. D. Mech, and J. F. Cochrane. 2003. Wolf population dynamics. Pages 161-191 *in* L. D. Mech and L. Boitani, editors. *Wolves: behavior, ecology, and conservation*. University of Chicago Press, Chicago, Illinois.
- Gable, TD, A. T. Homkes, and J. K. Bump. 2025. 2024–2025 Greater Voyageurs Ecosystem wolf population report, University of Minnesota Digital Conservancy, Minneapolis.
- Gese, E. M., P. A. Terletzky, J. D. Erb, K. C. Fuller, J. P. Grabarkewitz, J. P. Hart, C. Humpal, B. A. Sampson, and J. K. Young. 2019. Injury scores and spatial responses of wolves following capture: cable restraints versus foothold traps. *Wildlife Society Bulletin* 43: 42-52.
- Manly, B. F. J. 1997. *Randomization, bootstrap and Monte Carlo methods in biology*. Chapman and Hall, London.
- Minnesota Department of Natural Resources. 2001. Minnesota wolf management plan. Minnesota Department of Natural Resources, St. Paul.