



# Wolves by the Numbers:

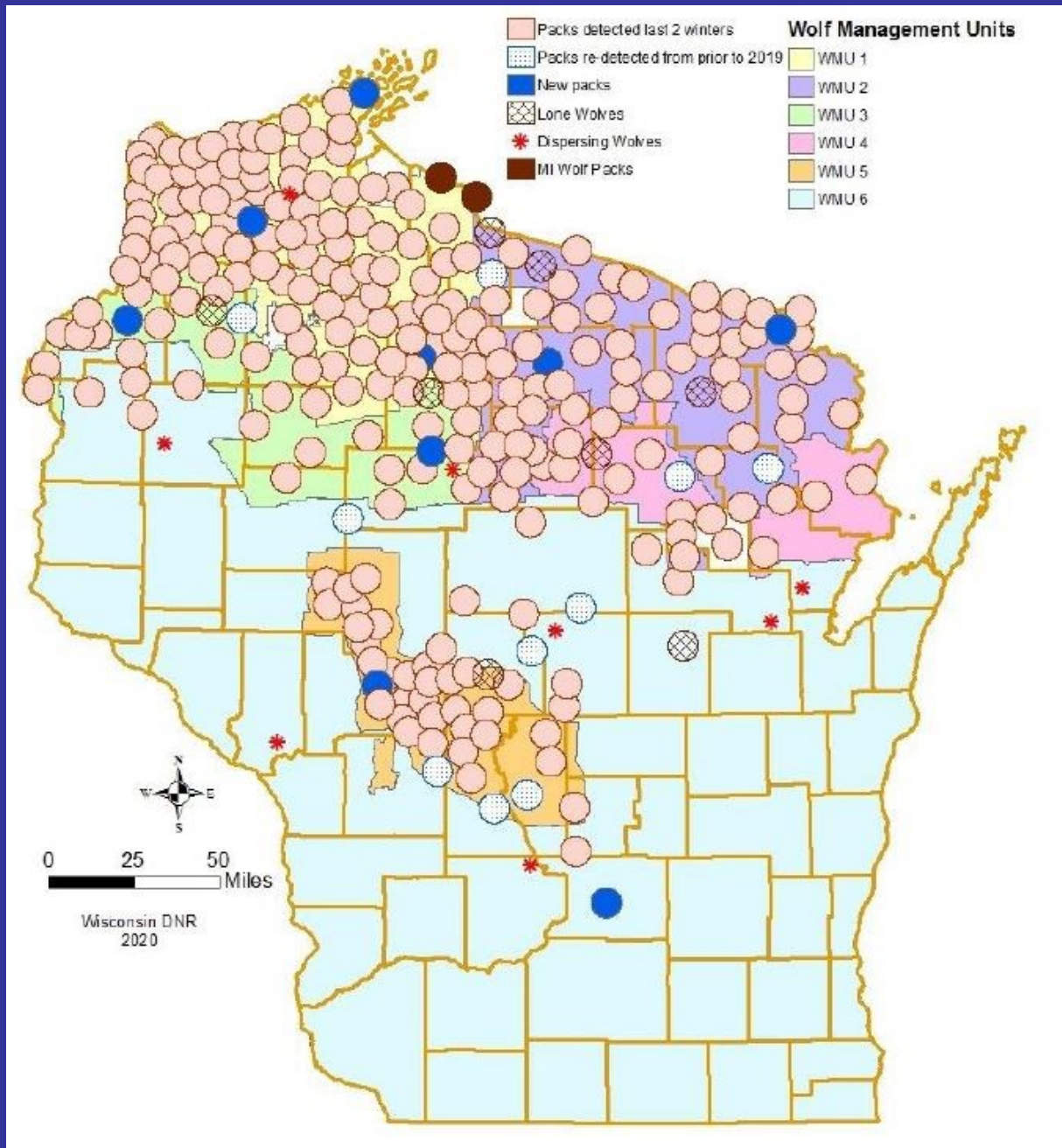
The Science and Math of Wolf Conservation in Wisconsin

By Adrian P. Wydeven [adrianwydeven@cheqnet.net](mailto:adrianwydeven@cheqnet.net)

and Karen Mesmer [klmesmer@gmail.com](mailto:klmesmer@gmail.com)

Wisconsin's Green Fire ([wigreenfire.org](http://wigreenfire.org))


# Wolves Detected in Wisconsin in winter 2019-2020







# ARE THESE STATEMENTS TRUE OR FALSE, AND HOW CAN WE EXAMINE WITH OUR STUDENTS?

- 
- The Wisconsin wolf population is exploding and is out of control.
  - Wolves have killed and eaten most of the deer and there are few deer remaining in northern Wisconsin.
  - Wolves are a major threat to our pet dogs in Wisconsin
  - Wolf damage compensations is soaring in Wisconsin
  - Wolf hunting seasons will cause wolves to again become endangered or disappear from the state.
  - Allowing lethal control on problem wolves will decimate the wolf population and cause wolves to again become endangered.
  - DNR does not know how many wolves live in Wisconsin, and there are many times more than they report.



## Great Lakes Gray Wolves

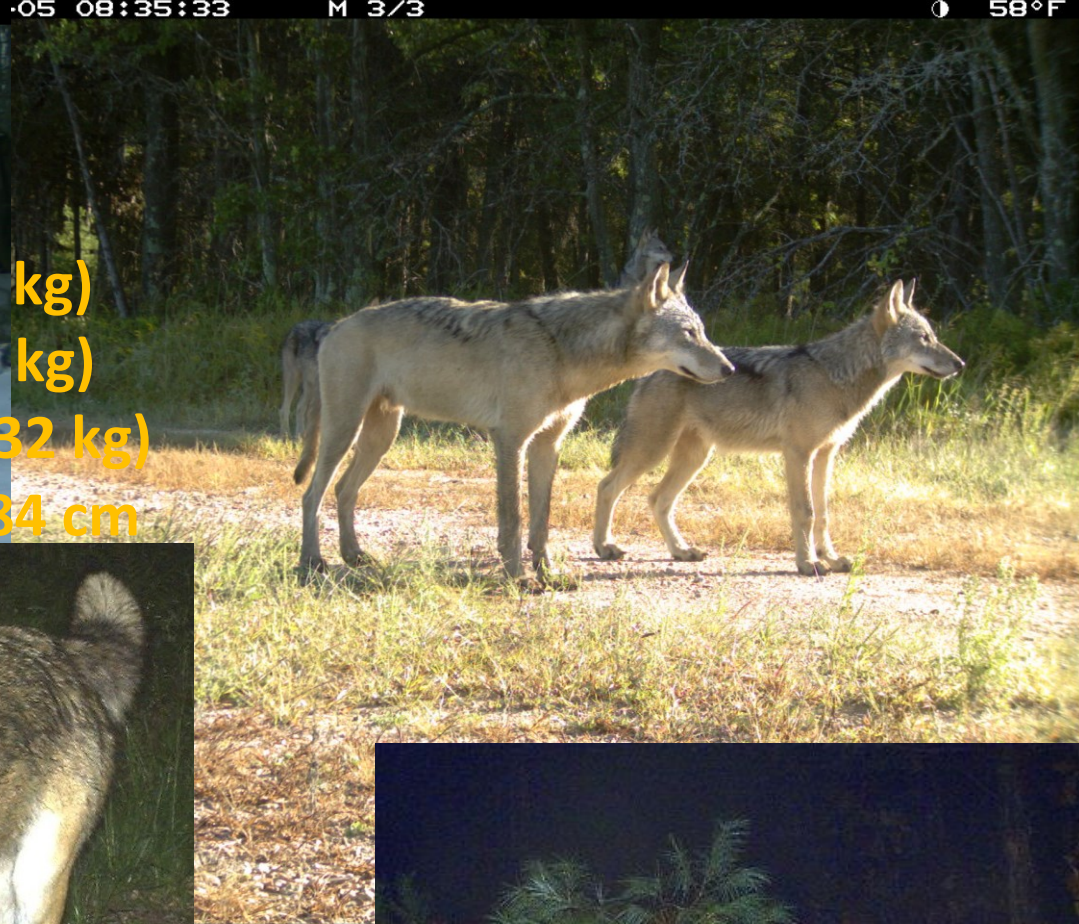
*Canis lupus*

Weights 55-108 pounds (25-49 kg)

Average Adult Male 80 lbs. (36 kg)

Average Adult Female 70 lbs. (32 kg)

Shoulder Height 28-33 in. (71-84 cm)





**Wolf**



**Coyote**







First Nations in the Great Lakes Region in 1700s: wolves were important to the culture of many tribes. The area that became Wisconsin may have had 3,000-5,000 or more wolves.



# Disappearance and Return of the Gray Wolf

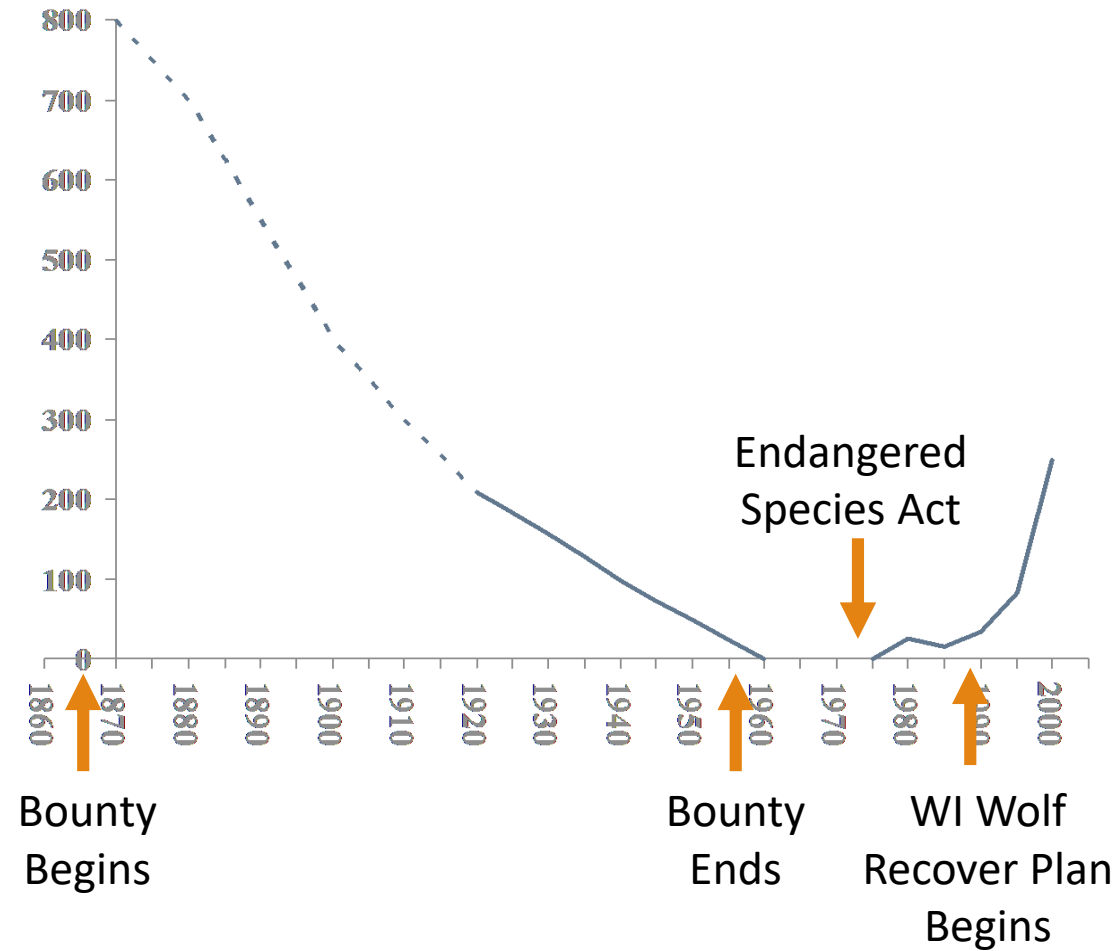
## Population Controls

- Unrestricted Hunting & Trapping
- Bounties
- Poison



Photo Credit: PBS

## Historical Changes in Wisconsin Gray Wolf Population





# Counting Wolves, One Pack at a Time





## Counting from the Air

Radio-Collared Wolf





# Counting by Tracks





## Counting from Trail Cam Photos



Cuddeback Digital Camera 2/19/09 5:04 PM Fort McCoy

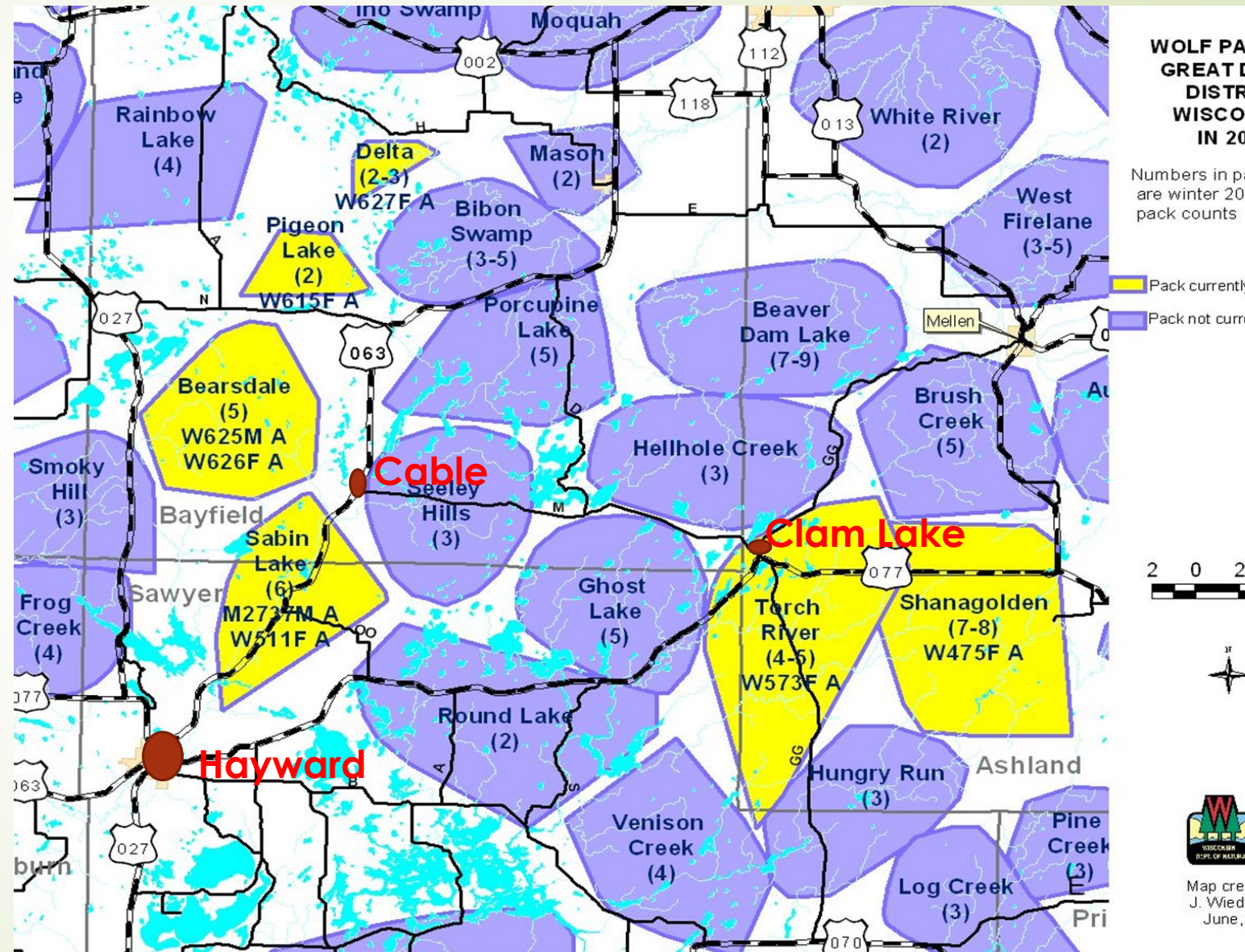


# Example of Wolf Count within Region of N. Wisconsin, using territory mapping, minimum counting system

24 packs with  
90-98 wolves.  
3.75-4.08 wolves/pack

50 mi x 38 mi area  
1900 sq. mi.

Typically 3-15% of wolf  
population may  
include lone wolves.  
Assume ~ 5 loners  
Total 95-103 wolves or  
1 wolf /18-20 sq. mi.





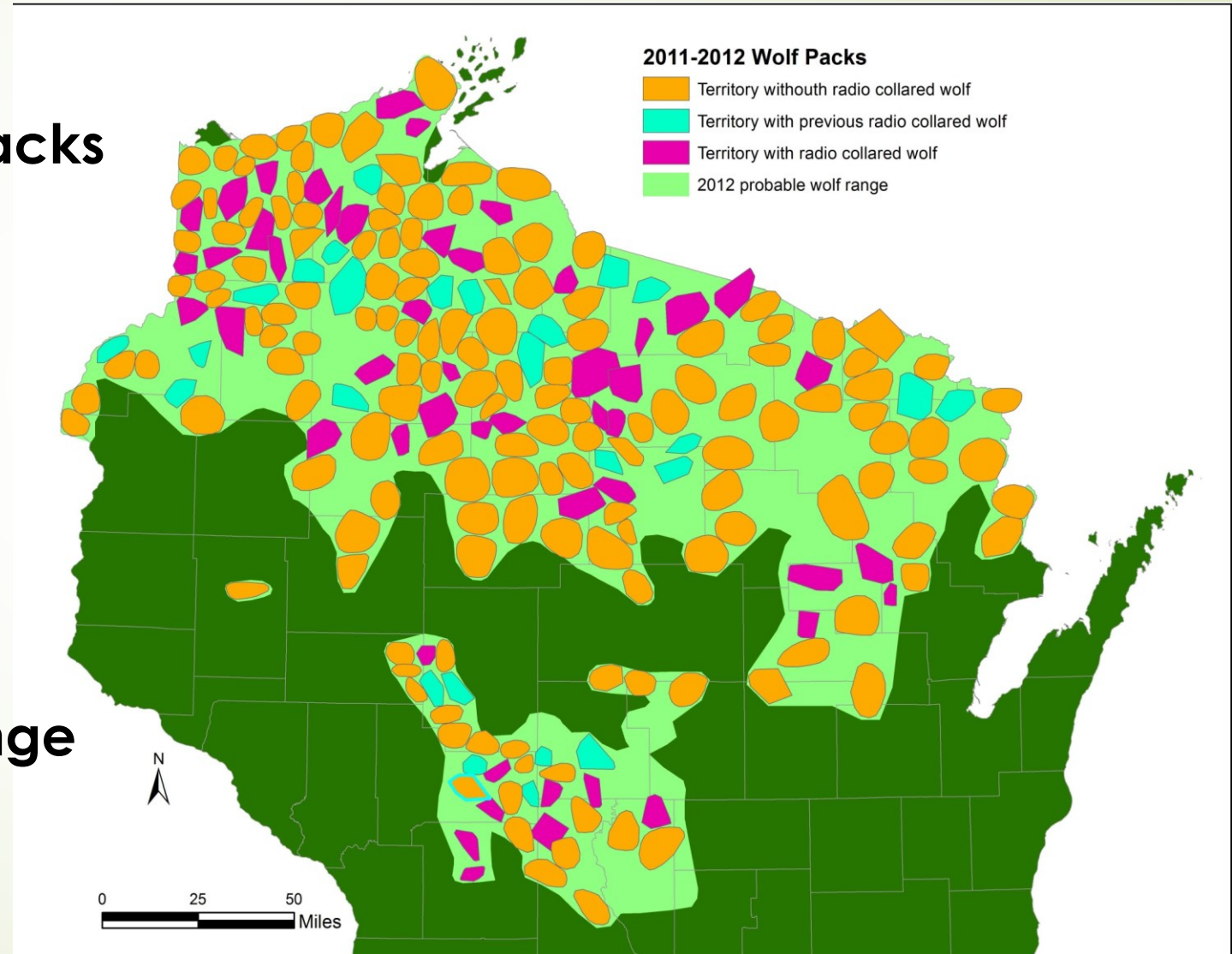
# Statewide Wolf Count in 2012, using the territory mapping minimum counting system

**795-820 wolves in 213 packs  
plus 20 lone wolves**

**Total 815-880 wolves in  
Wisconsin**

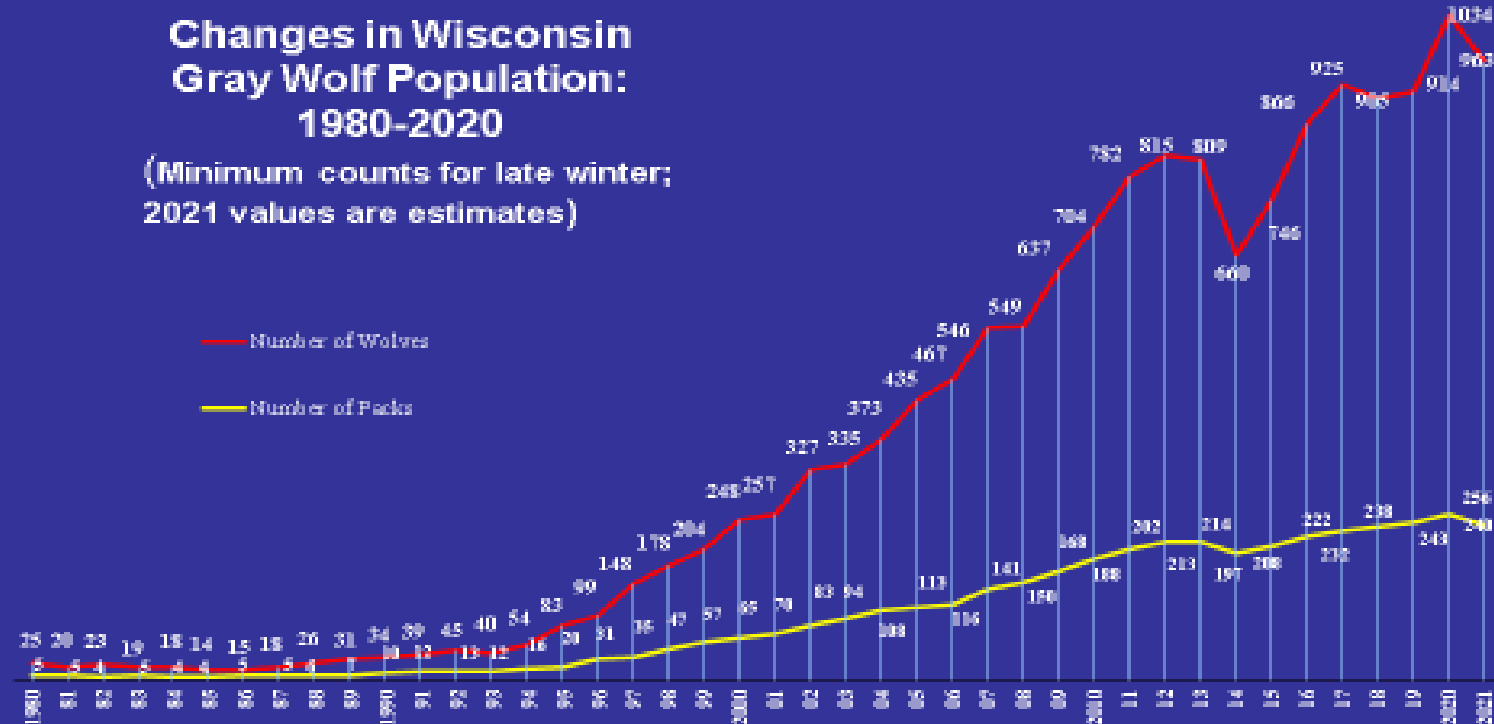
**Average pack size of  
3.7 to 4.0 wolves/ pack**

**Density in Occupied Range  
1 wolf/13 -15 sq. mi.**





Using this minimum counting system, WDNR has estimated the number of wolves in WI in winter between 1980-2020. The population grew only slightly between 1980 and 1993. From 1994 through 2011 the population grew very rapidly, but since 2012, population growth seems to be stabilizing.



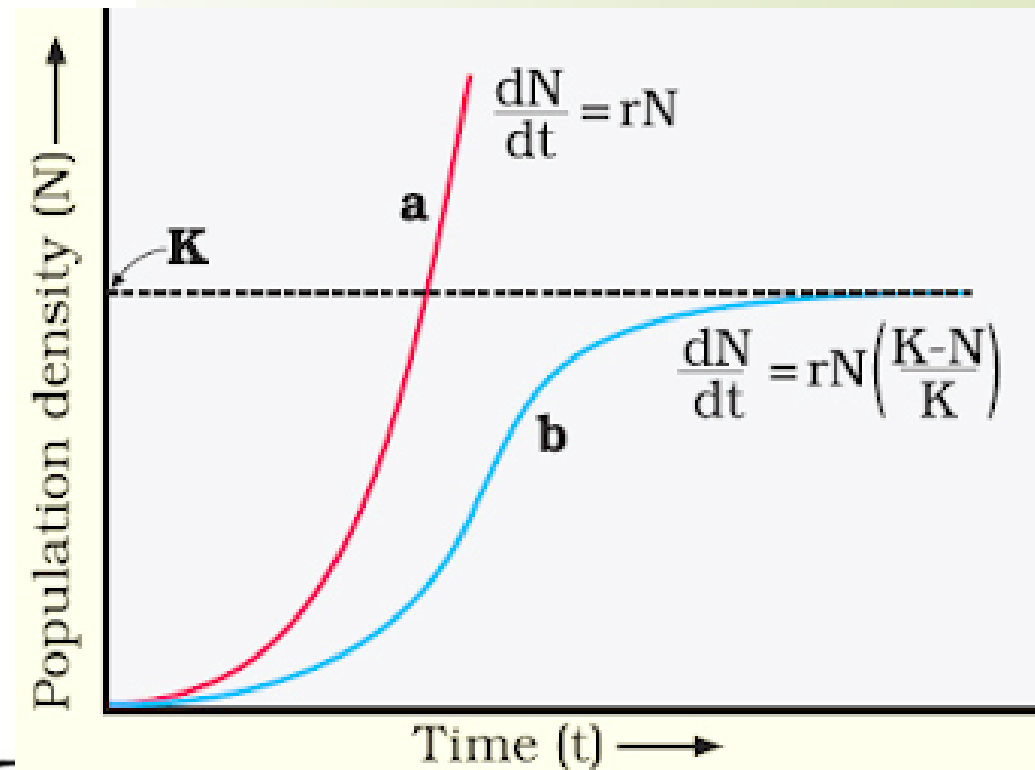
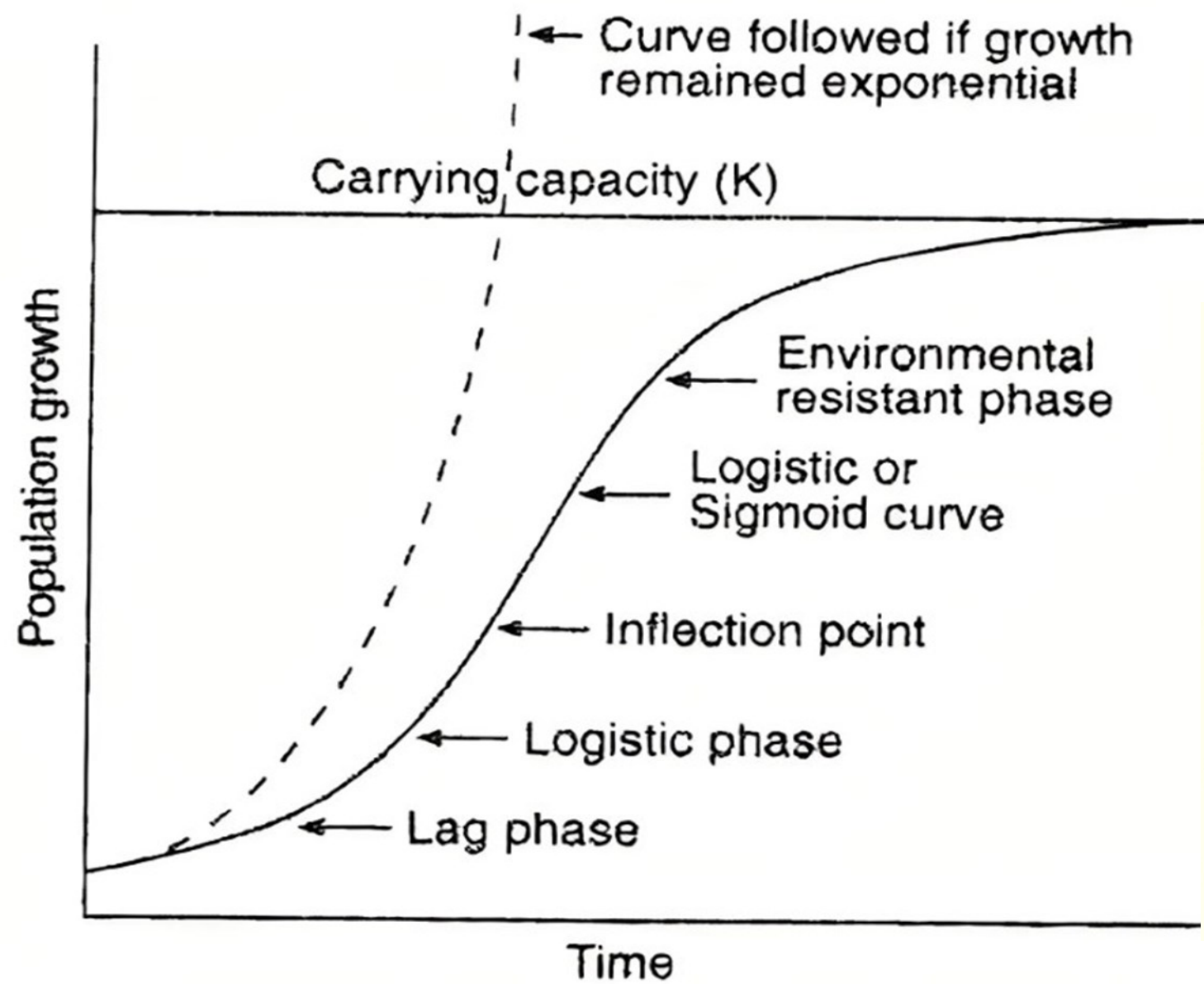


Fig. 4.42 : Logistic or sigmoid growth curve. The total size of the population grows in an S shape





**Has the Wisconsin wolf population reached biological carrying capacity? A paper by Stenglein et al. (2015) suggested a potential carrying capacity of 1242 +/- 34 wolves.**

**WI DNR discontinued use of minimum counting system in 2020, and went to a statistical estimates using patch occupancy modeling (POM). The method better accounts for missing observations, and unevenness in survey coverage, but also has a broad confidence intervals.**

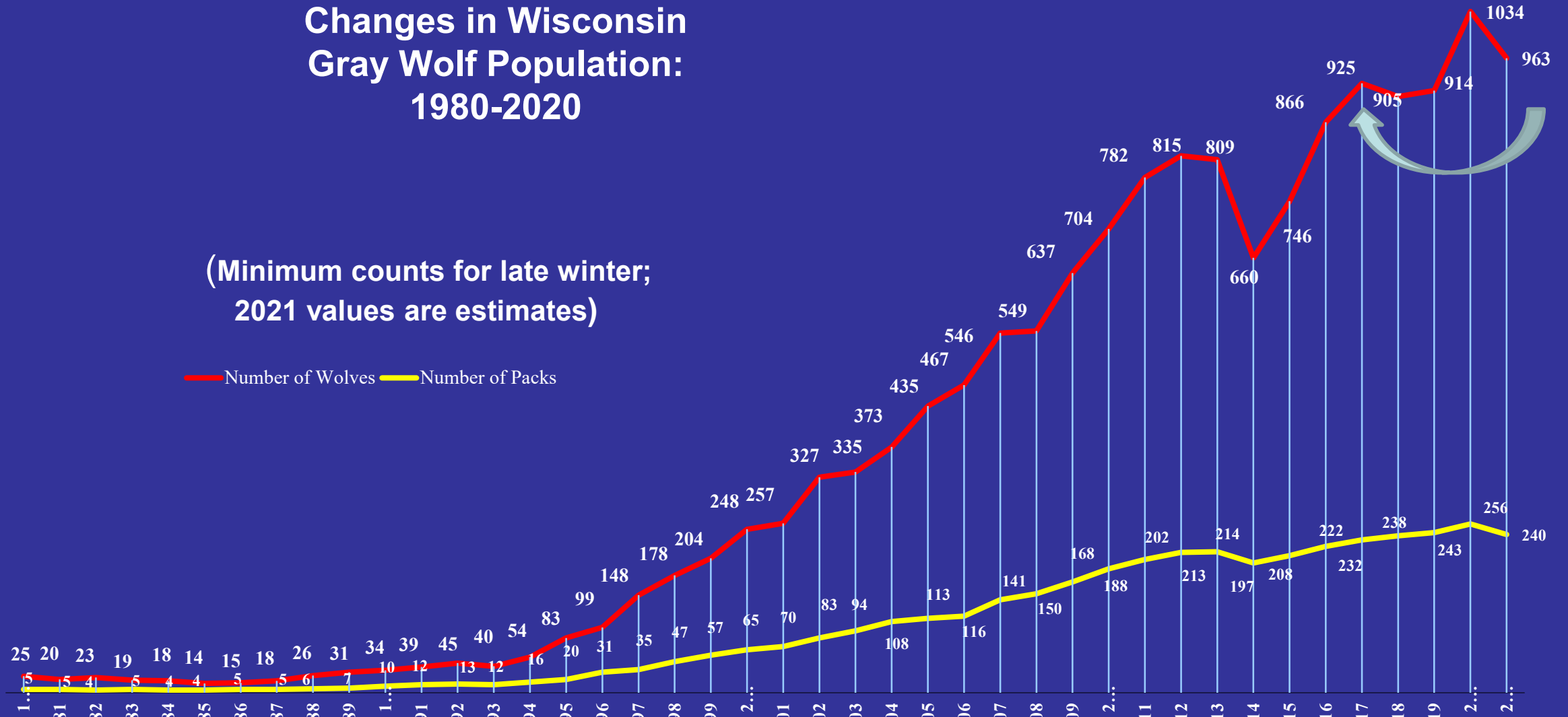
**The mode estimates of wolf population by POM was calculated in 2018, 2019 ,and 2020, and averaged about 14.5% higher than the minimum counting system. The most recent mode estimate in winter 2021 was 1126 wolves with 95% credible interval 937-1364. A minimum count was not done in 2021, but subtracted 14.5% from the mode estimate gives an estimate of minimum count of 963 wolves.**



Between 2017-2021 the wolf population has not changed more than 14%. Thus the population seems to be stabilizing, and not exploding.

## Changes in Wisconsin Gray Wolf Population: 1980-2020

(Minimum counts for late winter;  
2021 values are estimates)





**Have wolves killed and eaten most of the deer and  
are there few deer remaining in northern Wisconsin?**





**Thompson 1952**  
**97% Deer**  
**5% Snowshoe Hare**  
**3% Voles**  
**0% Beaver**  
**Other animals & plants**

**Mandernack 1983**  
**55% Deer**  
**16% Beaver**  
**10% Snowshoe Hare**  
**20% Misc.**





**“For deer..15-19 adult-sized deer...  
per year per wolf ...”**

**Mech & Peterson 2003**

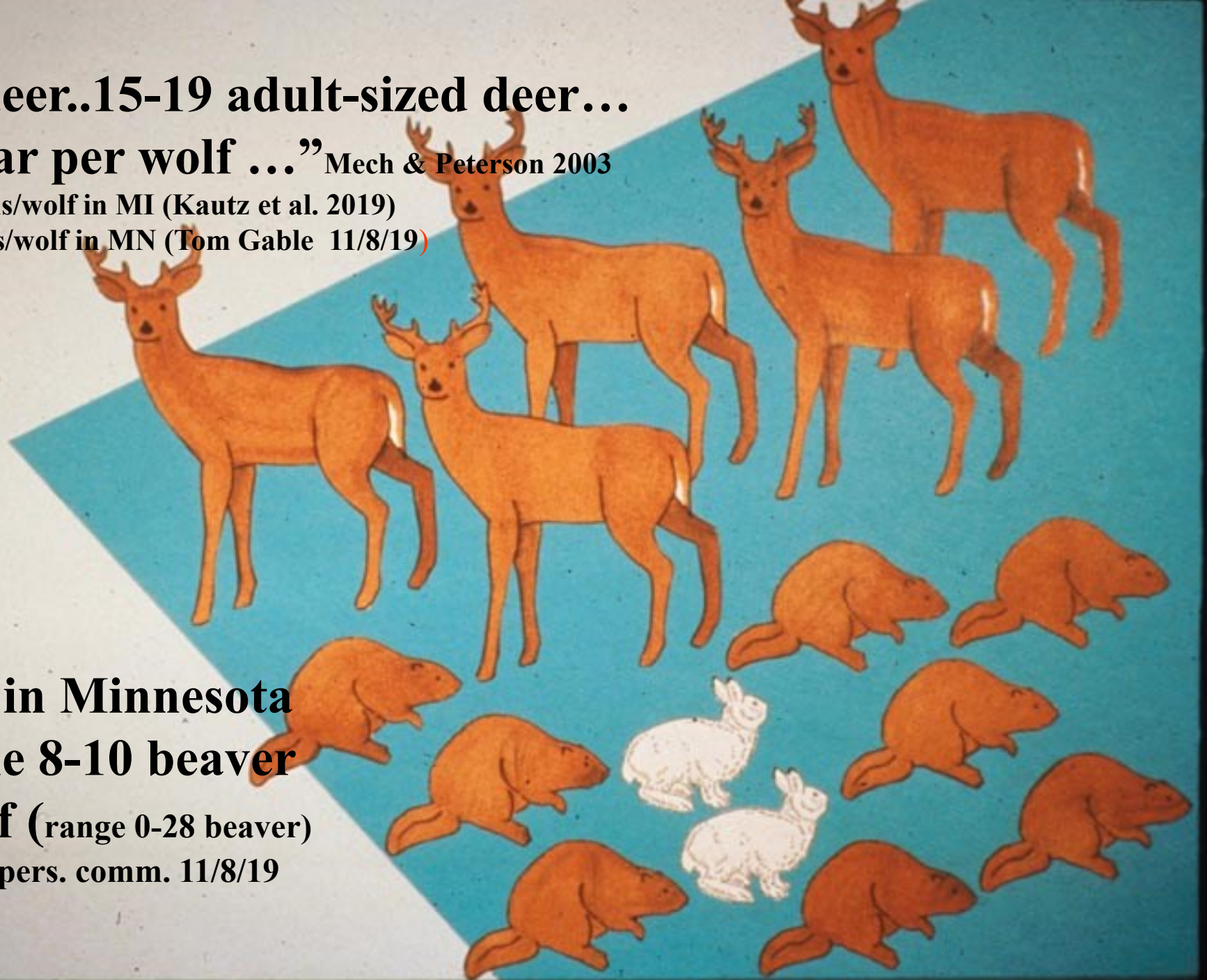
**and 9 fawns/wolf in MI (Kautz et al. 2019)**

**13-15 fawns/wolf in MN (Tom Gable 11/8/19)**



**Wolves in Minnesota  
consume 8-10 beaver  
per wolf (range 0-28 beaver)**

**Tom Gable pers. comm. 11/8/19**





# Deer Predator and Human Kill Rates in Northern Wisconsin (N 1/3 of WI, ~18,000 mi<sup>2</sup> in 2020)


<b>➤ <u>Species</u></b>	<b><u>Population</u></b>	<b><u>Deer/Year</u></b>	<b><u>Total Deer killed</u></b>
➤ Black Bear	18,000	1.5 <sup>a</sup>	27,000
➤ Bobcat	3,800	6.0 <sup>a</sup>	22,800
➤ Coyote	~ 12,000	3.0 <sup>a</sup>	36,000
➤ Wolf	900	20.0 <sup>b</sup>	18,000
➤ Human/Vehicles	NA	NA	2,000
➤ Human/Hunters ~180,000		0.3	54,000
➤ Deer (post-hunt) 376,000		NA	159,800

<sup>a</sup>Kautz et al. 2019. J. Wildl. Mgmt. 83:1261-1270

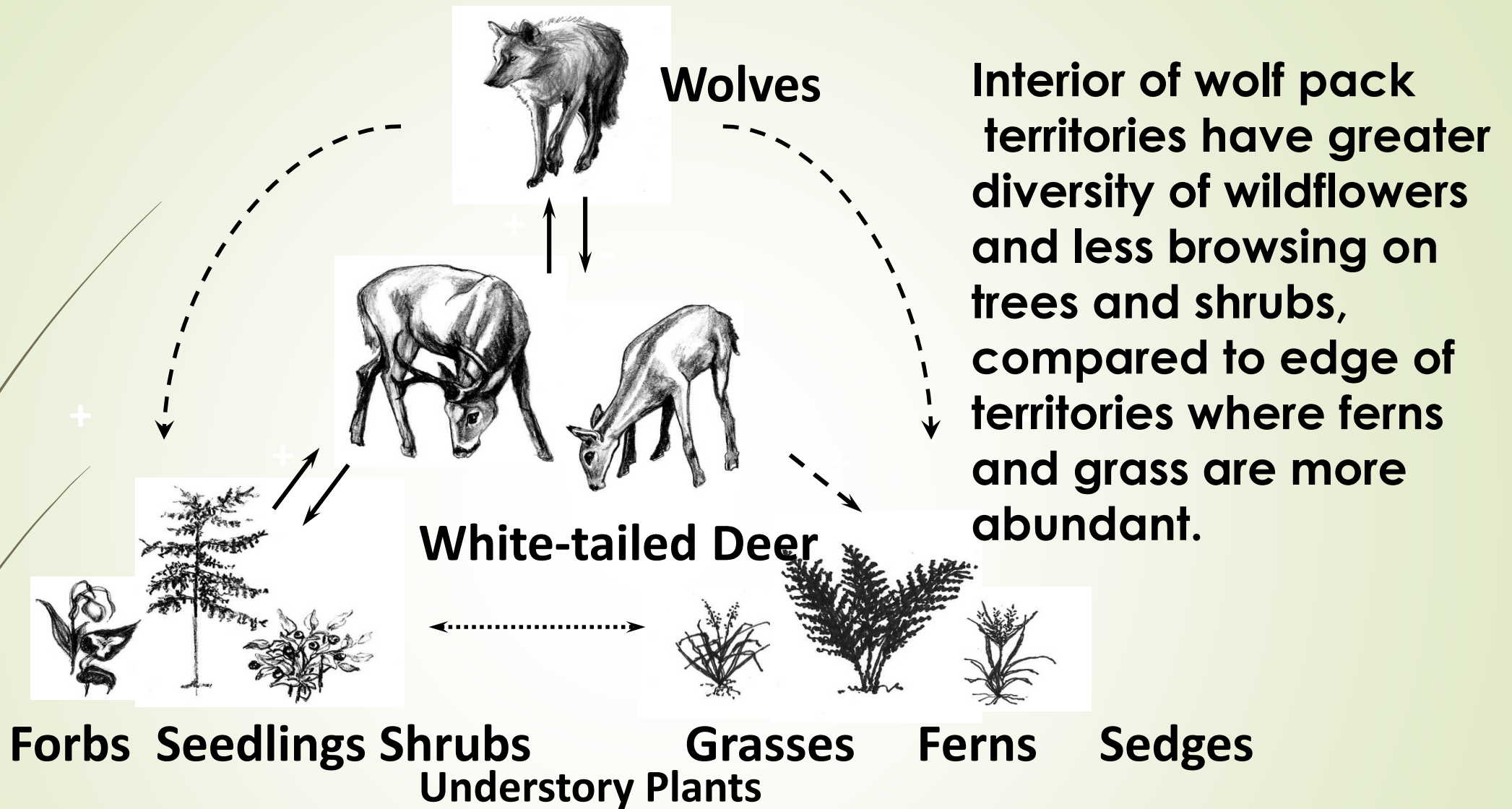
<sup>b</sup>Mech and Peterson 2003. p. 145 (modified) Wolves, U. Chicago Press



# **Wolves also provide Ecological Service because of Predation on Prey Species**

- 
- **Cull less fit deer from the herd**
  - **Reduce spread of diseases such as Chronic Wasting Disease and Tuberculosis**
  - **Increase diversity and abundance of wild flowers**
  - **Reduce browsing on shrubs and tree seedling by moving deer around.**
  - **Reduce abundance of coyotes, that are important fawn predators**
  - **Reduce rates of vehicle collision from deer**





**Fig. 1** Diagram of hypothesized tri-trophic interactions in northern Wisconsin forests. Solid arrows represent direct positive and negative interactions. Dashed arrows represent hypothesized indirect interactions. Dotted line represents competitive interactions. (Callan, R., N.P. Nibblelink et al. 2013; Bouchard et al. 2013)

# Are Wolves a Major Threat to Pet Dogs?

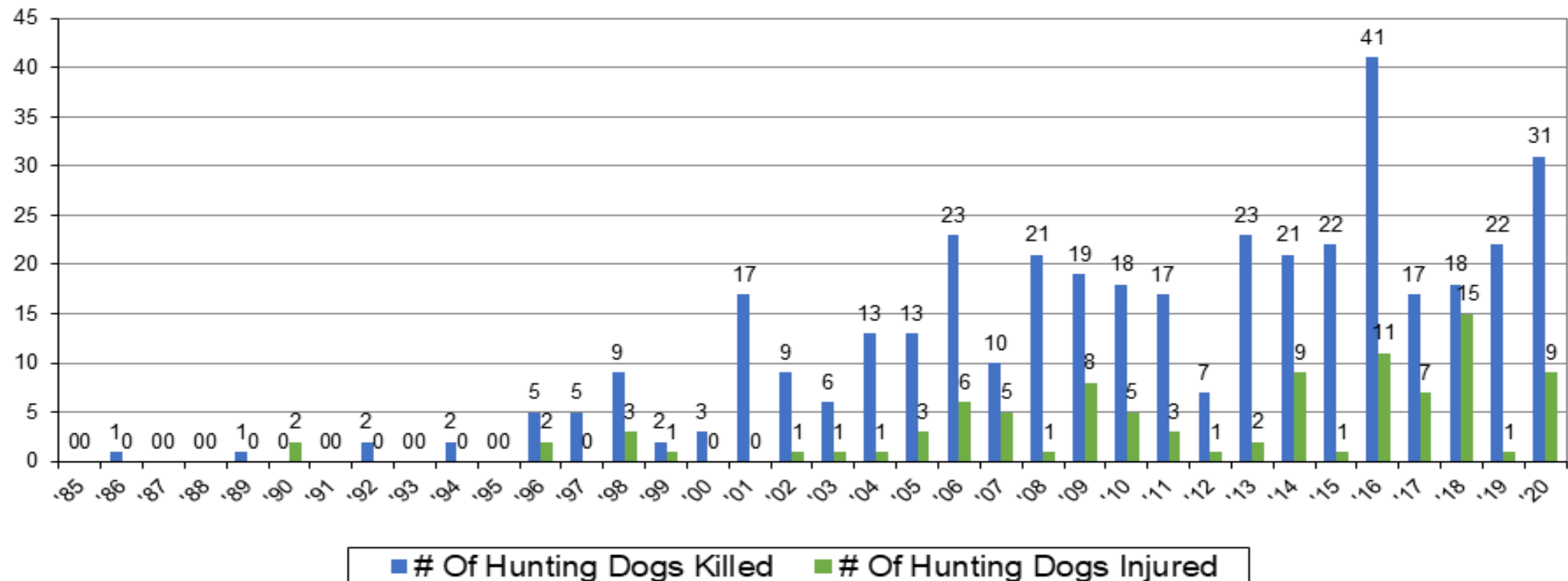




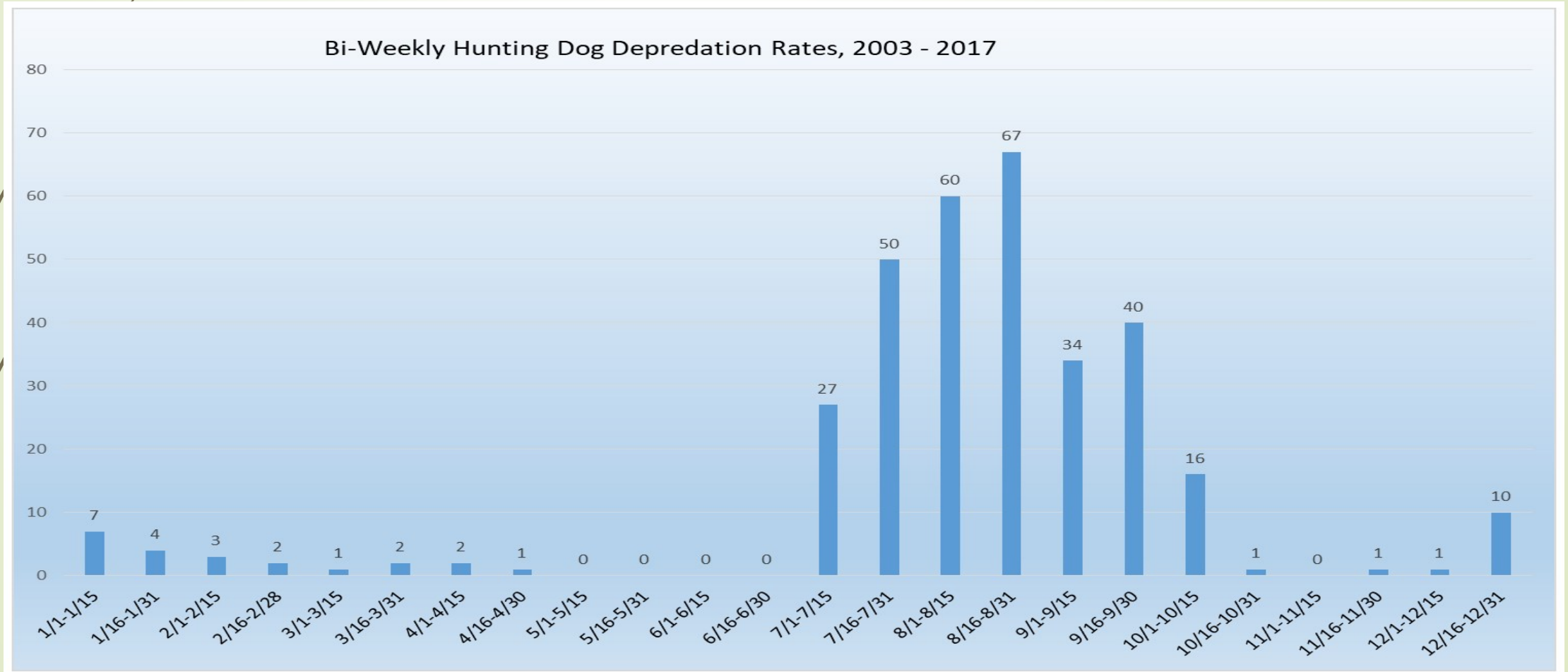
# Wolf Depredation on Hunting Dogs (mainly Hounds) 1985-2020

Ave. ~20-22 killed per year, and 5-6 injured per year; extremes related to regulatory changes.

Hunting dogs killed and injured by wolves in Wisconsin, 1985 - 2020  
(398 killed, 98 injured)



# Timing of Hunting Dog Depredation by Wolves; mainly bear-hound training and bear hunting period in Summer when wolf packs defend pups

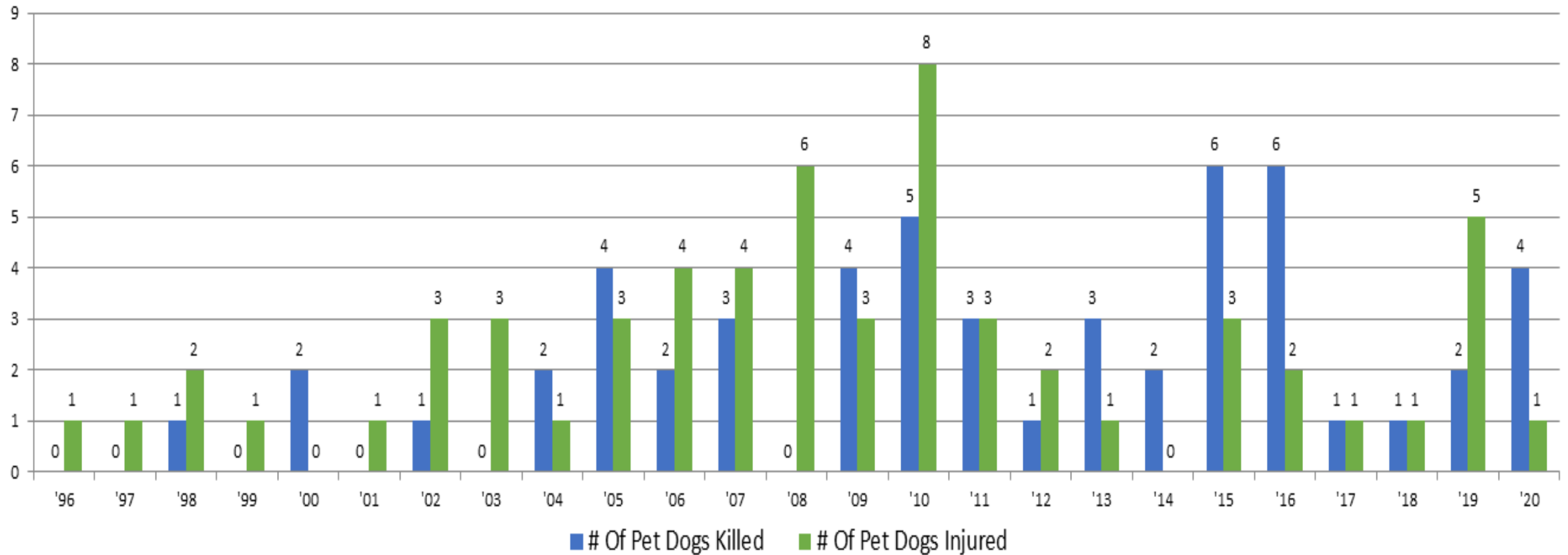




# Wolf Depredations on Pet Dogs 1996-2020


(Not Breed specific but situation under which the wolf attack occurred): Ave. 2-3 dogs killed and 2-4 inured per year.

Pet dogs killed and injured by wolves in Wisconsin, 1996 - 2020  
(53 Killed, 60 Injured)





# Summary of Wolf Depredations on Dogs in Wisconsin

- Most attacks are on hunting dogs in summer when wolves are defending pups
  - Rate of attacks seem unrelated to wolf population since early 2000s
  - Extreme peaks and low points in depredation seem related to regulatory/policy changes
  - Pet dog attacks seem to be declining as people have learned to live with wolves, and death or serious injury is often avoid by owner nearby scaring wolves off.
- 



# Are Wolf Damage Compensations soaring in Wisconsin?

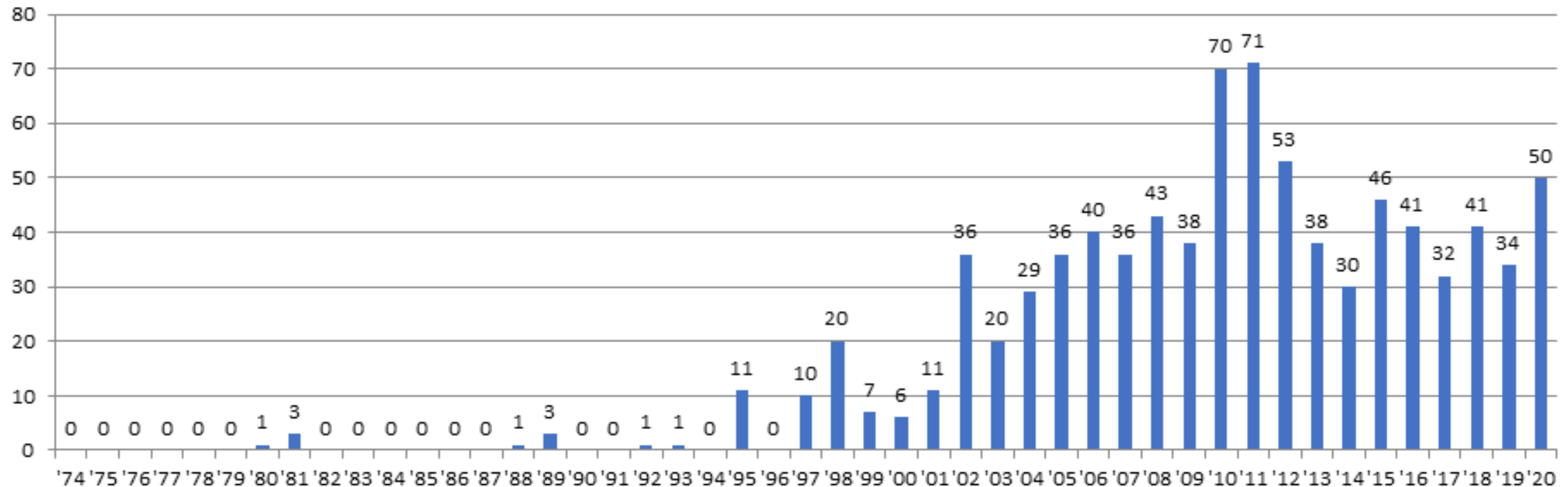
The enclosed website by the Wisconsin DNR summarizes all wolf depredation payments from 1985-2021, <https://p.widencdn.net/7o52me/WolfDamagePayments>

Since 1985, a total of \$3,112,067.69 has been paid for wolf damage compensation  
Payments included:

- Killed and Injured (vet. fees) Hunting Dogs, \_\_\_\_\_ 33.0%
- Missing calves that may have been wolf kills, \_\_\_\_\_ 29.7%
- Verified calf and cattle kills and injury, \_\_\_\_\_ 22.7%
- Captive Deer killed, \_\_\_\_\_ 6.3%
- Killed and Injured Pet Dogs, \_\_\_\_\_ 3.6%
- Sheep, \_\_\_\_\_ 2.1%
- Horses & Donkeys, \_\_\_\_\_ 1.9%
- Llama, pigs, goats, chickens, turkeys, \_\_\_\_\_ 0.7%

# Verified Wolf kills and injury to Cattle 1980-2020.

Cattle depredated (killed & injured) by wolves in Wisconsin, 1974 - 2020  
(859 cattle)







# Wolf Depredation Payments

Since 1985 a total of , \$3,112,067.69, has been paid for wolf depredations and annually ranged from \$0 (1986, 1989) to \$336,129 (2011)

Between 2012-2021 the average payments was \$169,720 per year, and ranged from low of \$102,600 in 2017 to high of \$244,066 in 2020.

Wisconsin has had some high payments for wolf damage, but partially due to generous programs to reimburse for missing calves that 'may' have been killed by wolves, and WI is the only US state to reimburse for hunting dogs.

For the most part Depredations on Livestock have declined since the peaks of 2010 and 2011.

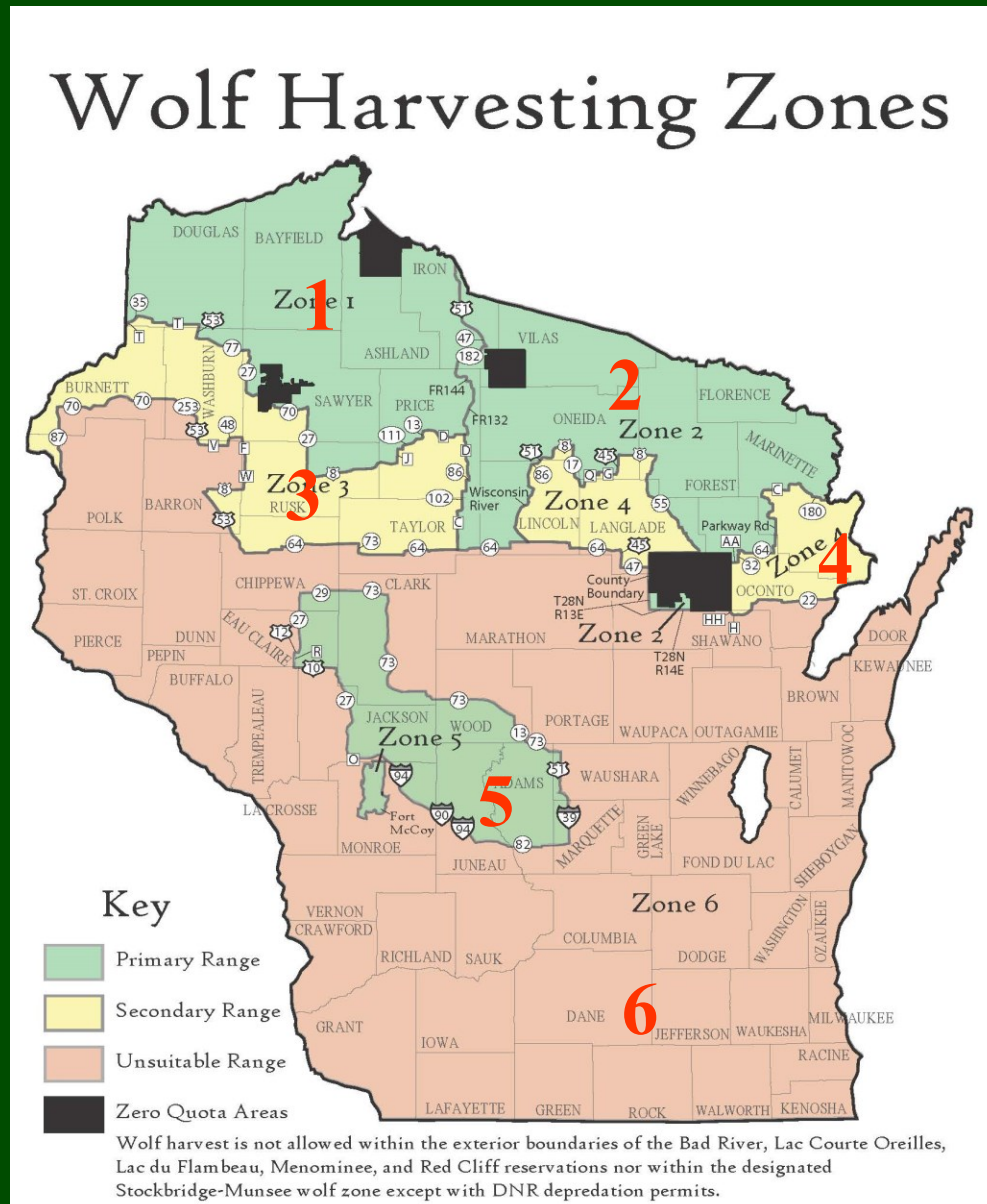
**Will Wolf Hunting Seasons cause Wolves to again become endangered or disappear from the State.**





# Wolf Harvests

	<u>2012</u>	<u>2013</u>	<u>2014</u>
<b>Zn. 1</b>	<b>32</b>	<b>77</b>	<b>36</b>
<b>Zn. 2</b>	<b>19</b>	<b>29</b>	<b>29</b>
<b>Zn. 3</b>	<b>19</b>	<b>75</b>	<b>30</b>
<b>Zn. 4</b>	<b>5</b>	<b>12</b>	<b>5</b>
<b>Zn. 5</b>	<b>23</b>	<b>33</b>	<b>18</b>
<b>Zn. 6</b>	<b>19</b>	<b>31</b>	<b>36</b>
<b>Total</b>	<b>117</b>	<b>257</b>	<b>154</b>





# Impacts of regulated hunting and trapping seasons on Wolves in Wisconsin

Count before hunt was 815 wolves in winter 2012.

Harvest in fall 2012 was 117 wolves intended to avoid population decline.

Count was 809 wolves in winter 2013.

Harvest in fall 2013 was 257 wolves intended to reduce population by 15%.

Count was 660 wolves in winter 2014, reduction of 18%.

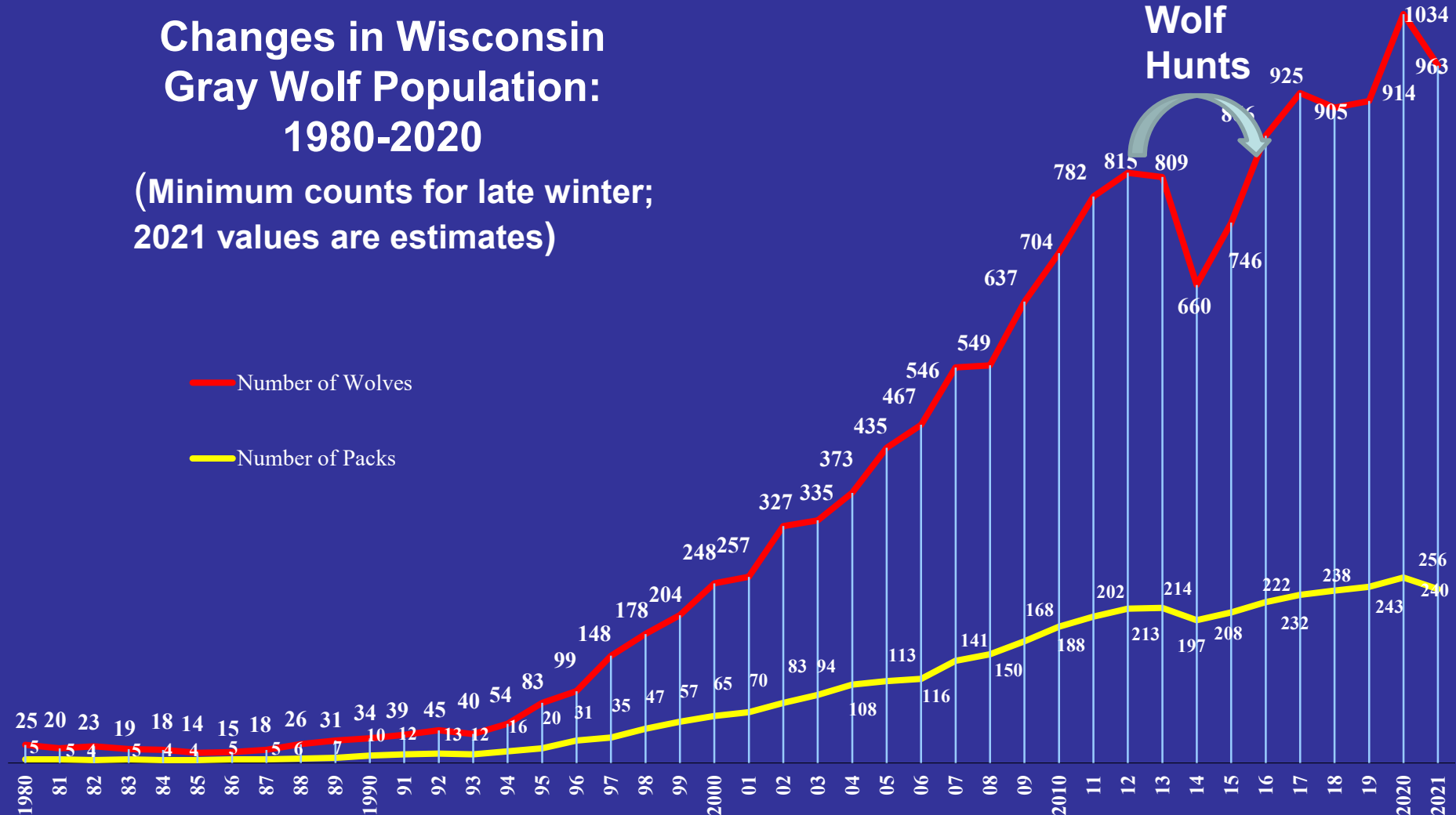
Harvest in fall 2014 was 154 wolves, intended to stabilize population.

Count was 746 wolves in winter 2015, increase of 13%



# Changes in Wisconsin Gray Wolf Population: 1980-2020

(Minimum counts for late winter;  
2021 values are estimates)



# Annual Cycle of Wolf Population in Wisconsin







# Overall Impact of regulated hunting and trapping season on Wolves.

- Three years of wolf hunt and trapping resulted in 8.5% decline in the winter wolf count in Wisconsin. During the same period there was a 58% decline in cattle killed by wolves.
- Wolf hunting and or trapping season are allowed in most Canadian provinces, as well as AK, ID, MT, WY in USA, and when federally delisted 2012-2014 was allowed in MI, MN and WI.
- Wolf populations can be sustainably harvested at rates of 22-29% of the winter wolf population.
- BUT, ethics, ecological benefits, value judgments, and cultural concerns should also be considered when determining IF, WHEN, WHERE, and HOW wolves will be hunted or trapped by the public.

# Will lethal control on problem wolves decimate the wolf population and cause wolves to again become endangered?



## Wisconsin Gray Wolf Population and Federal Status: 1980-2020

Gray wolves are listed as **Endangered** and are within federal authority under the Endangered Species Act (ESA)

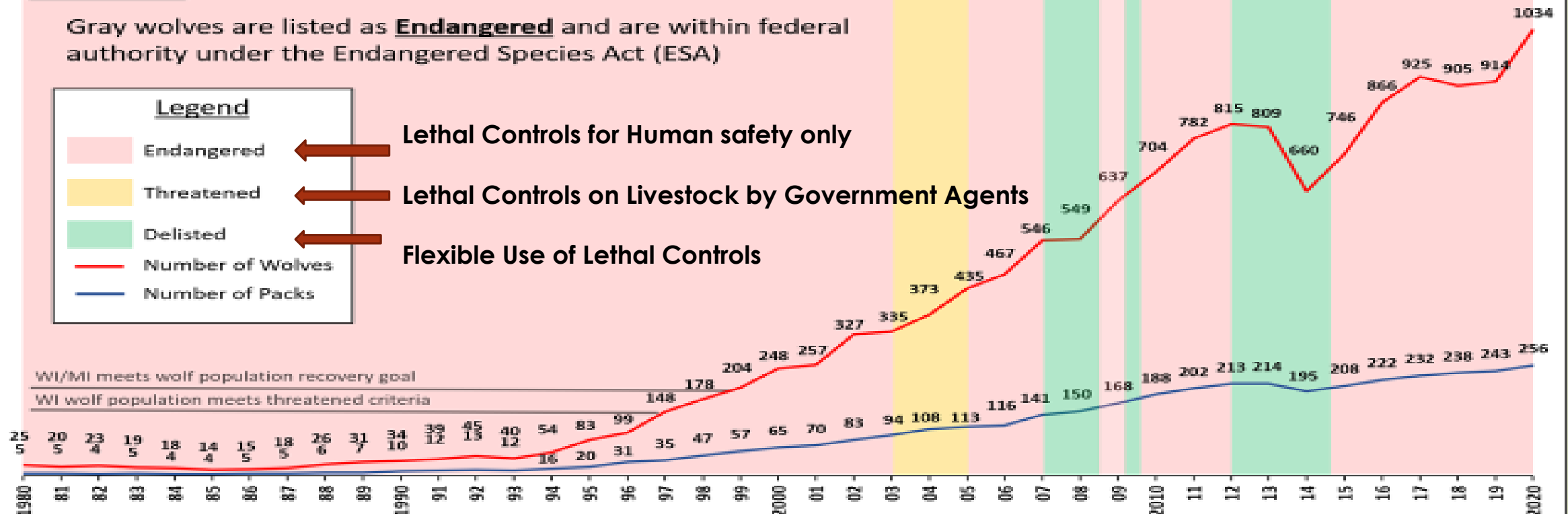
### Legend

- Endangered
- Threatened
- Delisted
- Number of Wolves
- Number of Packs

Lethal Controls for Human safety only

Lethal Controls on Livestock by Government Agents

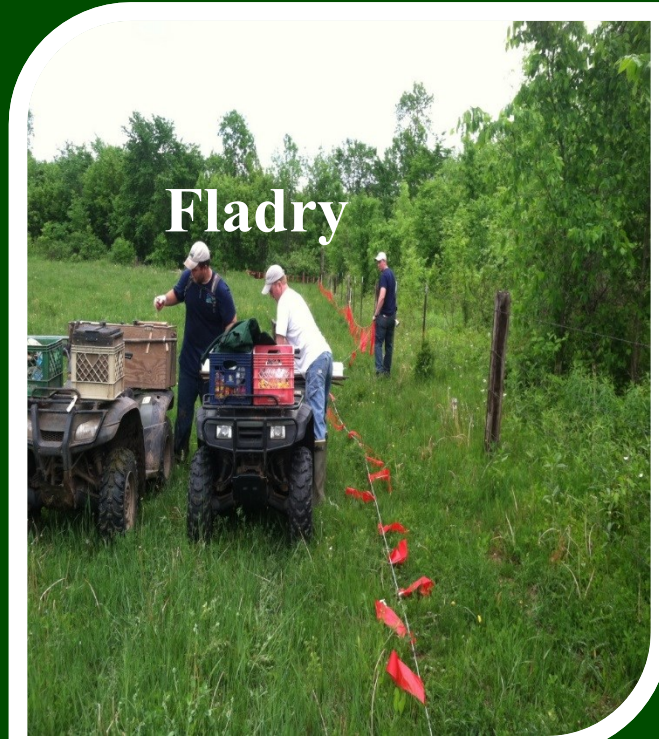
Flexible Use of Lethal Controls



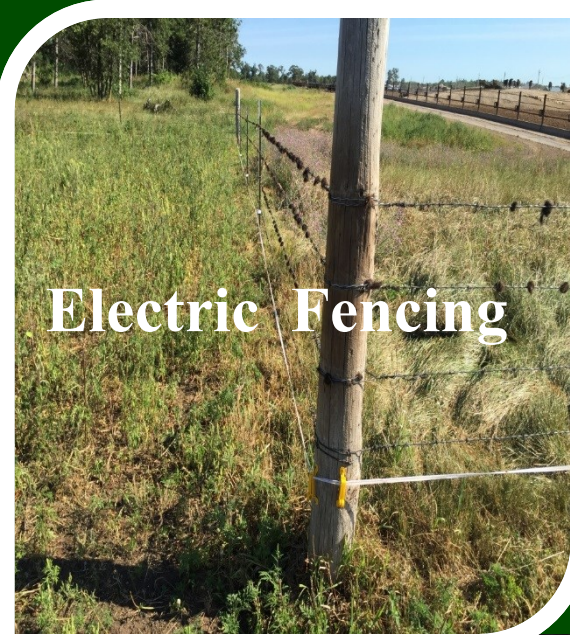


# NON-LETHAL METHODS USED

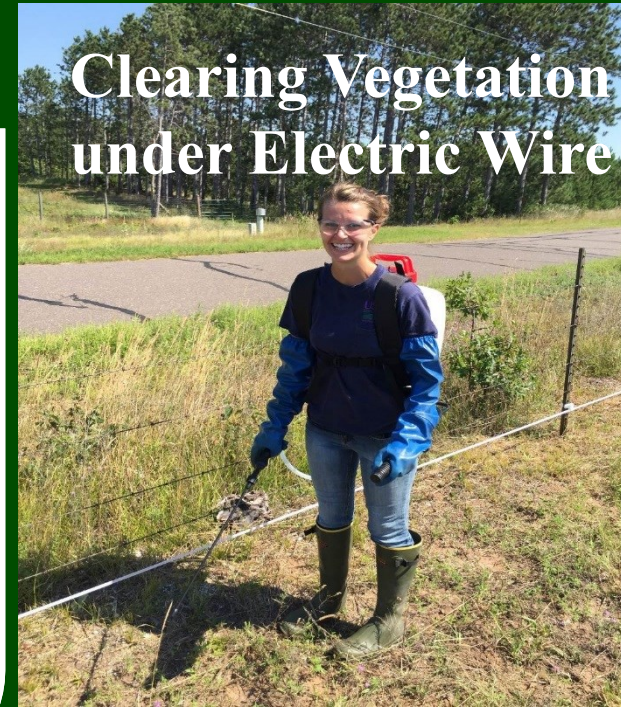
## BY WIWS



Fladry



Electric Fencing



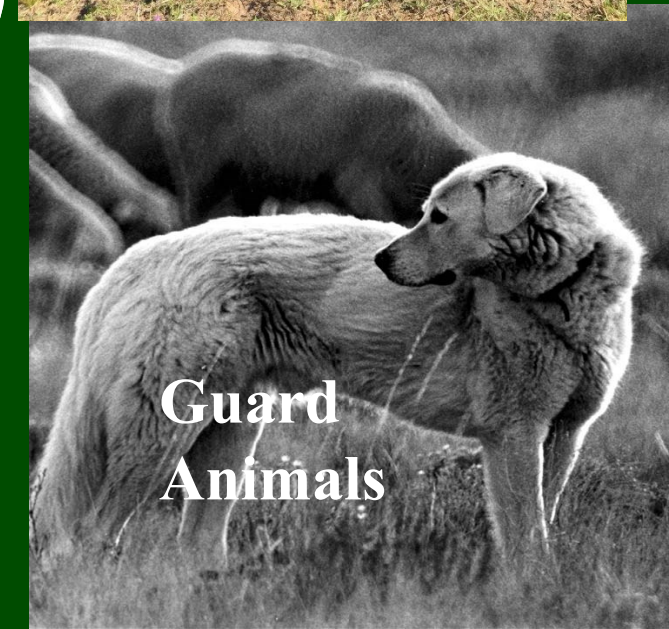
Clearing Vegetation  
under Electric Wire



Noise Making Devices



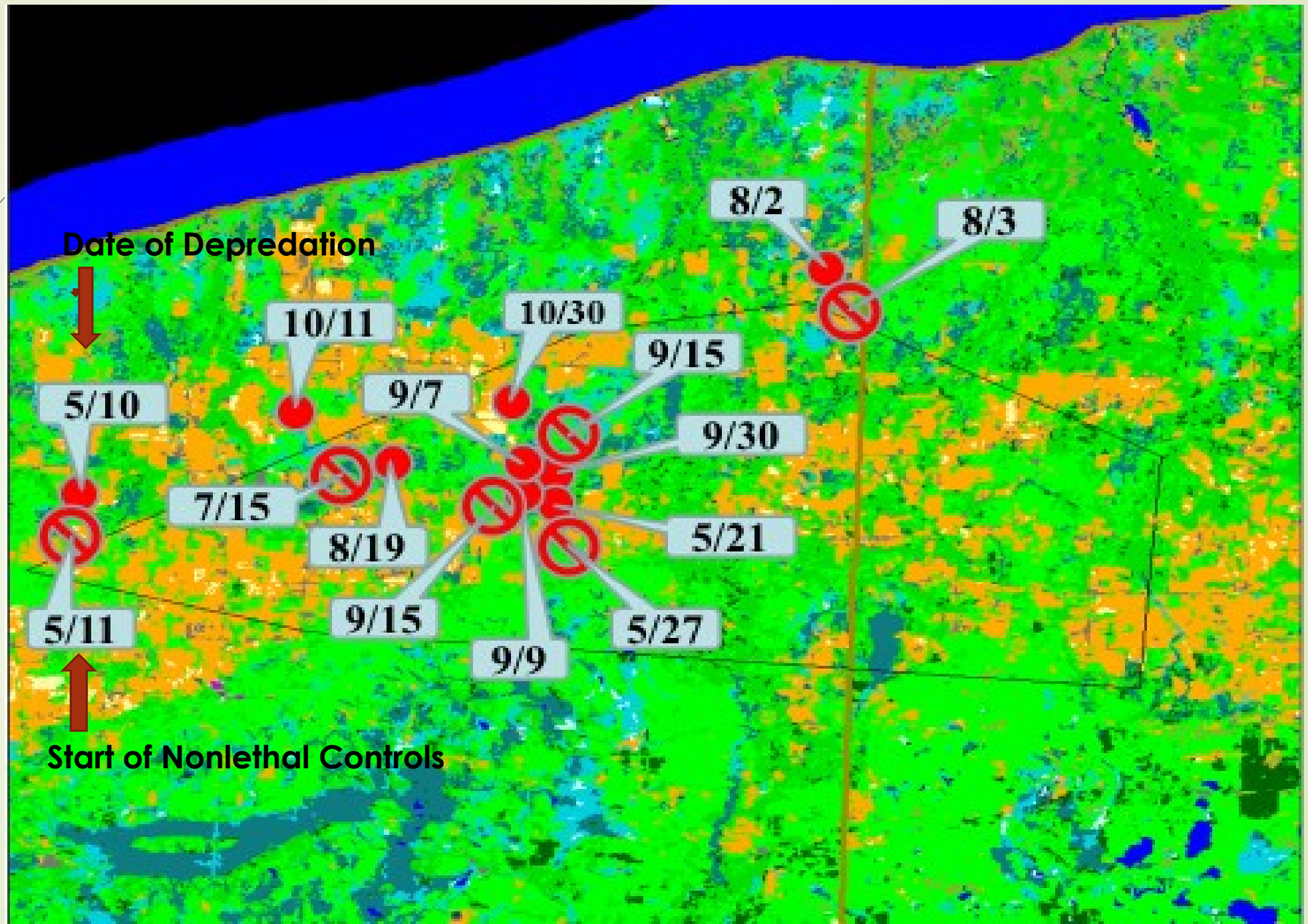
Flashing  
Lights



Guard  
Animals



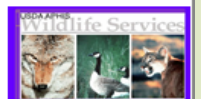
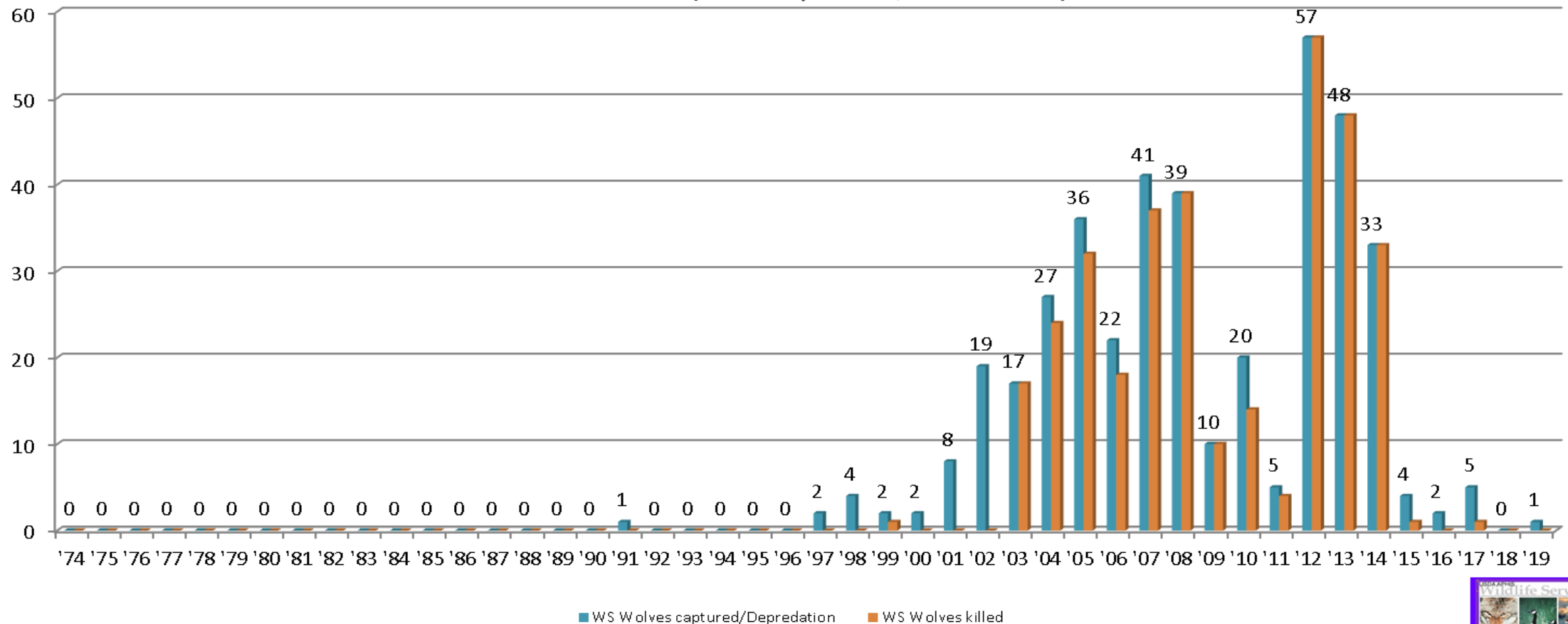
Nonlethal Controls may shift Wolves onto other Farms, as can be seen in this pack in N WI Involved in Livestock Depredations on 6 different Farms.






**Wolves captured at depredation sites were relocated across the state prior to 2003, but since then have mostly been euthanized especially when wolves were delisted.**

Wolves Captured and Killed for Depredation Management by WDNR - USDA/WS,  
1974 - 2019 (405 Captured, 336 Killed)






# Impact of Lethal Controls on the State Wolf Population.

- When Lethal Controls are authorized, generally <8% of the wolf population are removed.
- Generally < 15% of state wolf packs are involved in livestock or pet dog depredations, thus only a small percent of packs are exposed to controls.
- During periods when Lethal Controls were applied, the Wolf Population continued to grow in Wisconsin.
- Targeted Lethal Controls have been applied to many Wolf Population across the North America and none have endangered Wolf Populations.
- Generally an Integrated Approach using a mixture of Lethal and Nonlethal Controls are most effective in reducing Wolf Depredation on Livestock





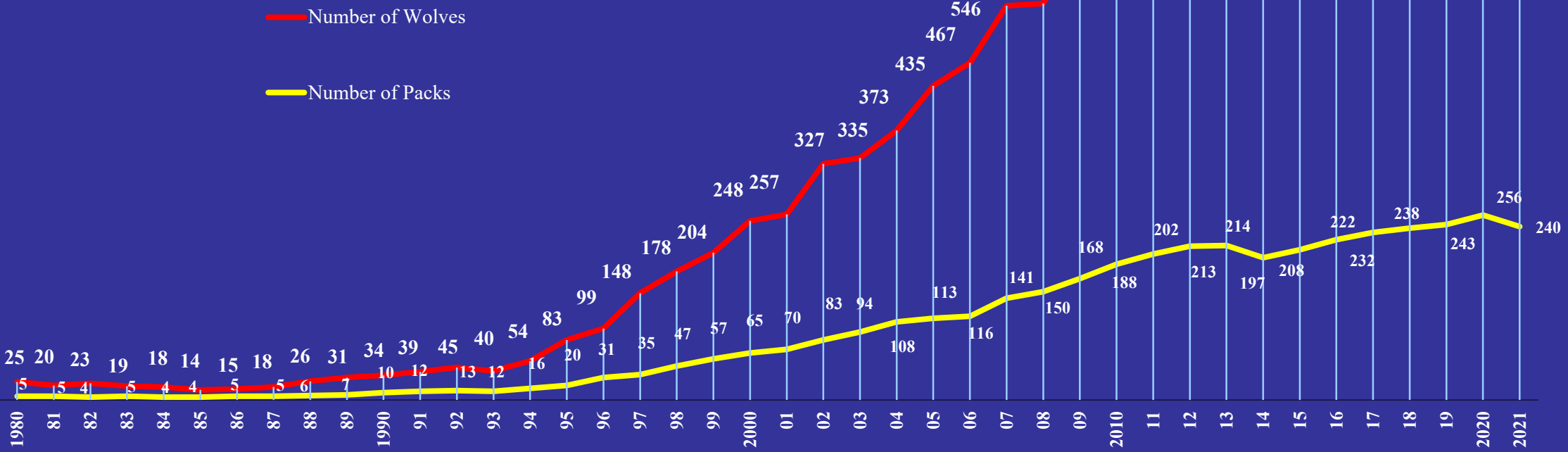
# **Does the WI DNR know how many wolves live in the state, or are their more than DNR demonstrates by surveys?**

- **Between 1980 through 2020 the WI DNR has annually reported minimum wolf counts, with territory mapping in the state, with population ranging from 14 to 1034 wolves.**
- **These represent the minimum number of wolves detected in the state through track surveys, aerial telemetry, and verified wolf observations.**
- **Counts were done in mid or late winter when the population is a the low point of the annual cycle**

# Minimum Counts of the Wisconsin Gray Wolf Population 1980-2021

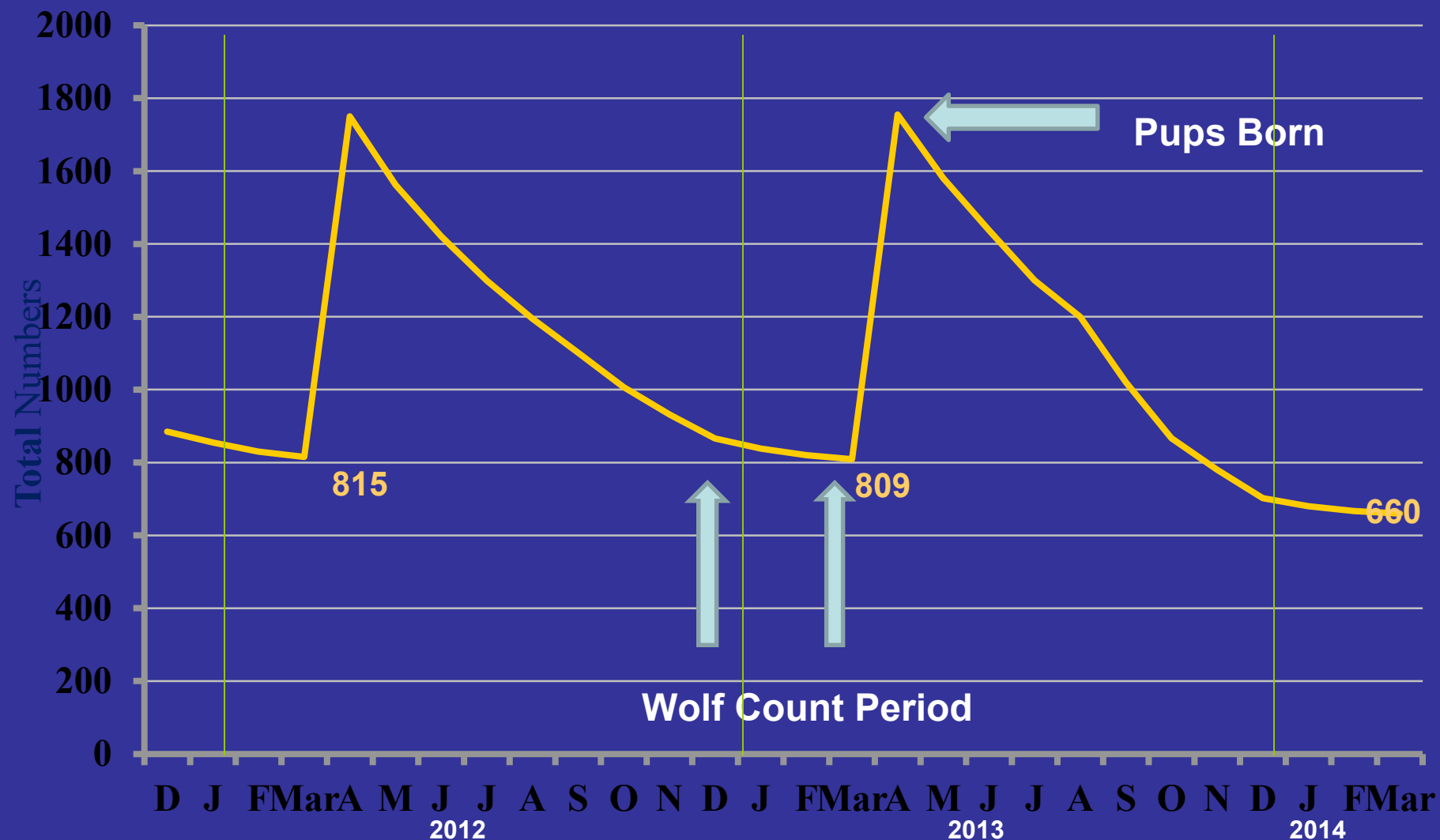
## Changes in Wisconsin Gray Wolf Population: 1980-2020

(Minimum counts for late winter; 2021 values are estimates)





# Annual Cycle of Wolf Population in Wisconsin

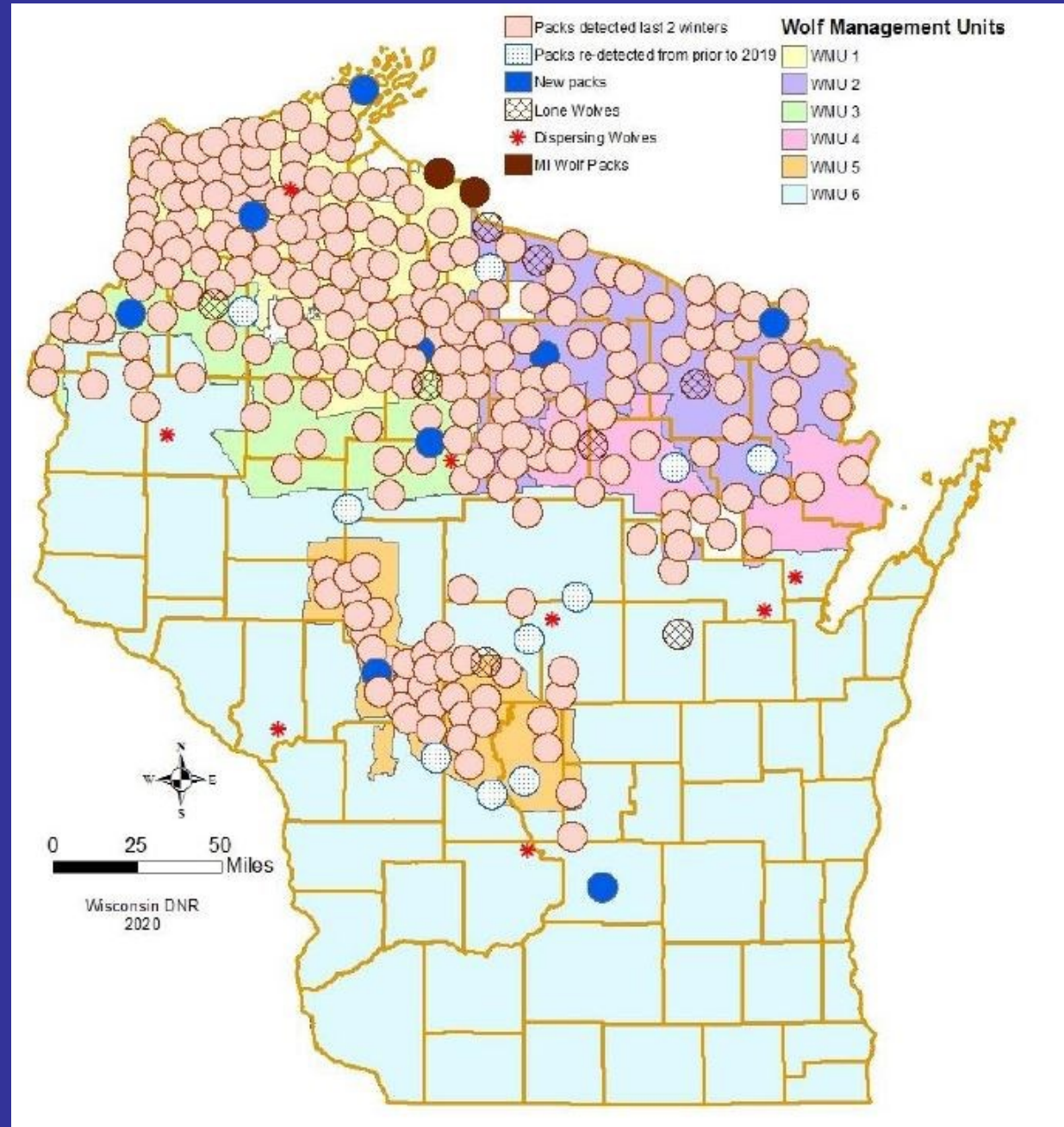


## Wolves Detected in Wisconsin in winter 2019-2020

### Wolf Packs occurring in Wisconsin in 2020

Circles of pink, blue, brown and dotted represent packs with  $\geq 2$  wolves, and circles with crosshatching represent territories with lone wolves.

This is the last year for the territory mapping, minimum counting system. Future maps will only show the broad wolf range, but not individual territories.



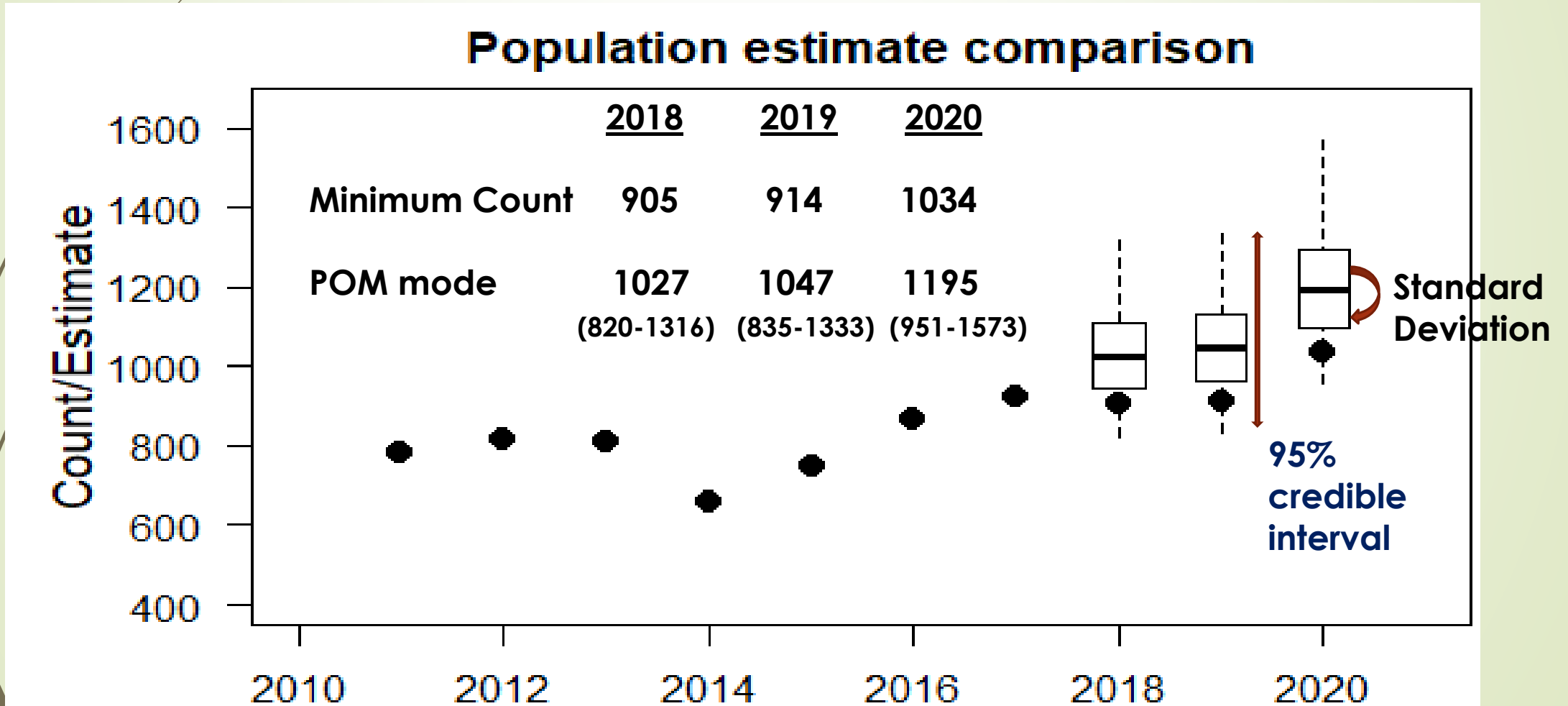




## **In 2020 the WI DNR shifted from minimum counts to population estimations with statistical modeling through patch occupancy modeling (POM)**


- **The new system continues to rely on snow track surveys and verified observations to determine occupied wolf range and average pack size.**
- **POM uses GPS collared wolves to determine average territory size.**
- **POM makes statistical estimates for possible wolves not detected and areas under-surveyed**
- **POM provides credible intervals around mode measurements to measure levels of uncertainty in the population estimates.**

# Patch Occupancy Modeling of the Wisconsin Gray Wolf Population; Mode (Horizontal Line) vs. Minimum Counts (Dots).





# Value of Patch Occupancy Modeling vs. Minimum Counting System

- ▶ Minimum counts are more suited for small populations of a few hundred animals, while POM is more suited for larger populations approaching a 1000 or more animals.
  - ▶ POM can provide measure of uncertainty
  - ▶ Modes of POM average 14.5% higher than minimum counts, but minimum counts do fall within the 95% credible interval.
  - ▶ Both estimates probably undercount lone wolves traveling outside wolf range across the state.
- 





# Do WI DNR Wolf Surveys provide reasonable estimates of wolves living in the State?

- The estimates are reasonable estimates of wolves living in wolf range in late winter, with POM more likely capturing the actual numbers of wolves in Wisconsin
- Neither method adequately accounts for lone wolves traveling across the rest of the state, but these generally represent only a small number of animals that are traveling over large areas.
- All wildlife population estimates include levels of uncertainty, but the wolf estimate provide reasonable levels of information on wolf numbers to conserve and manage wolves in the state.

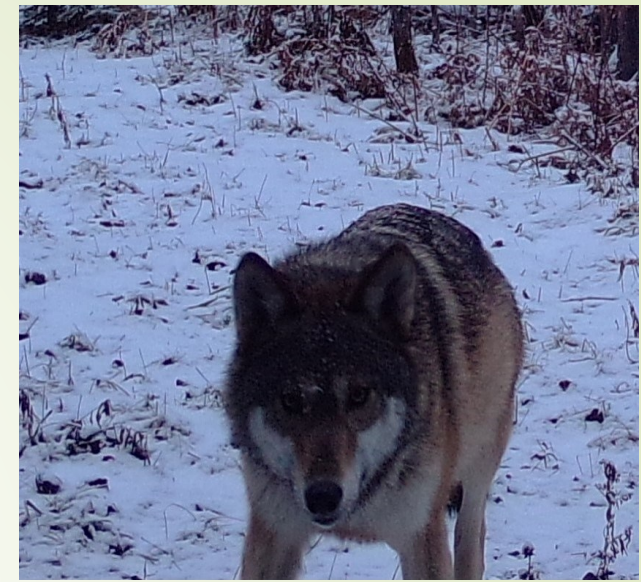


# What the Numbers Tell us about Wolves in Wisconsin

- The wolf population is not exploding but seems to be stabilizing
- Wolves are only one of many mortalities on the deer population, and healthy populations of deer continue to live in northern Wisconsin
- While wolves are a risk factor to hunting dogs in summer, rates of attacks on pet dogs are low.
- Costs of wolf depredation payments have mostly stabilized
- Wolves can be hunted at sustainable levels, but other factors need to also be considered in planning wolf hunts.
- Targeted lethal controls will not endanger the state wolf population
- WI DNR has good estimates on wolf numbers in winter within areas occupied by wolf packs.

## Sharing the Land with Wolves:

- Don't feed wolves or feed pets outside in wolf areas.
- Avoid feeding deer in areas that might attract wolves.
- Don't allow dogs to run at large in wolf areas.
- Turn lights on and accompany dogs going outside after dark.
- Avoid den or wolf kill sites with dogs.
- Learn wolf sign, tracks and scats and other sign.
- Don't leave carcasses of dead animals exposed at home or at farm sites.
- Stand tall and be aggressive to any wolf not showing normal fears.
- Report any bold or tame acting wolves to WDNR





# Questions ?

**Adrian Wydeven**

**[adrianwydeven@cheqnet.net](mailto:adrianwydeven@cheqnet.net)**

**Karen Mesmer**

**[klmesmer@gmail.com](mailto:klmesmer@gmail.com)**

**wigreenfire.org**

**Wisconsin' Green Fire**

