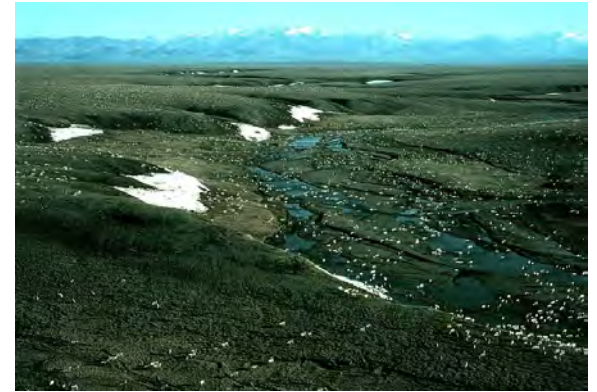
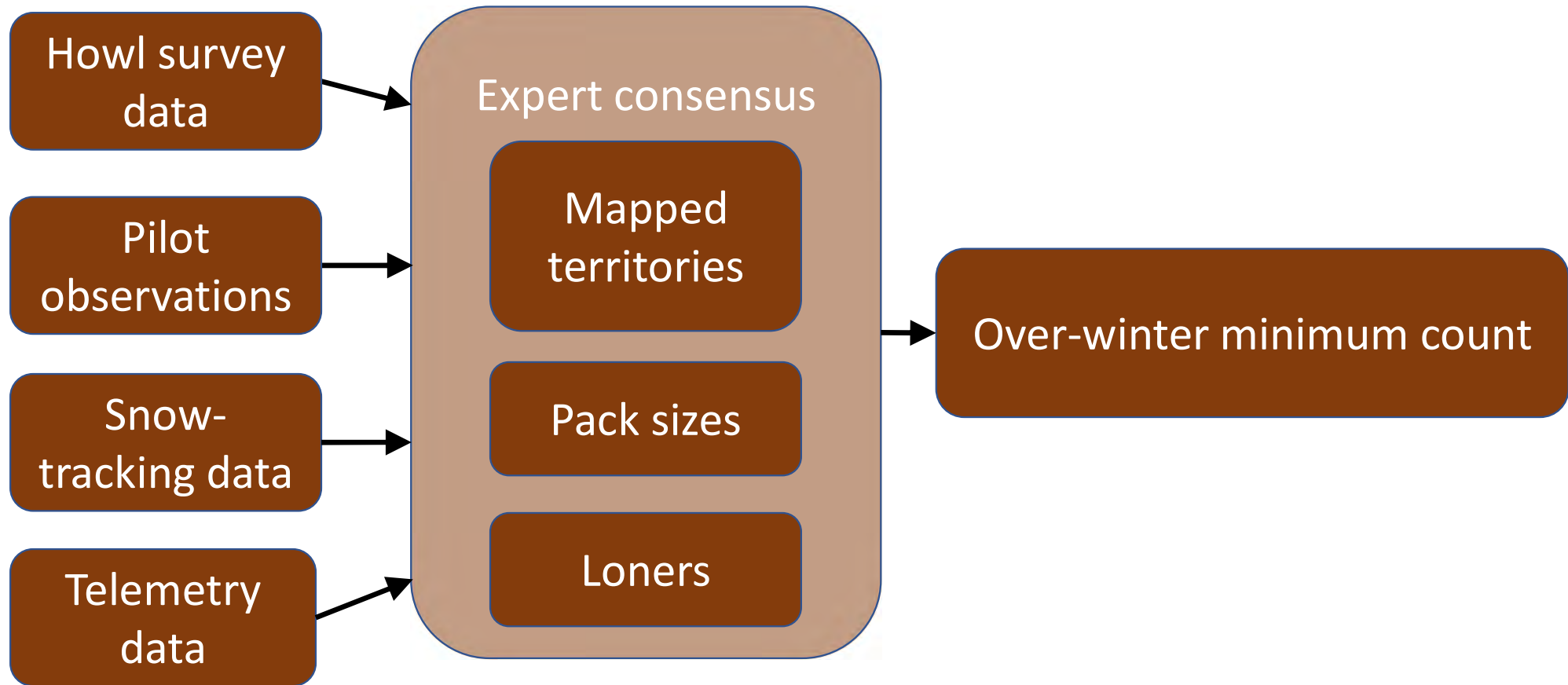


Wildlife populations

- Getting a census is hard, often impossible
- Estimate, or describe, using a model
- Many different kinds of models

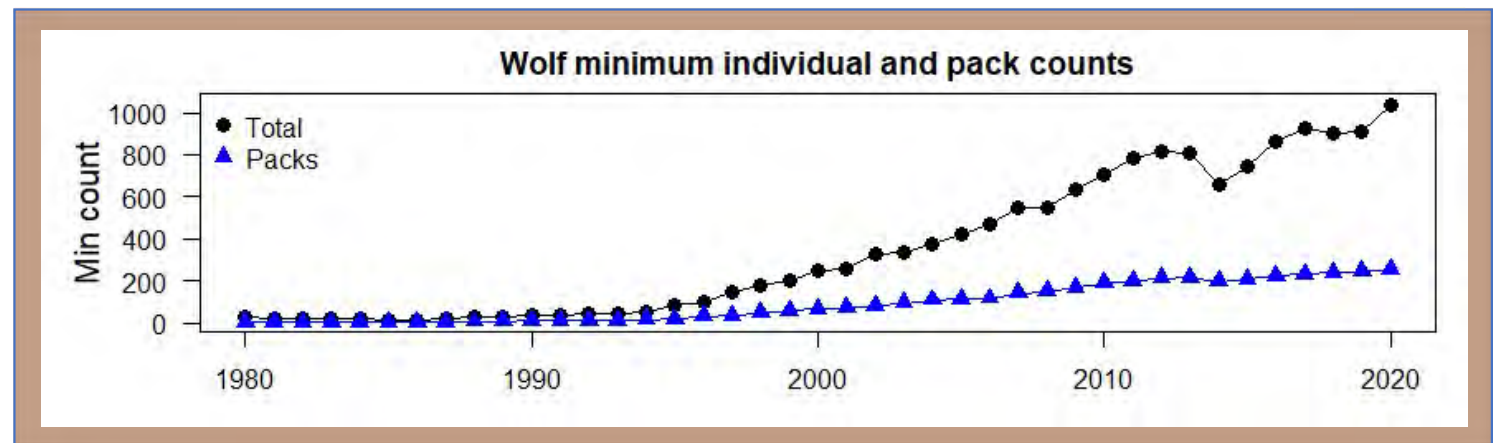
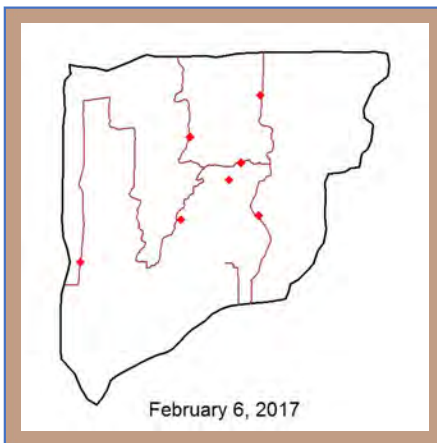


Wolf territory mapping model



Wolf territory mapping model

- Over-winter minimum count, not a total population estimate
- Min/max bounds, but no estimate of uncertainty
- Current and historical information to assign tracks to packs



The goal was to identify a method that would:

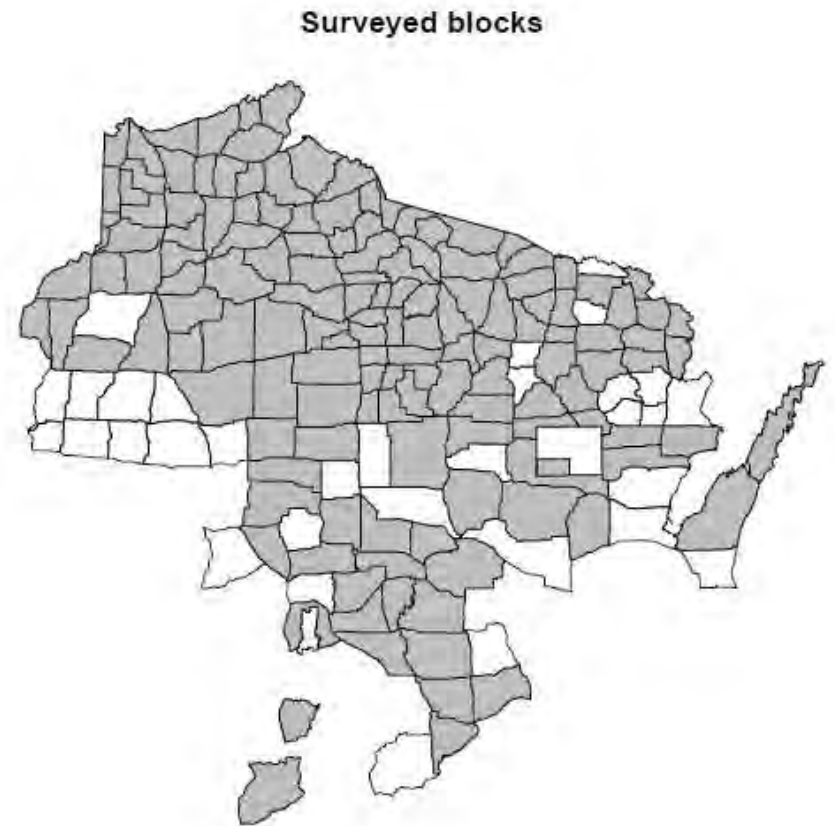
1. Produce reliable estimates
2. Provide realistic measures of uncertainty
3. Efficiently use state resources

Estimating wolf population abundance

1. Define pack-occupied core range
2. Produce intermediate estimates
 1. Area occupied in each zone
 2. Zone-specific average pack sizes
 3. Range-wide average pack territory size
3. Use intermediate estimates to produce range-wide and zone-specific abundance estimates

Defining pack-occupied wolf range: what and why?

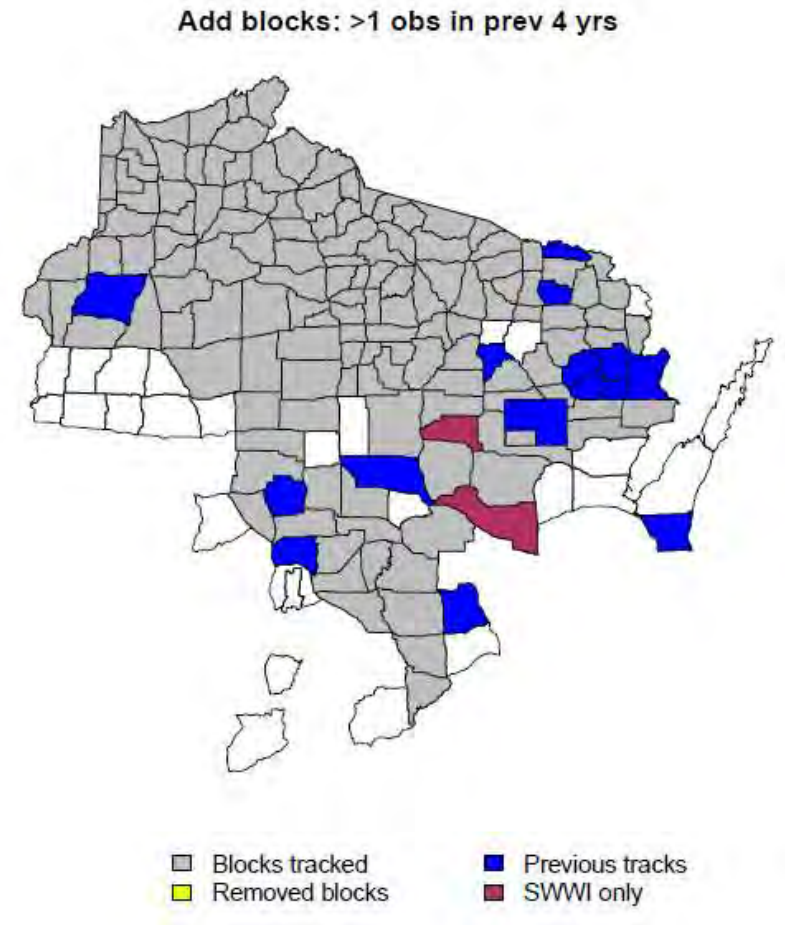
- Area of inference for the “statewide” population estimate
- Not all blocks are surveyed every year
- Model uses covariate information to estimate wolves



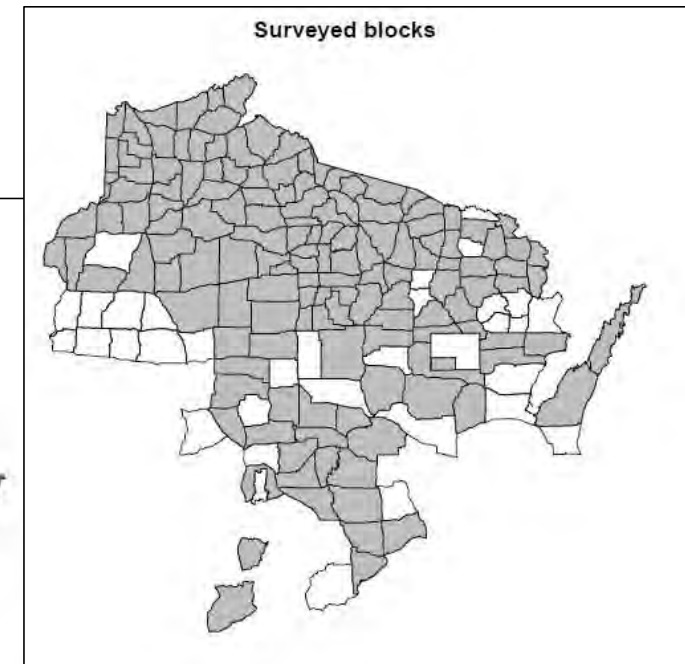
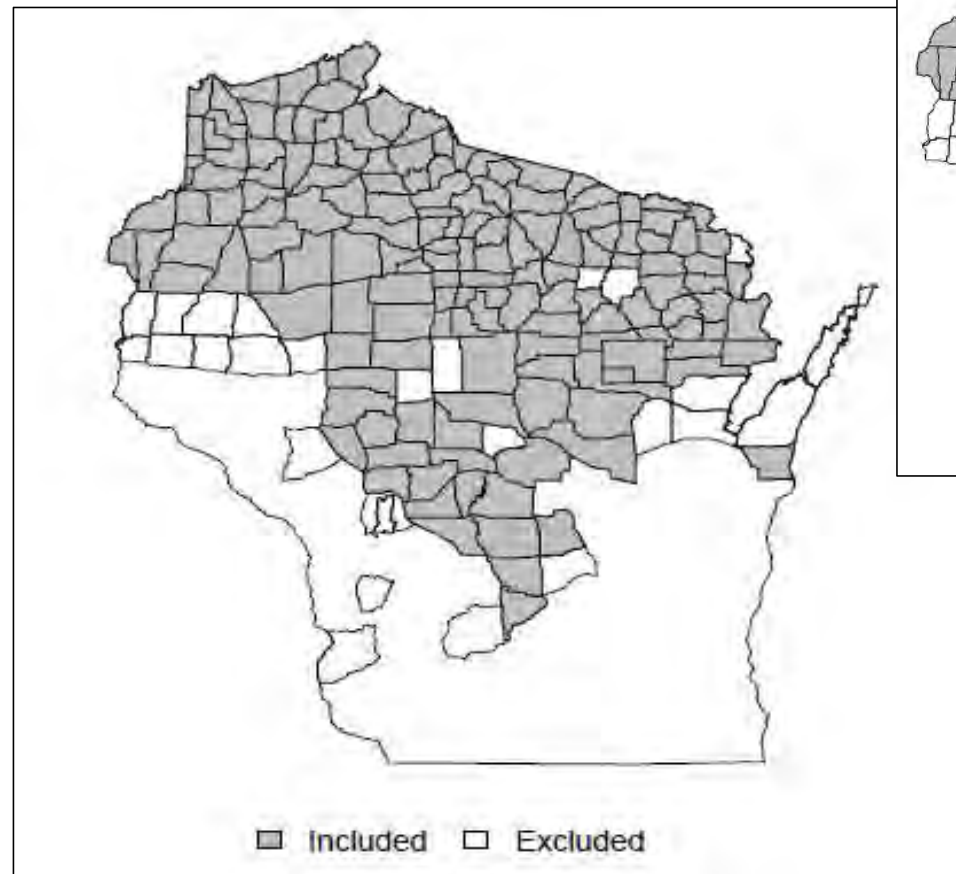
Criteria for inclusion

Include blocks that meet any of the following criteria during the previous 4 tracking seasons (2016-17, 2017-18, 2018-19, 2019-20):

- Tracks from two or more wolves were observed during a single survey
- Wolf tracks were observed within a block during ≥ 2 separate surveys
- OR confirmed evidence of pack activity



Core range, 2020 – 2021



Occupancy approach

$$\hat{N} = \frac{\text{Total area occupied}}{\text{Average territory size}} \times \text{Average pack size}$$



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Scaling Occupancy Estimates up to Abundance for Wolves

Glenn E. Stauffer Nathan M. Roberts, David M. Macfarland, Timothy R. Van Deelen

First published: 28 July 2021 | <https://doi.org/10.1002/jwmg.22105>



SECTIONS

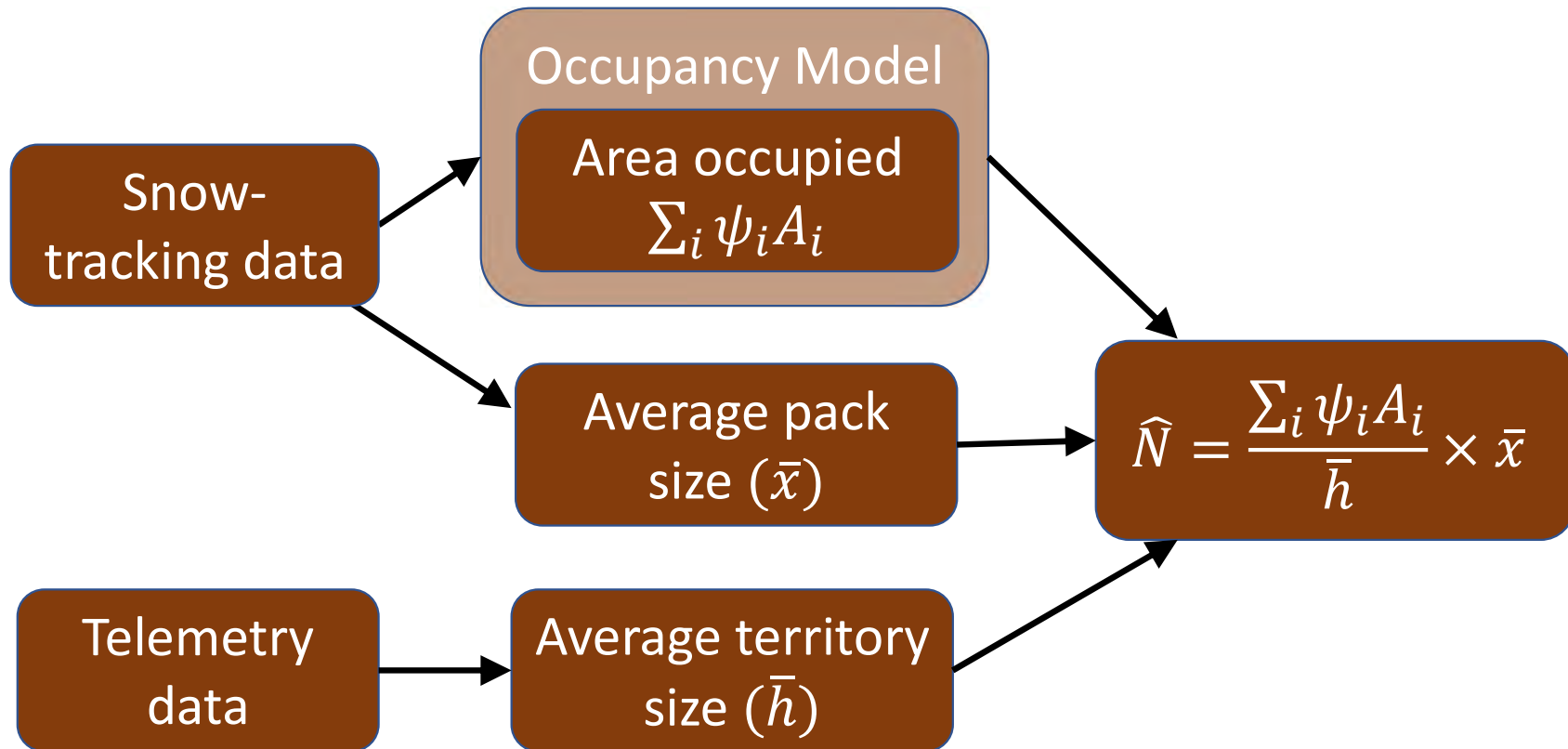
PDF TOOLS SHARE

ABSTRACT

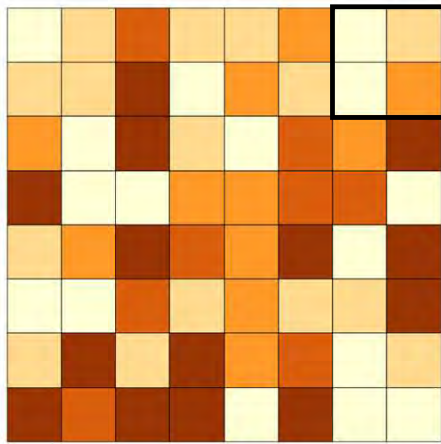
Management of wildlife populations often requires reliable estimates of population size or distribution. Estimating abundance can be logistically difficult, and occupancy models have been used as a less expensive proxy for abundance estimation. Another alternative is to use independent estimates of home-range size and mean group size to directly scale occupancy estimates up to abundance. We used simulations to explore when scaling occupancy up to abundance is reliable, and as an example we applied an occupancy approach to estimate abundance of wolves (*Canis lupus*) from roadside snow-tracking

Occupancy approach

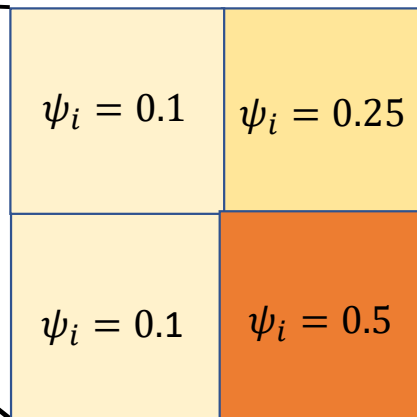
$$\hat{N} = \frac{\text{Total area occupied}}{\text{Average territory size}} \times \text{Average pack size}$$



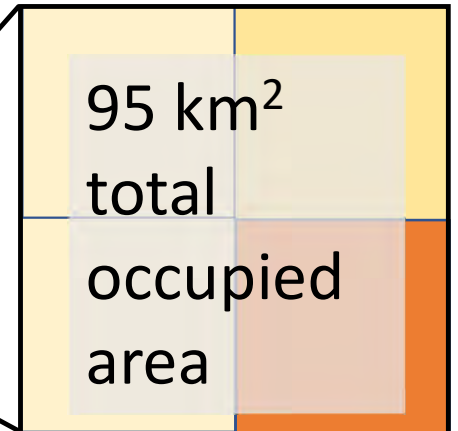
Occupancy approach - example



100 km² cells: estimate ψ_i

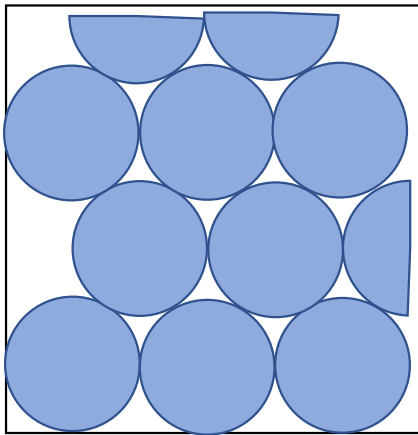


$$\sum_i \psi_i A_i = 100 \text{ km}^2 \times 0.95 =$$



Occupancy approach - example

Let $\bar{x} = 4$, and $\bar{h} = 10$



Multiply by \bar{x} to
estimate \hat{N}



$$\begin{aligned}\hat{N} &= 9.5 \text{ packs} \\ &\times 4 \text{ wolves/pack} \\ &= 38 \text{ wolves}\end{aligned}$$

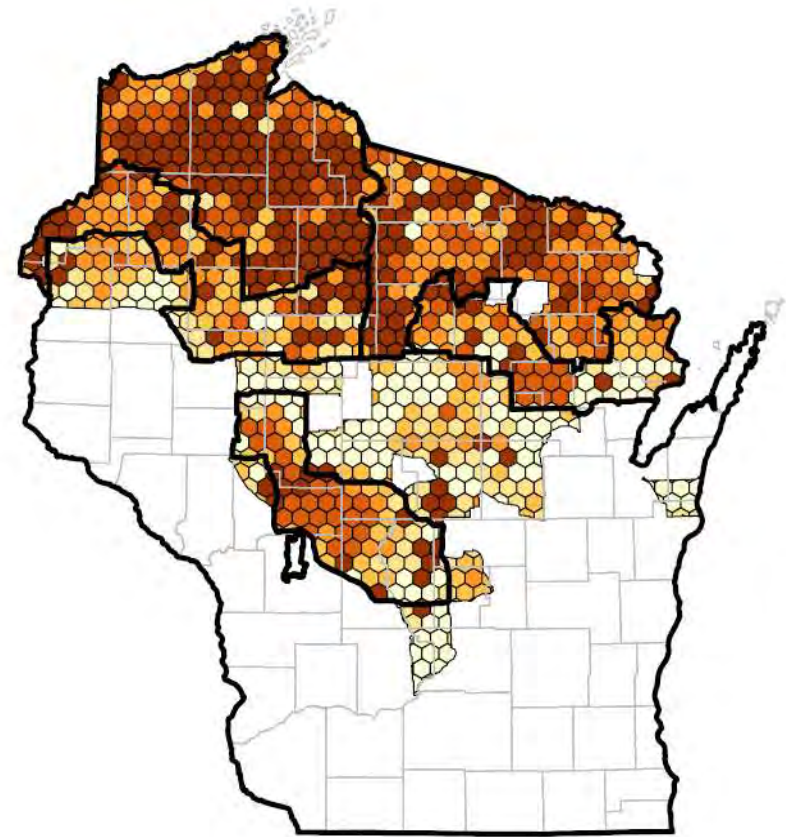
$$\begin{aligned}95 \text{ km}^2 &\div 10 \text{ km}^2 \text{ per pack} \\ &= 9.5 \text{ packs}\end{aligned}$$

With uncertainty in all estimates...

Occupancy probabilities for pack-occupied wolf range, 2020-2021

Zone	Mean	SE
1	4.48	0.201
2	4.11	0.325
3	4.04	0.353
4	3	0.447
5	3.3	0.367
6	2.79	0.422

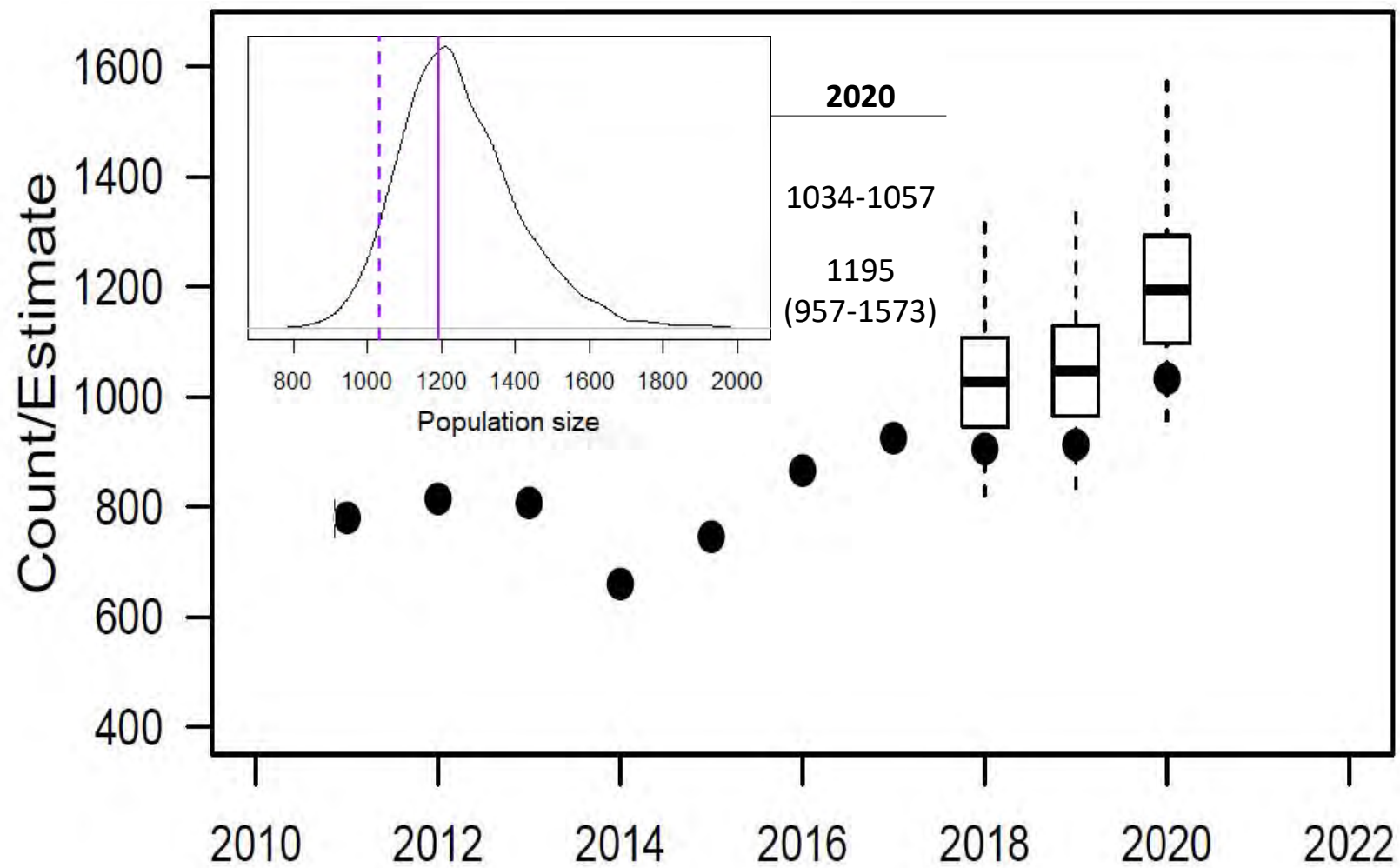
Average home range size
164.3 km² (SE=12.85)



Occupancy Probability

0-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-0.95	>0.95
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Population estimate comparison



Occupancy modeling approach

1) Produce reliable estimates

- Robust, accounts for detection probability
- No need to map all pack territories
- Approach has been peer-reviewed

2) Provide more realistic measures of uncertainty

- Uncertainty in intermediate and final estimates

3) Efficiently use state resources

- Cost-effective for large populations and areas



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- Wisconsin DNR
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- Jane Wiedenhoeft, Shannon McNamara

