Estimating Bear Numbers in Florida

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Image courtesy of S. Uffman

Background

DNA mark-recapture revolutionized bear population estimation

- Cost-effective (traditional M-R >4x more costly)
- Estimation of N, population growth, survival,...

But, logistically infeasible over large geographic areas

- >4 traps/home range results in large numbers of traps and hair samples

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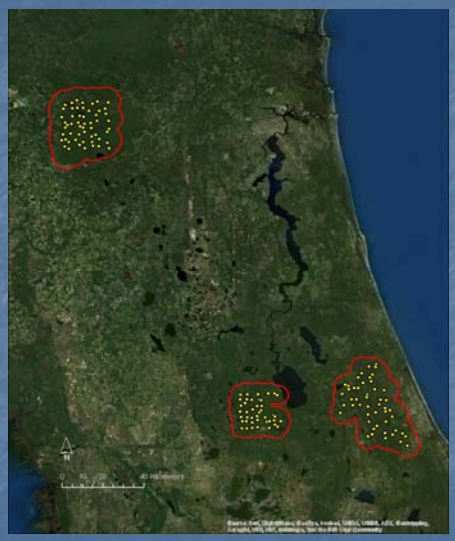
Simek et al. 2005

- Estimated bear abundance on 6 study areas and extrapolated densities to rest of the primary ranges
- But, difficult to know area sampled
- Assumes densities consistent across larger study area



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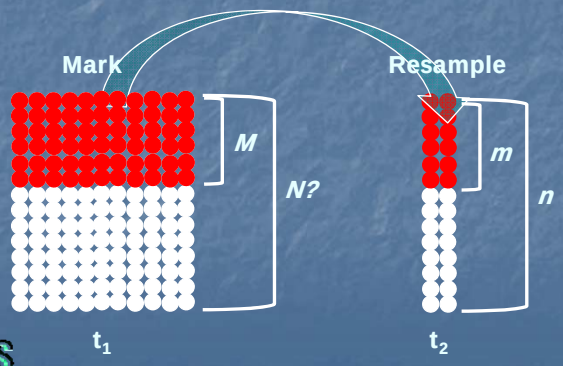
Spatially explicit capture-recapture explained (sort of)

Ex., marbles in a jar



$$p = \frac{m}{n}$$

$$N = \frac{M}{p}$$

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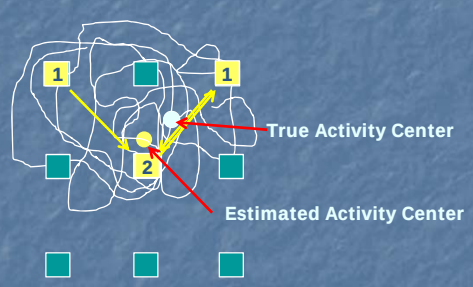
Previous method assumes all animals have equal probability of capture (bears are not marbles in a jar)

Now, consider a bear and a hair trap

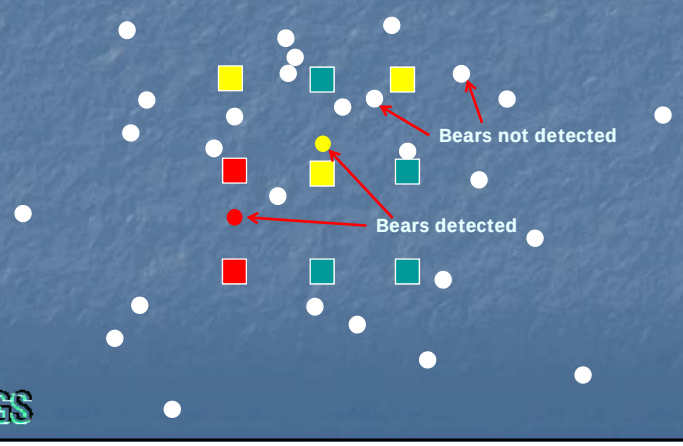
- Capture probability (p) a function of the distance the animal center of activity is from the trap

With multiple traps of known locations, can estimate the location of the activity center

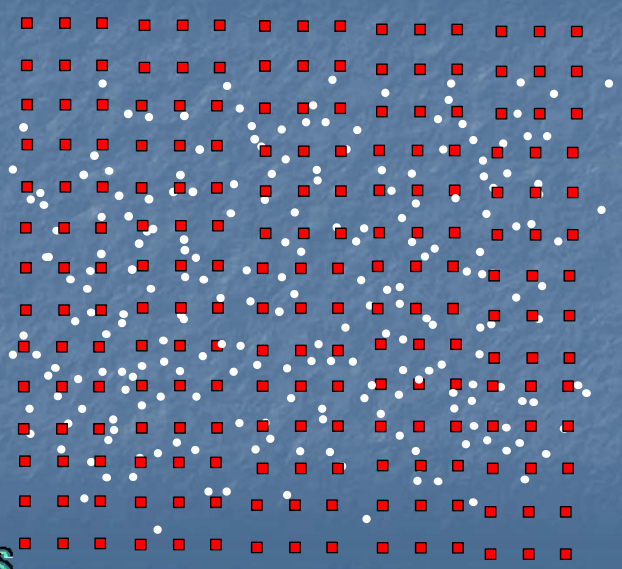


And, assuming a random spatial distribution of bears on the landscape, we can estimate the number *and location* of all bears that have access to the grid

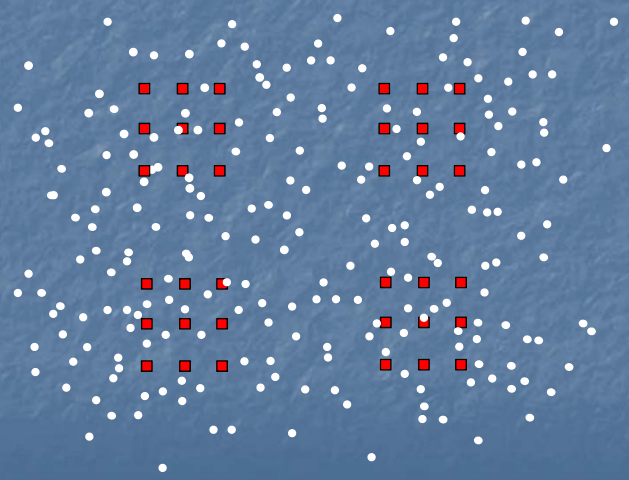
- This can be directly interpreted as density (bears/km^2)



- No expectation that all animals have access to a trap; i.e., the sampling grid can have holes



And density can be estimated in areas *not* sampled allowing for more cost-efficient trapping designs, assuming homogeneity …



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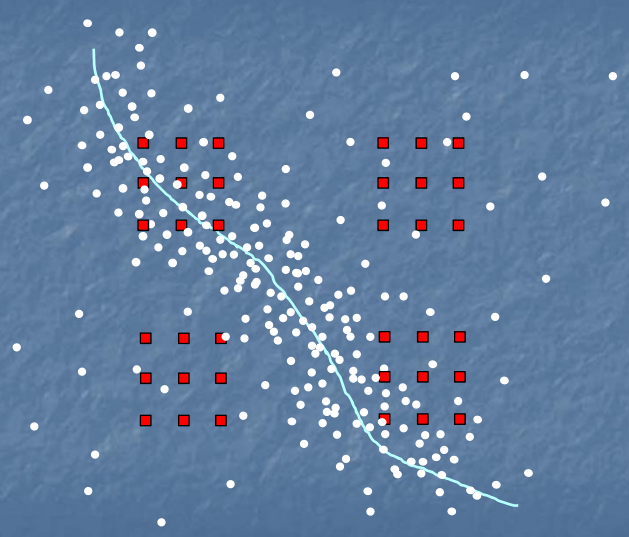
Or using habitat covariates …



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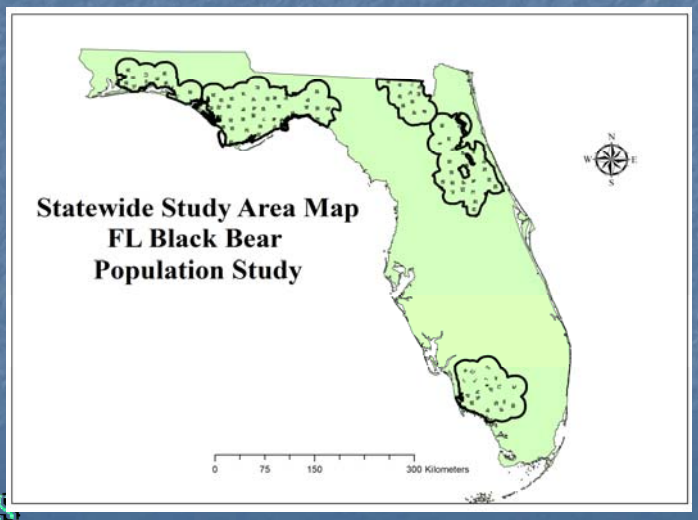
2001-2003 Study

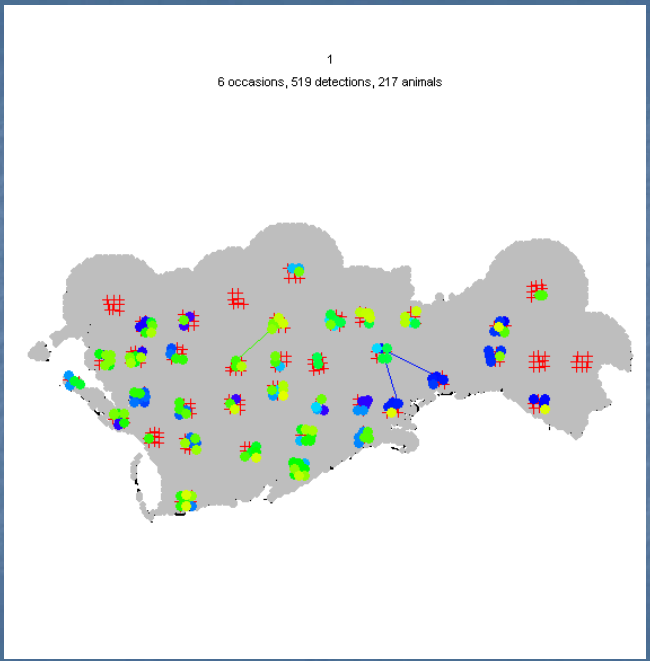
- Hair snares, DNA extraction
- Non-spatial methods

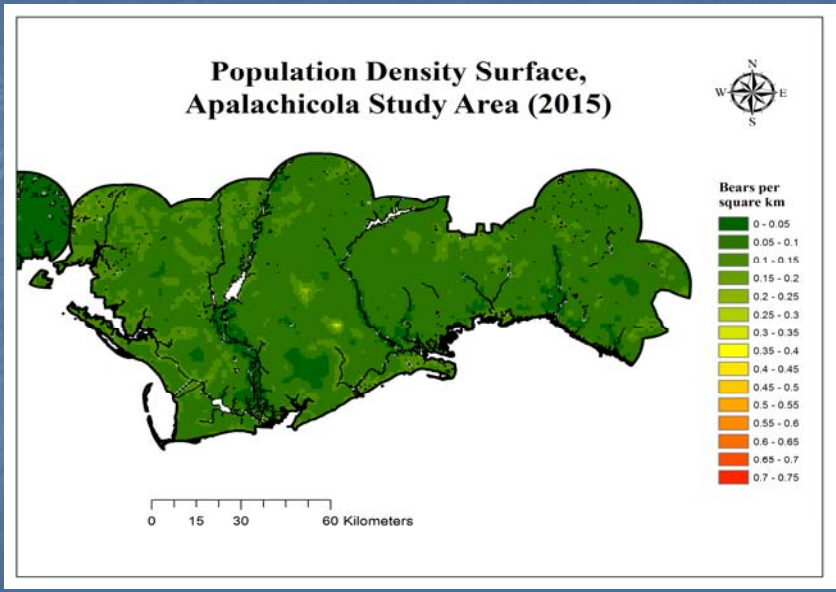
2014-15 Study

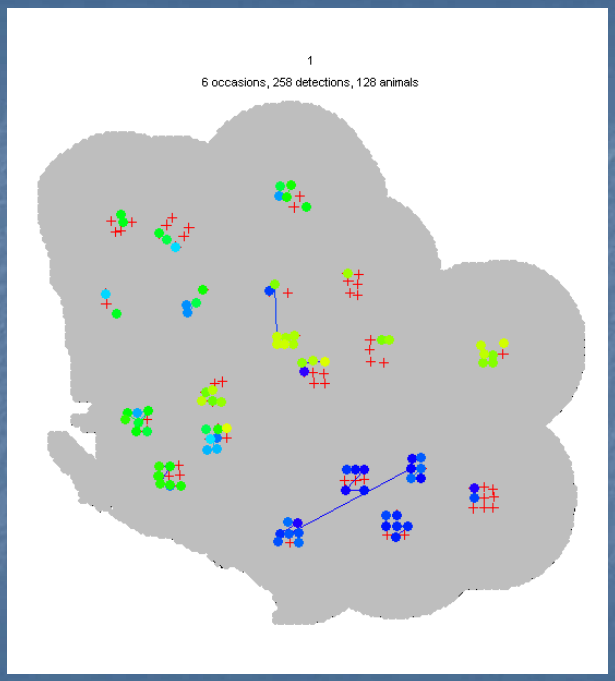
- Spatially explicit methods
- 3x3 trapping grids, 16 km apart, traps 2 km apart, 6 weeks of sampling

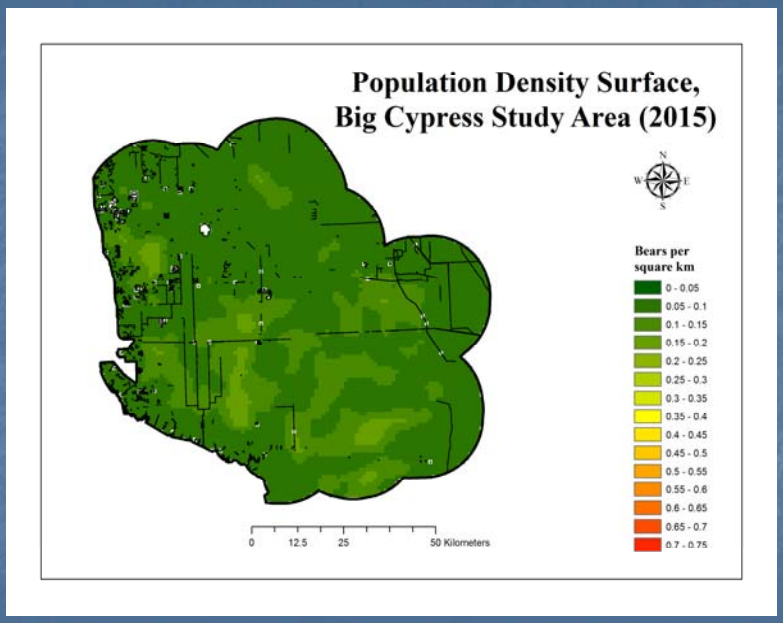
Florida Bear Population Assessment

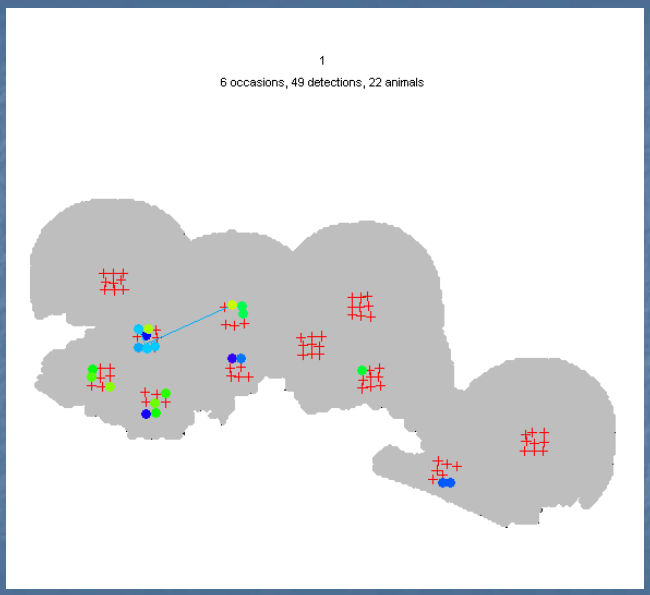


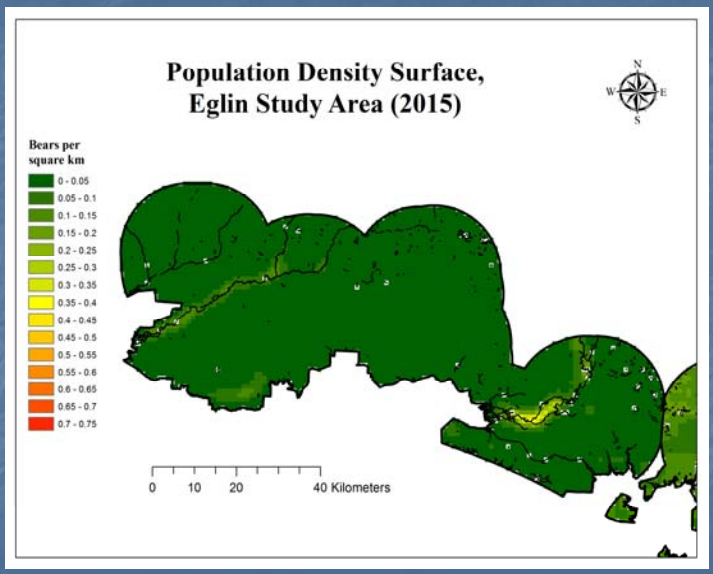

1
6 occasions, 519 detections, 217 animals


Population Density Surface,
Apalachicola Study Area (2015)
N
W
E
S
Bears per square km
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 - 0.55
0.55 - 0.6
0.6 - 0.65
0.65 - 0.7
0.7 - 0.75
0 15 30 60 Kilometers

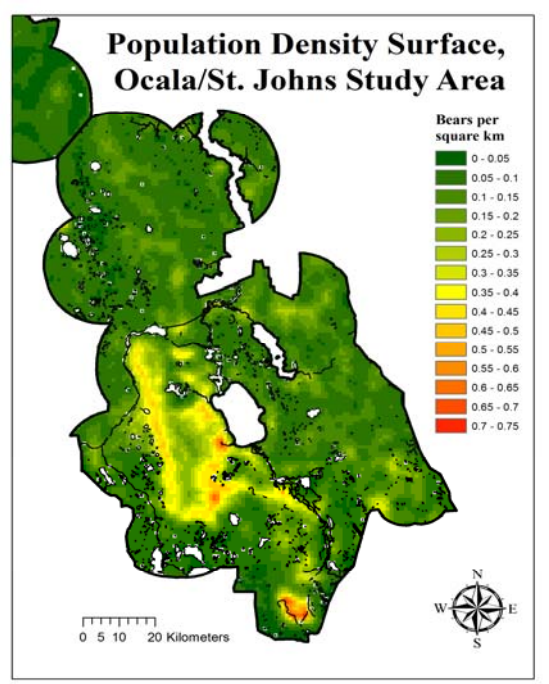

1
6 occasions, 258 detections, 128 animals

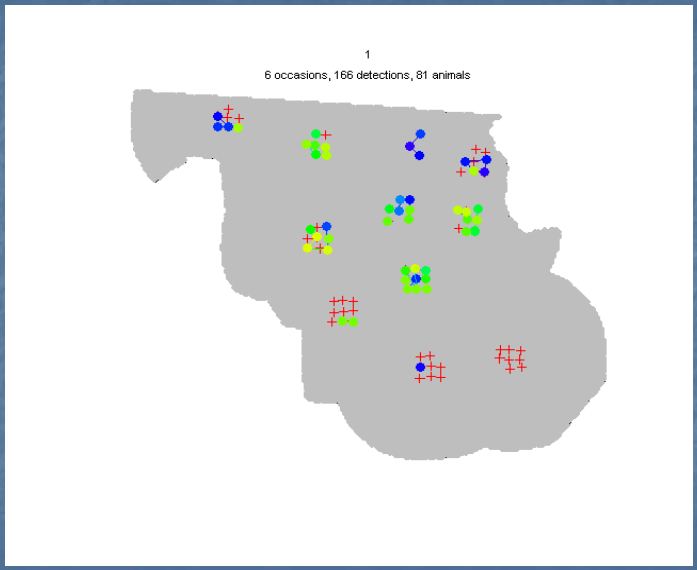

Population Density Surface,
Big Cypress Study Area (2015)
N
W
E
S
Bears per
square km
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 - 0.55
0.55 - 0.6
0.6 - 0.65
0.65 - 0.7
0.7 - 0.75
0
12.5
25
50 Kilometers

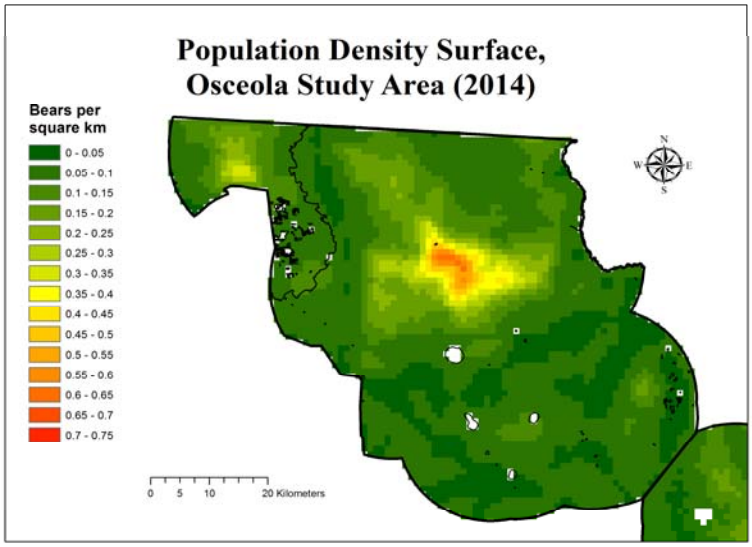

1
6 occasions, 49 detections, 22 animals


Population Density Surface,
Eglin Study Area (2015)
N
W
E
S
Bears per
square km
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 - 0.55
0.55 - 0.6
0.6 - 0.65
0.65 - 0.7
0.7 - 0.75
0
10
20
40 Kilometers

1
6 occasions, 590 detections, 264 animals


Population Density Surface,
Ocala/St. Johns Study Area
Bears per square km
0 - 0.05
0.05 - 0.1
0.1 - 0.15
0.15 - 0.2
0.2 - 0.25
0.25 - 0.3
0.3 - 0.35
0.35 - 0.4
0.4 - 0.45
0.45 - 0.5
0.5 - 0.55
0.55 - 0.6
0.6 - 0.65
0.65 - 0.7
0.7 - 0.75
0 5 10 20 Kilometers
N
W
E
S





~616 bears on 1 million ac

Preliminary Estimates

Apalachicola
- 0.082 bears/km^2 (0.063-0.105)
- 1,076 bears

Big Cypress
- 0.144 bears/km^2 (0.104-0.201)
- 1,152 bears

Eglin
- 0.029 bears/km^2 (0.012-0.066)
- 139 bears

Ocala/St. Johns
- 0.100 bears/km^2 (0.083-0.120)
- 1,226 bears

Osceola
- 0.104 bears/km^2 (0.063-0.180)
- 616 bears

Total over 5 areas (excluding cubs)
- ~4,200 bears on 9.6M ac

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Conclusions

- Method successful and an improvement over earlier methods in terms of both cost and accuracy
- Estimates difficult to compare across studies but overall numbers appear to have increased since 2003
- Abundance/density estimates much better than what most other states have and some are appropriating this methodology
- Assumptions that animals distributed according to habitat covariates, trap placement unbiased, no animals permanently leaving or dying, estimate does not include cubs
- Work ongoing, time-consuming process

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Acknowledgements

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