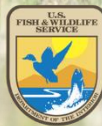


# Interagency Grizzly Bear Study Team Research and Monitoring Summary 2022



# Study Team Members

Justin Clapp (WGFD)

Hilary Cooley (FWS)

Cecily Costello (MTFWP)

Jennifer Fortin-Noreus (FWS)

Matthew Gould (USGS)

Kerry Gunther (NPS)

Mark Haroldson (USGS)

Pat Hnilicka (FWS)

Curtis Hendricks (IDFG)

Jeremy Nicholson (IDFG)

Jeremiah Smith (MTFWP)

Dan Thompson (WGFD)

Dan Tyers (USFS)

Frank van Manen (USGS)

Kate Wilmot (NPS)



# Overview

- Estimate of females with cubs and trend
- Occupancy by females with young
- Mortalities
- Additional data

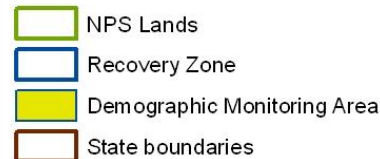
**This information is preliminary and is subject to revision.** It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information

# Greater Yellowstone Ecosystem

National Parks = 10,344 km<sup>2</sup>

Primary Conservation Area/Recovery Zone = 23,828 km<sup>2</sup>

Demographic Monitoring Area (DMA) = 49,931 km<sup>2</sup>



Preliminary Information-Subject to Revision. Not for Citation or Distribution.

# Greater Yellowstone Ecosystem

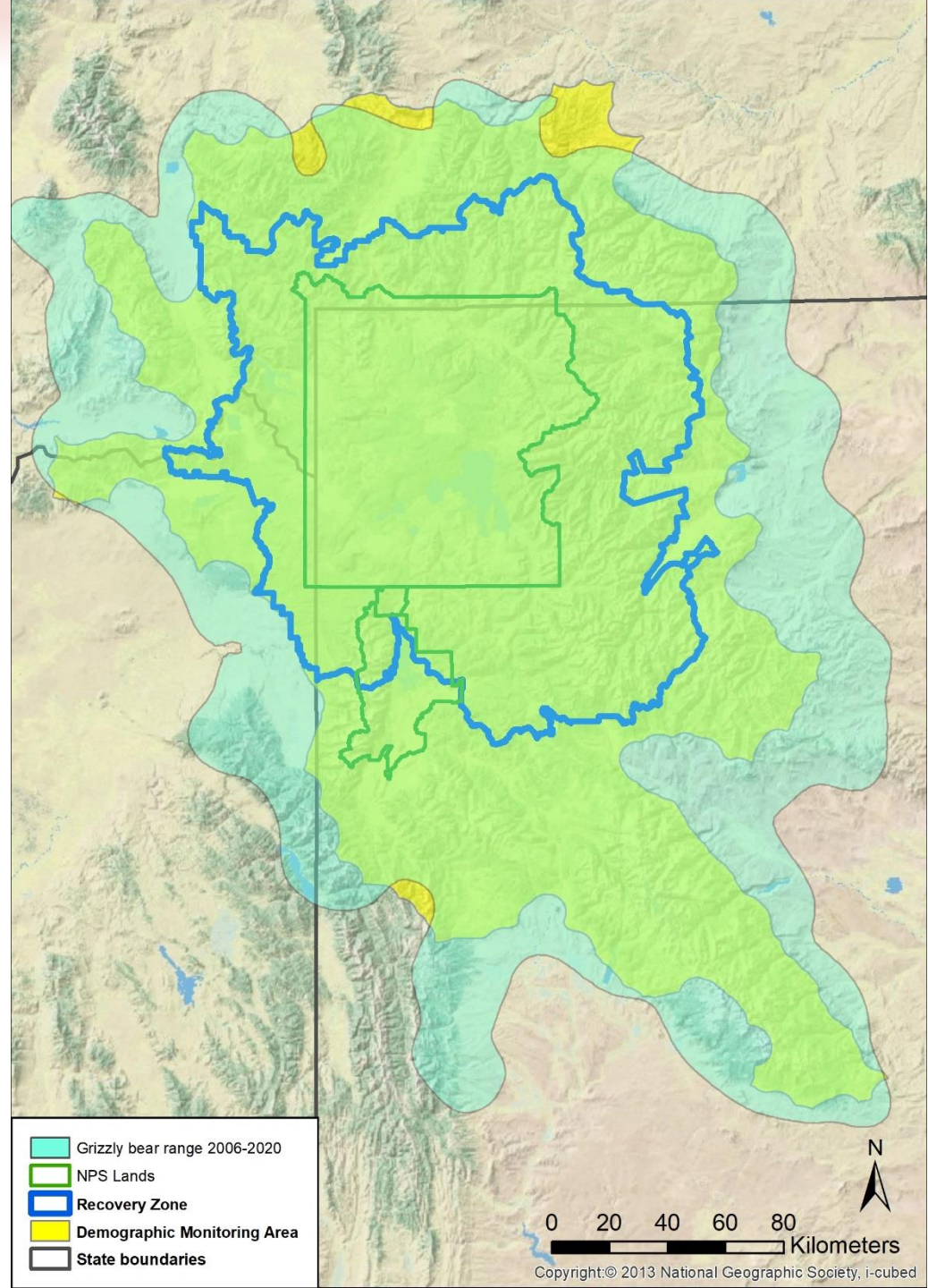
National Parks = 10,344 km<sup>2</sup>

Primary Conservation Area/Recovery Zone = 23,828 km<sup>2</sup>

Demographic Monitoring Area (DMA) = 49,931 km<sup>2</sup>

Occupied range (2006-2020) = 70,468 km<sup>2</sup>

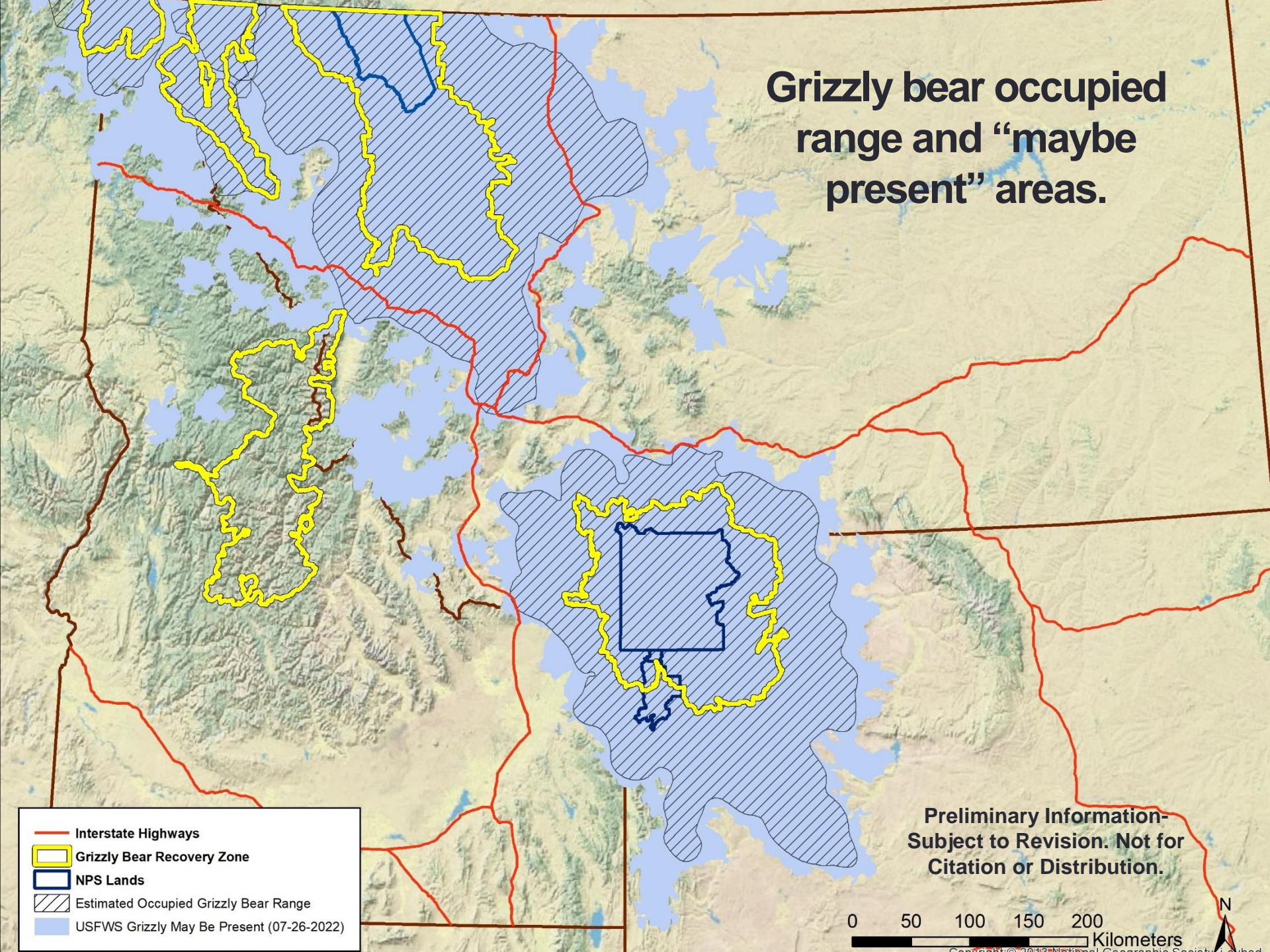
2022 update available in 2023



- Grizzly bear range 2006-2020
- NPS Lands
- Recovery Zone
- Demographic Monitoring Area
- State boundaries

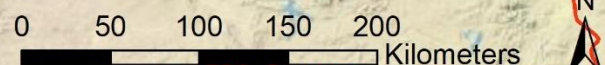
0 20 40 60 80 Kilometers  
Copyright © 2013 National Geographic Society, i-cubed

# Grizzly bear occupied range and “maybe present” areas.



- Interstate Highways
- ▭ Grizzly Bear Recovery Zone
- ▭ NPS Lands
- ▨ Estimated Occupied Grizzly Bear Range
- ▭ USFWS Grizzly May Be Present (07-26-2022)

Preliminary Information-  
Subject to Revision. Not for  
Citation or Distribution.



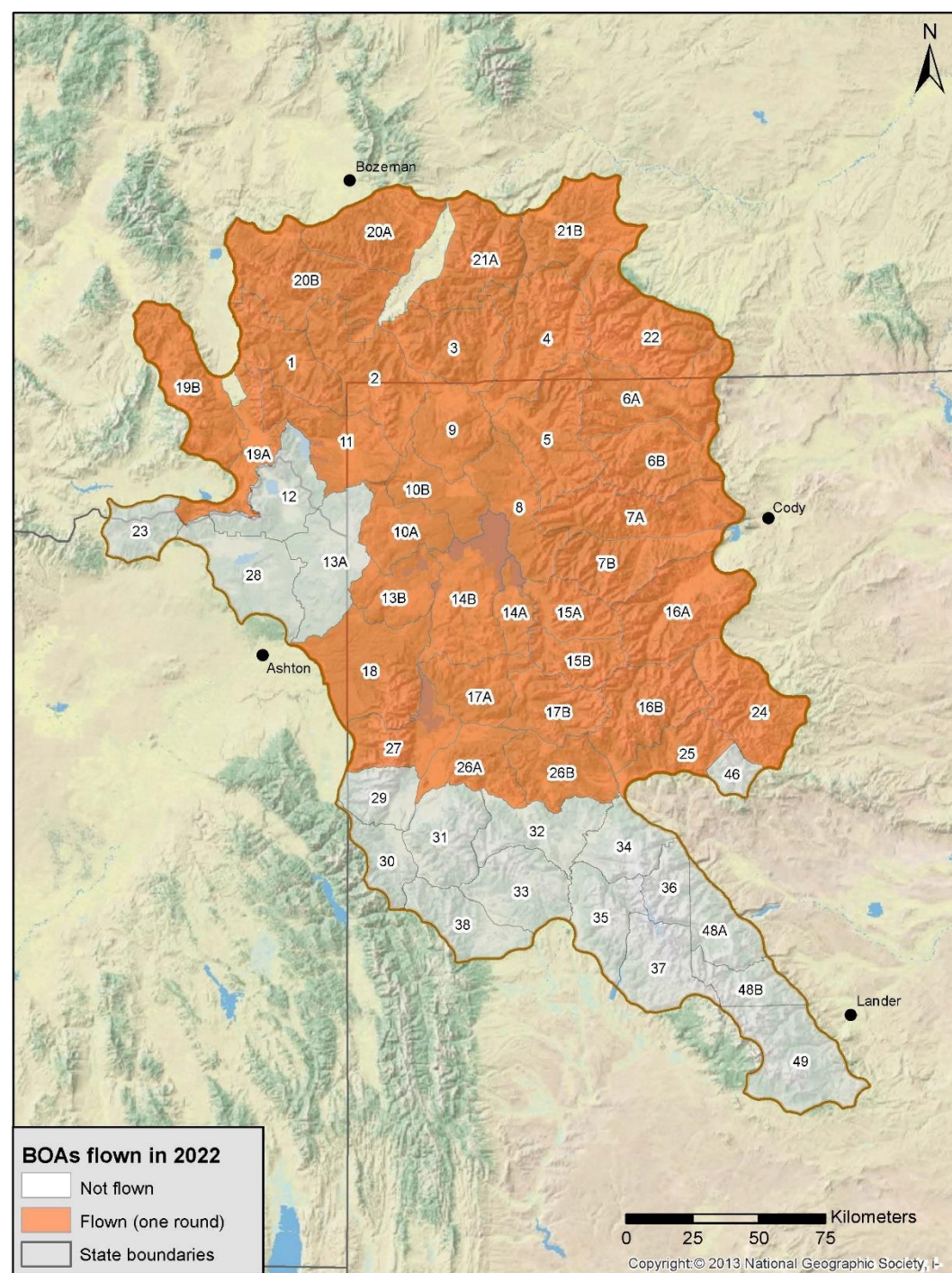
# Demographic Recovery Criterion #1: Females with Cubs and Population Size



*Photo: J. Davis*

# Observation flights 2022

- 36 units flown
- 18 units not flown
- One flight per unit



Preliminary Information-Subject to  
Revision. Not for Citation or Distribution.



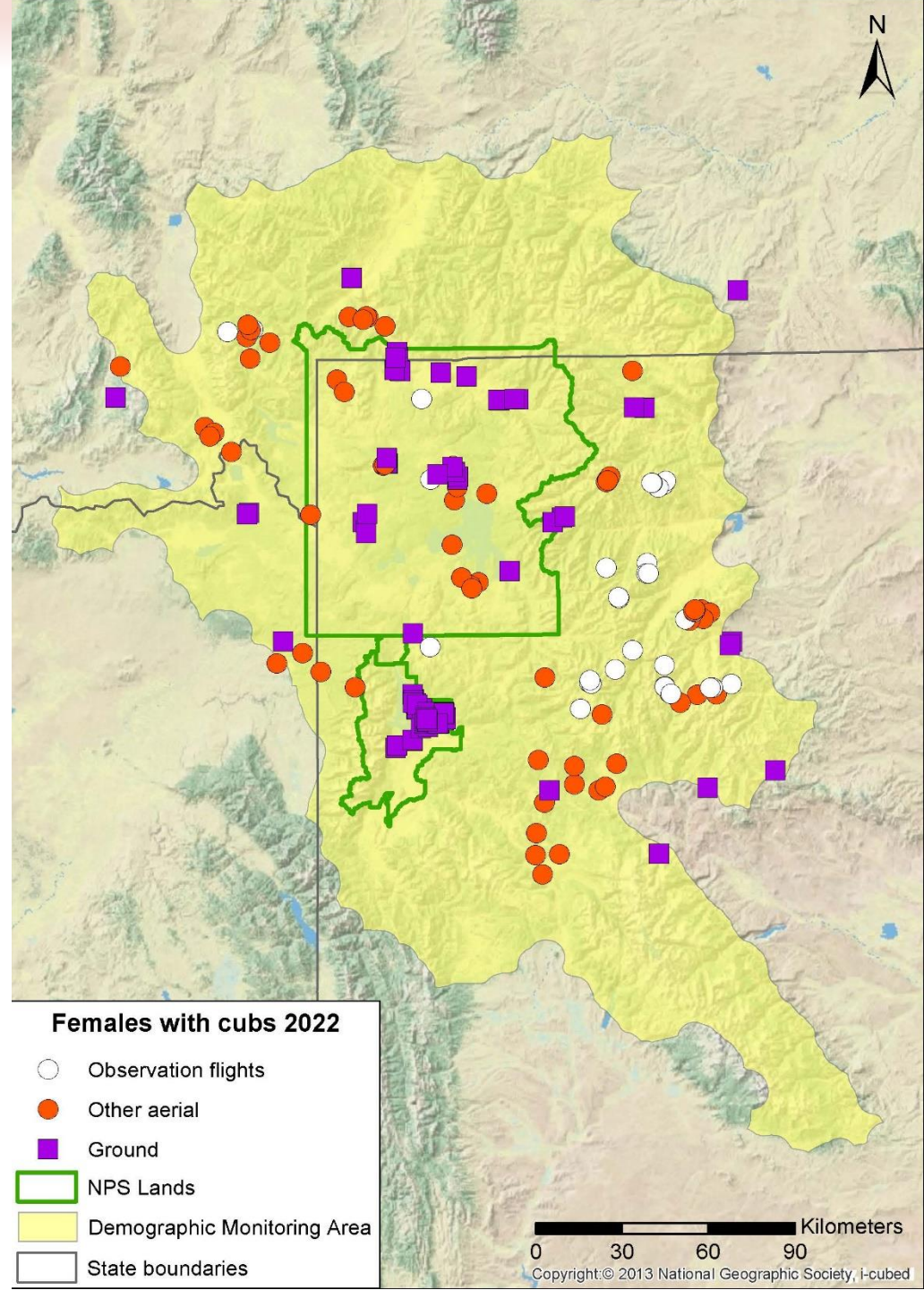
# Females with cubs 2022

## 205 Observations

34 observation flights (17%)

67 other aerial (33%)

104 ground (51%)



# Females with cubs 2022

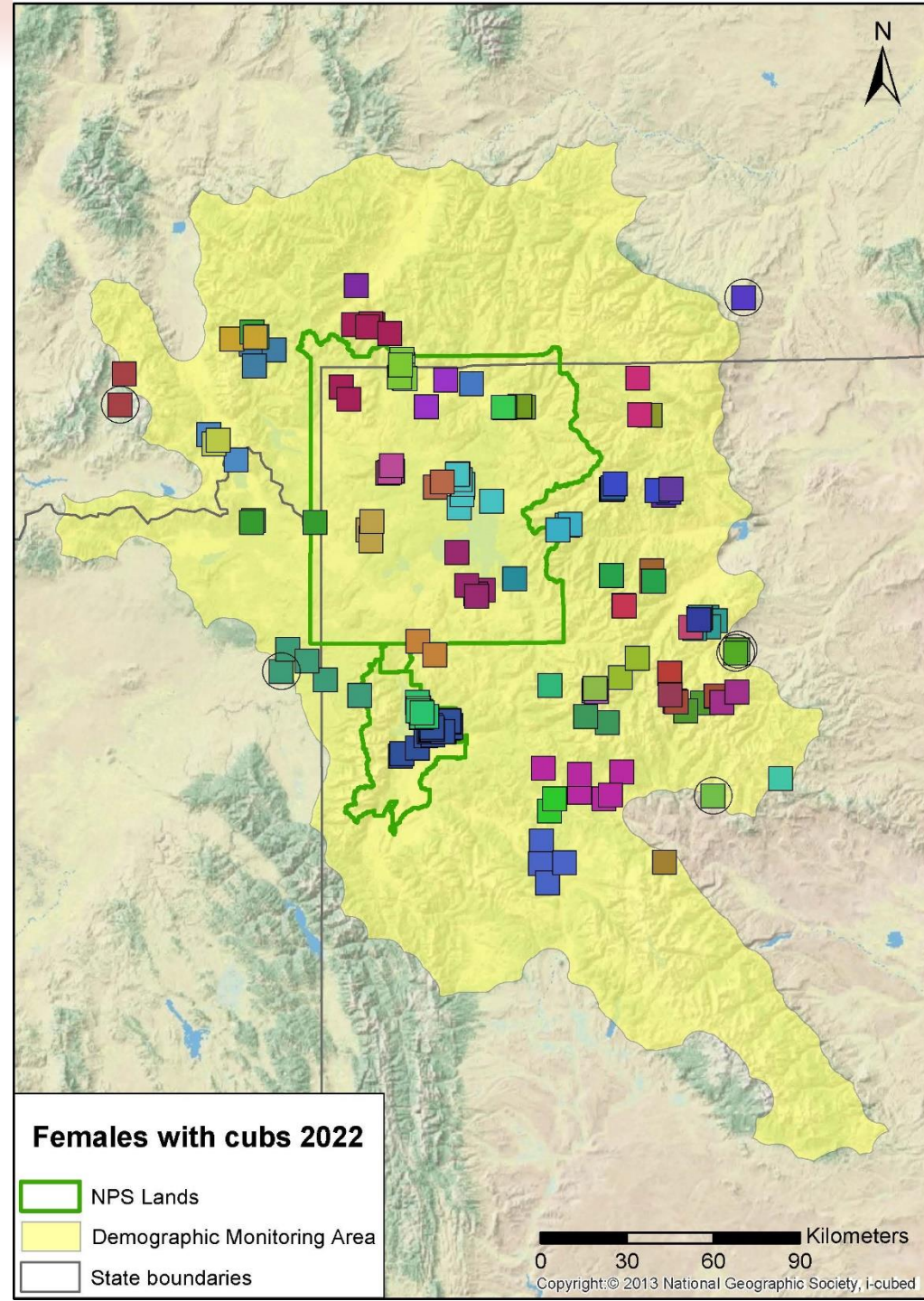
## 205 Observations

- 34 observation flights (17%)
- 67 other aerial (33%)
- 104 ground (51%)

## 60 unique females with cubs

Mean litter size = 1.97

- 16 single (27%)
- 30 twins (50%)
- 14 triplets (23%)



# Females with cubs 2022

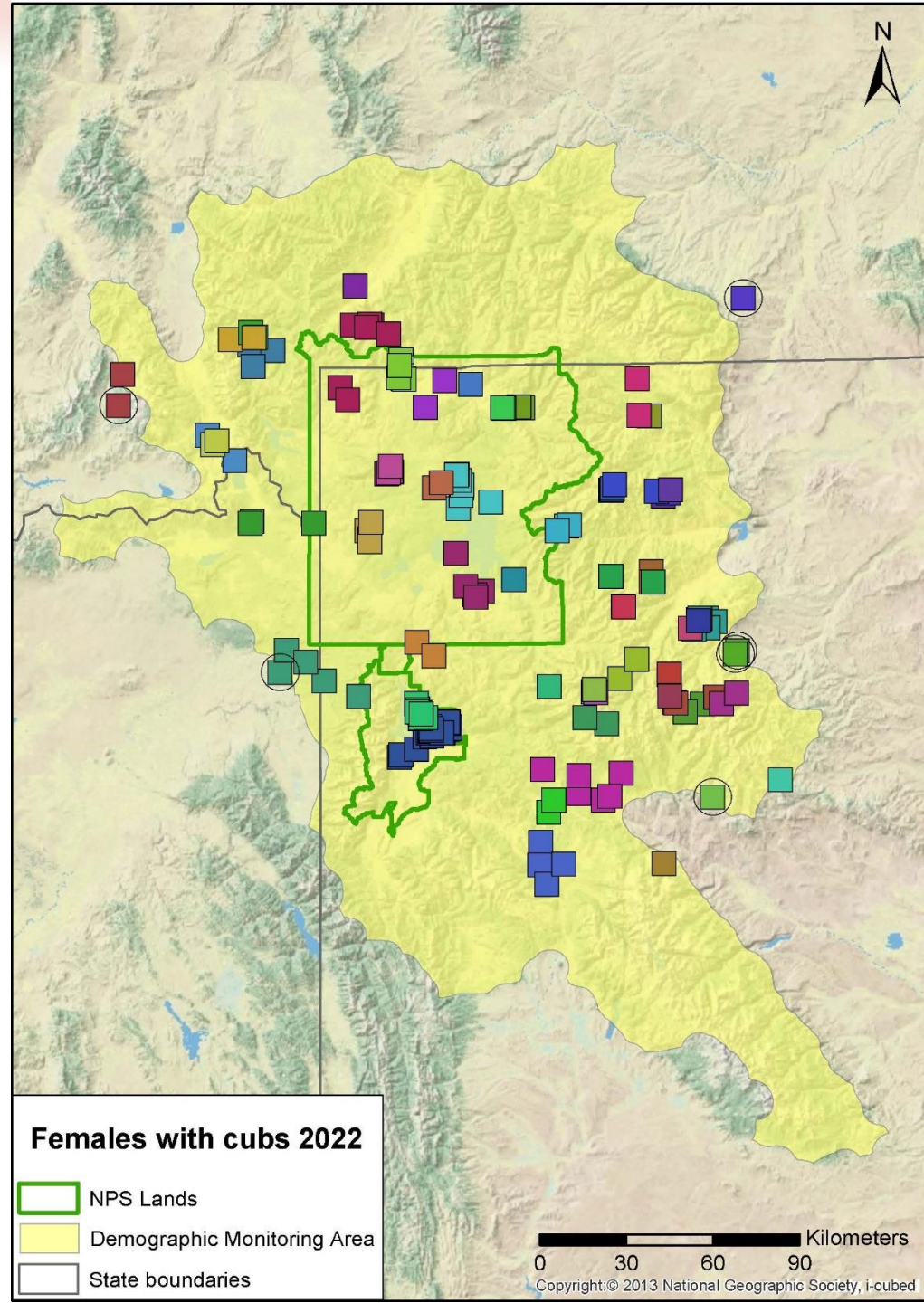
## 205 Observations

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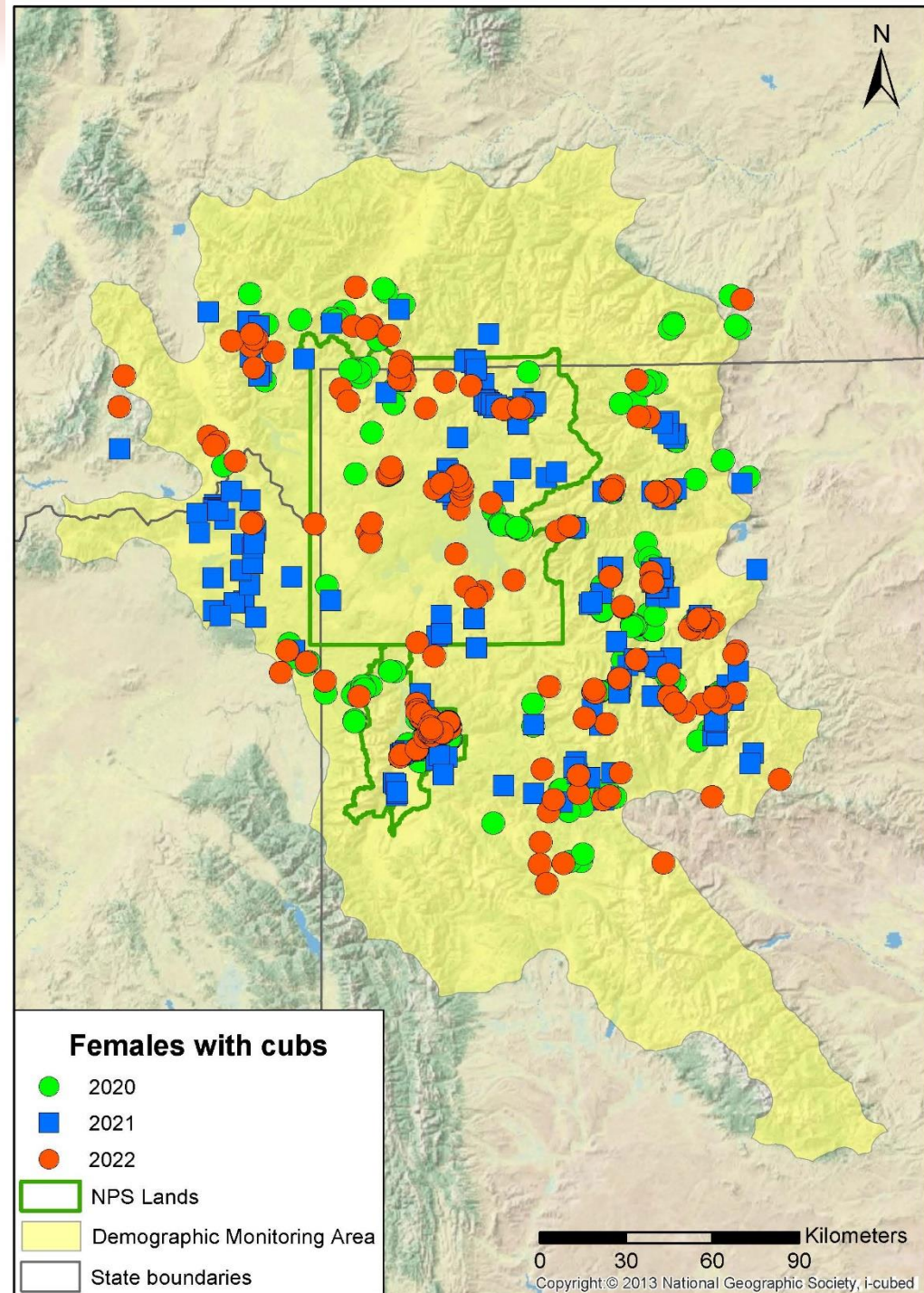
## 57 in DMA



# Females with cubs 2020-2022

## Observations

From den emergence through  
31 August



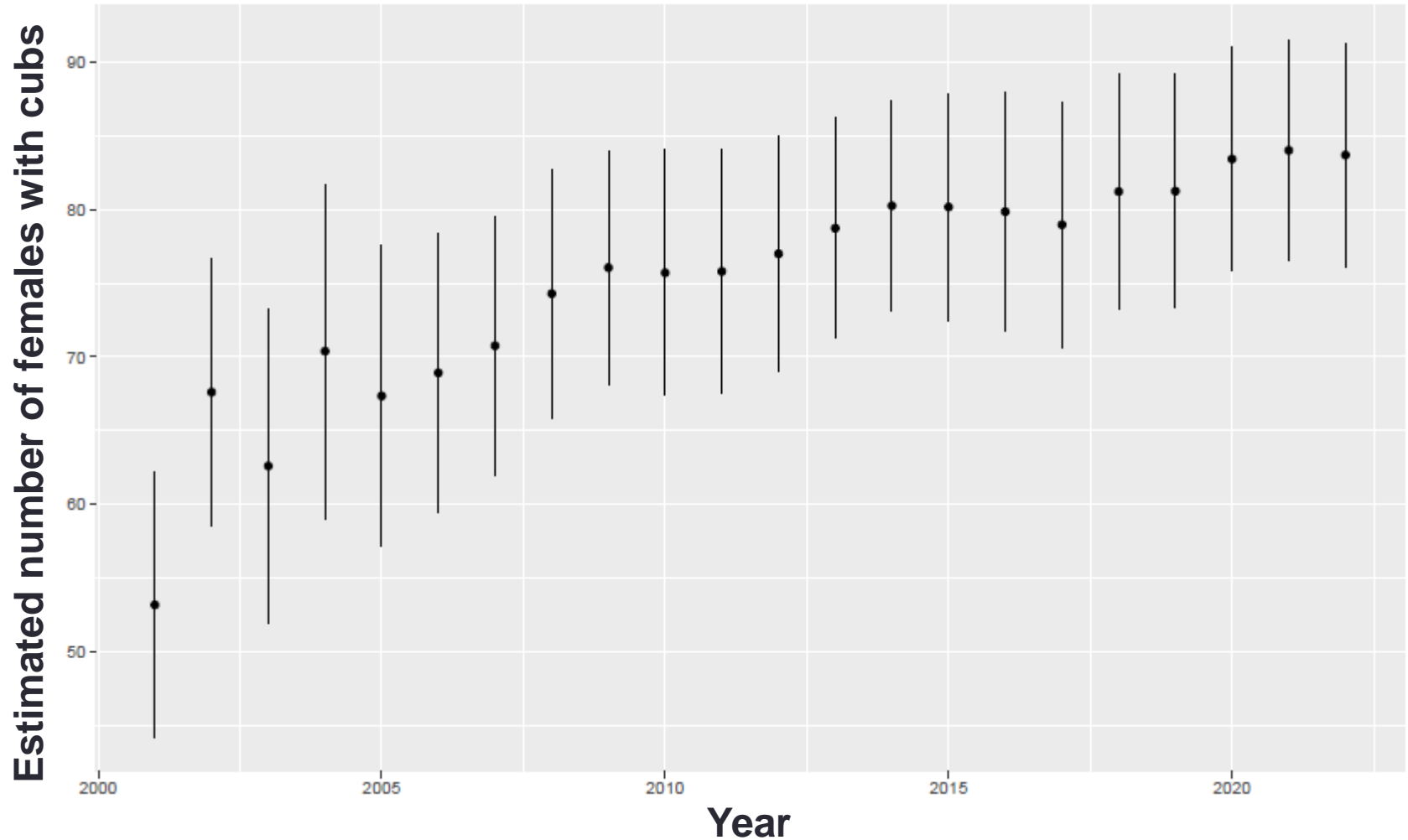
# Number of females with cubs 2022 (16-km distance criterion, inside DMA)

---

<b>Parameter</b>	<b>Estimate</b>
Unique females with cubs	57
Unique females with cubs (excluding telemetry observations)	49
Chao2 estimate	59
Chao2 (GAM)	84

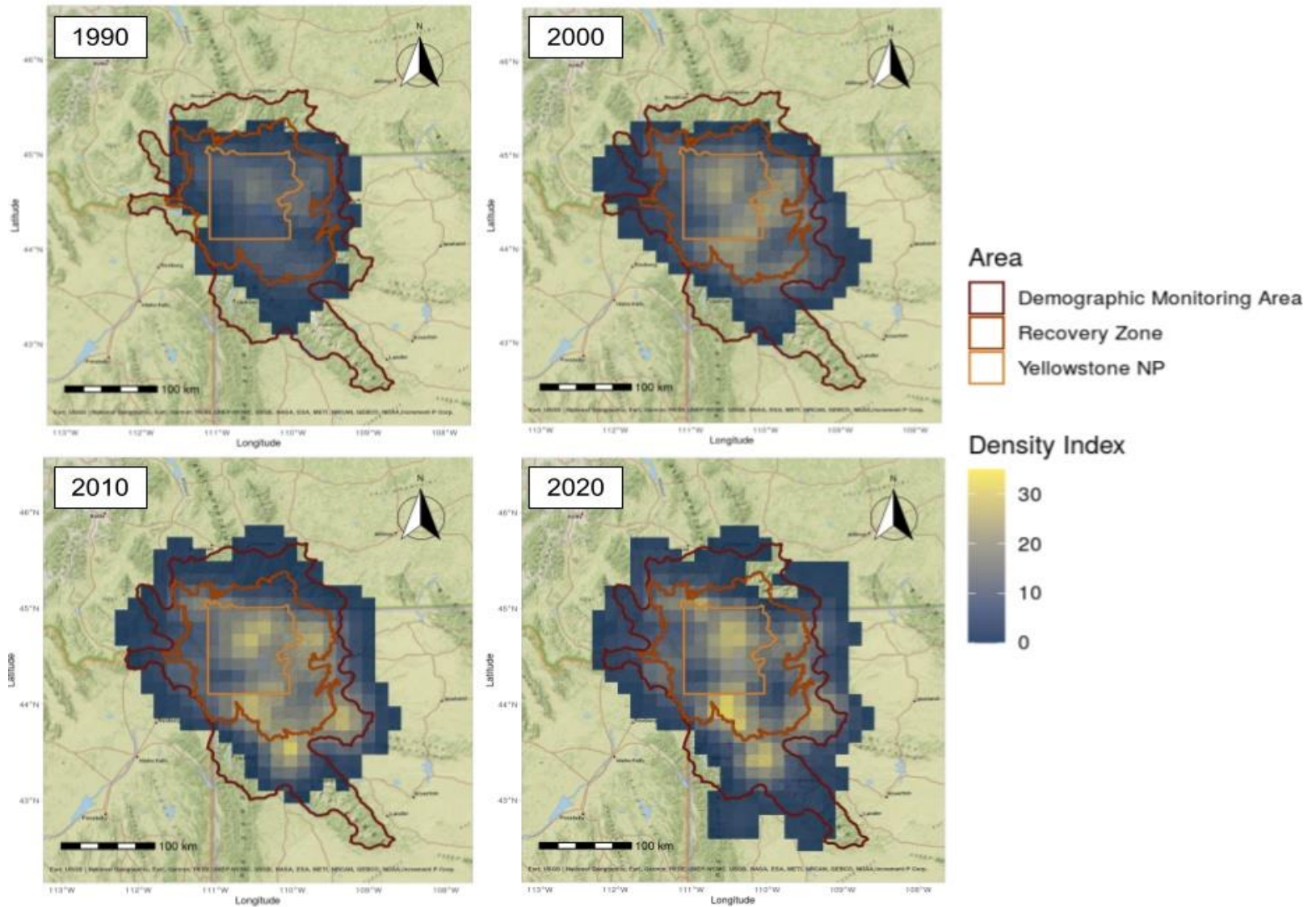
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# Trend in estimates of females with cubs 2001-2022 (DMA)



# Changes in bear density

Preliminary Information-Subject to Revision. Not for Citation or Distribution



Source: Bjornlie et al. 2014; Corradini et al. (in review)

# Demographic Recovery Criterion #2: Occupancy by Females with Young

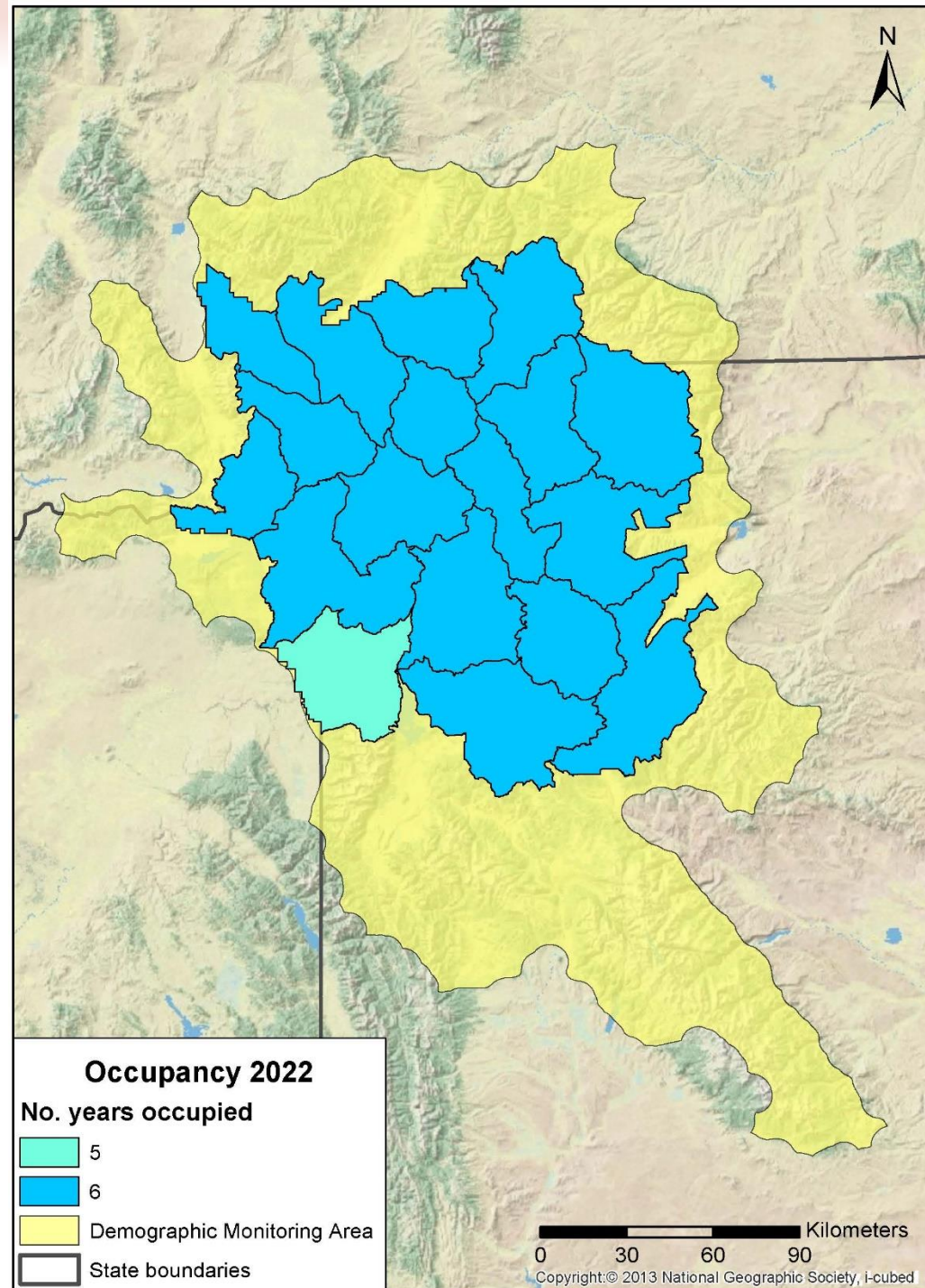


Photo: J. Davis



# Occupancy by females with young (cubs, yearlings, or 2-year-olds) 2022

- 18 of 18 Bear Management Units (BMUs) occupied during 2022
- 18 of 18 BMUs occupied at least 5 of last 6 years (2017-2022)



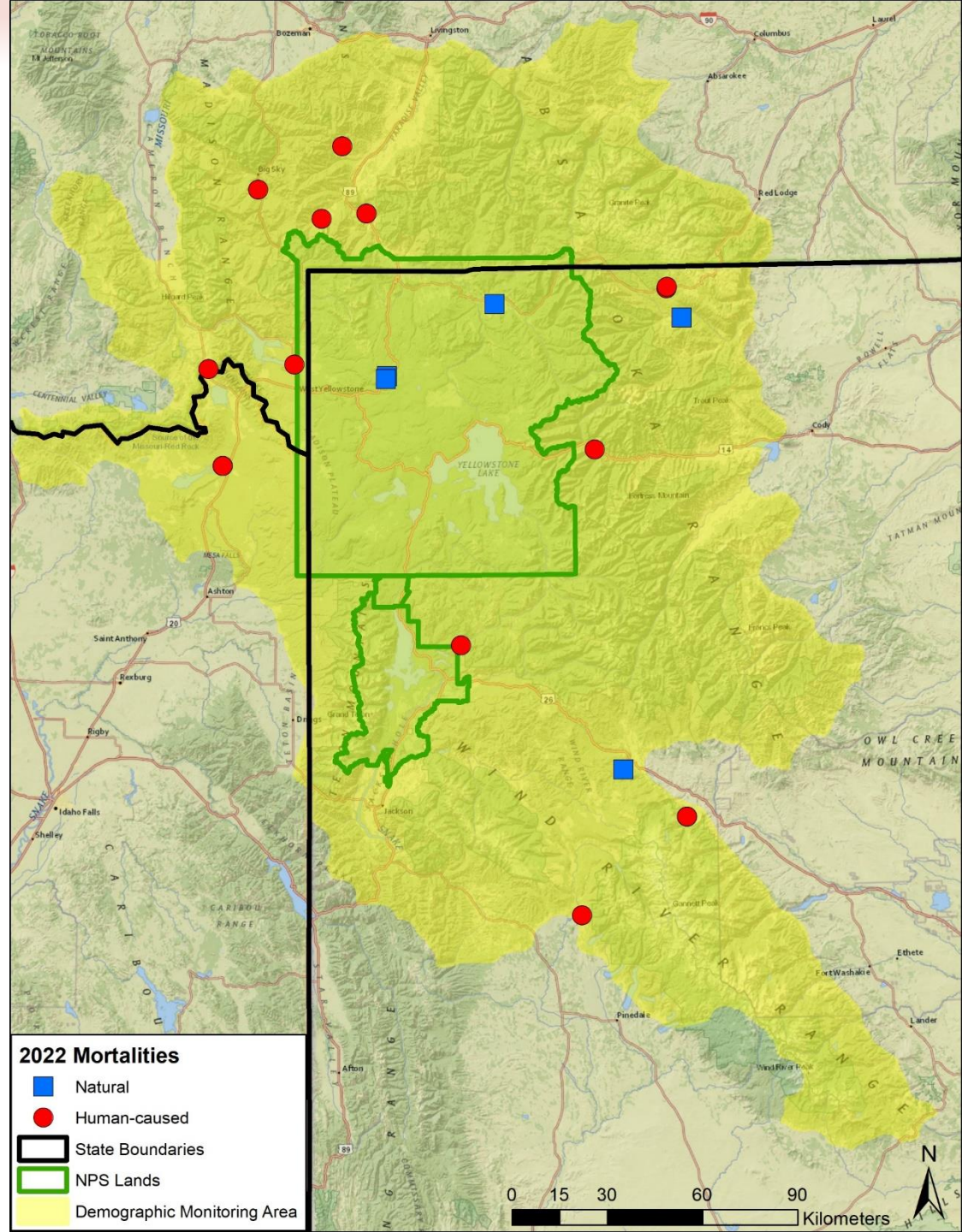
# Demographic Recovery Criterion #3: Mortalities and Mortality Rates



# Known and probable mortalities 2022

- **27 in DMA**
  - 21 Human-caused
  - 6 Natural
  - 0 Undetermined cause

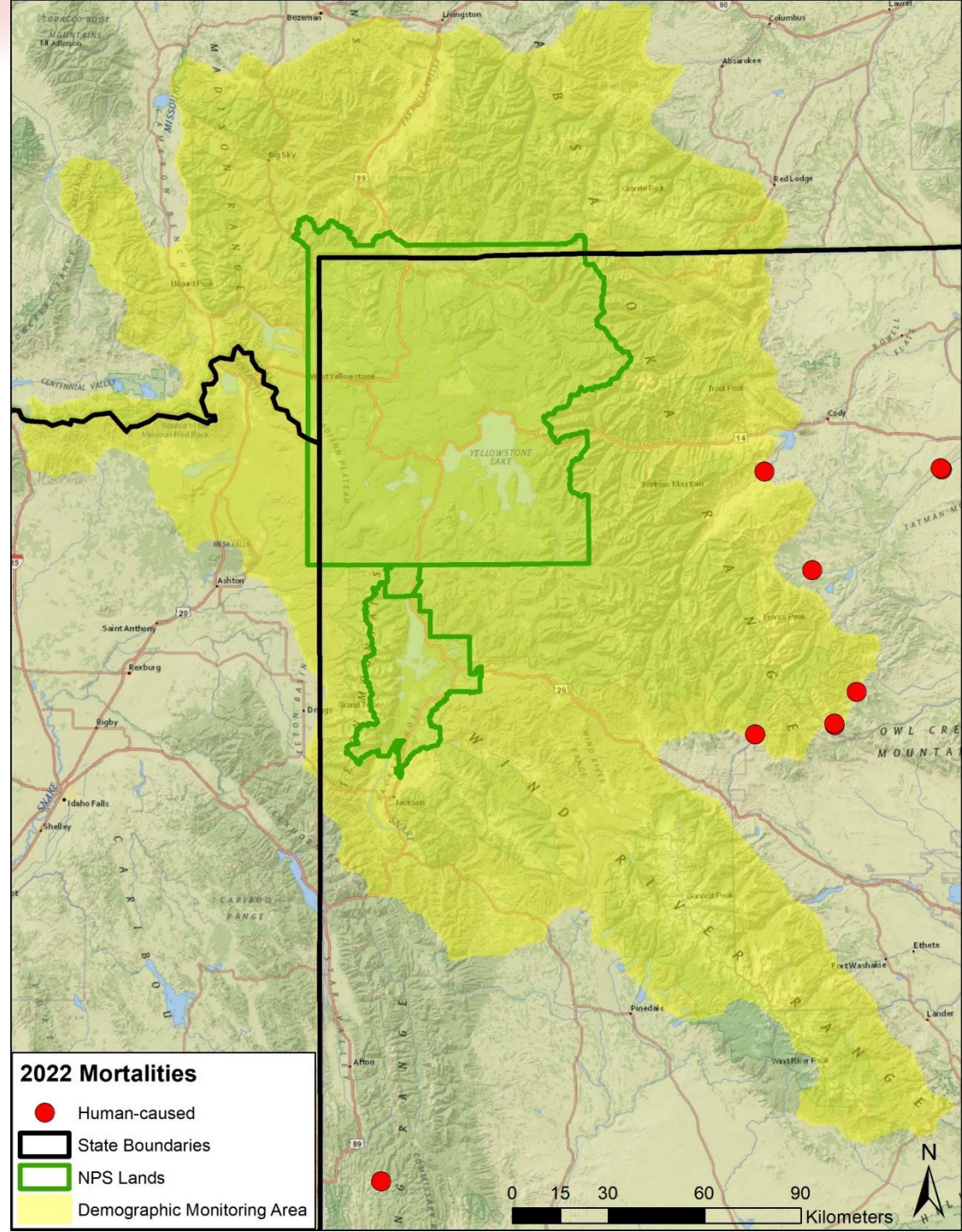
Mortalities as of 11/04/2022



# Known and probable mortalities 2022

- **27 in DMA**
  - 21 Human-caused
  - 6 Natural
  - 0 Undetermined cause
- **13 Outside DMA**
  - All human-caused

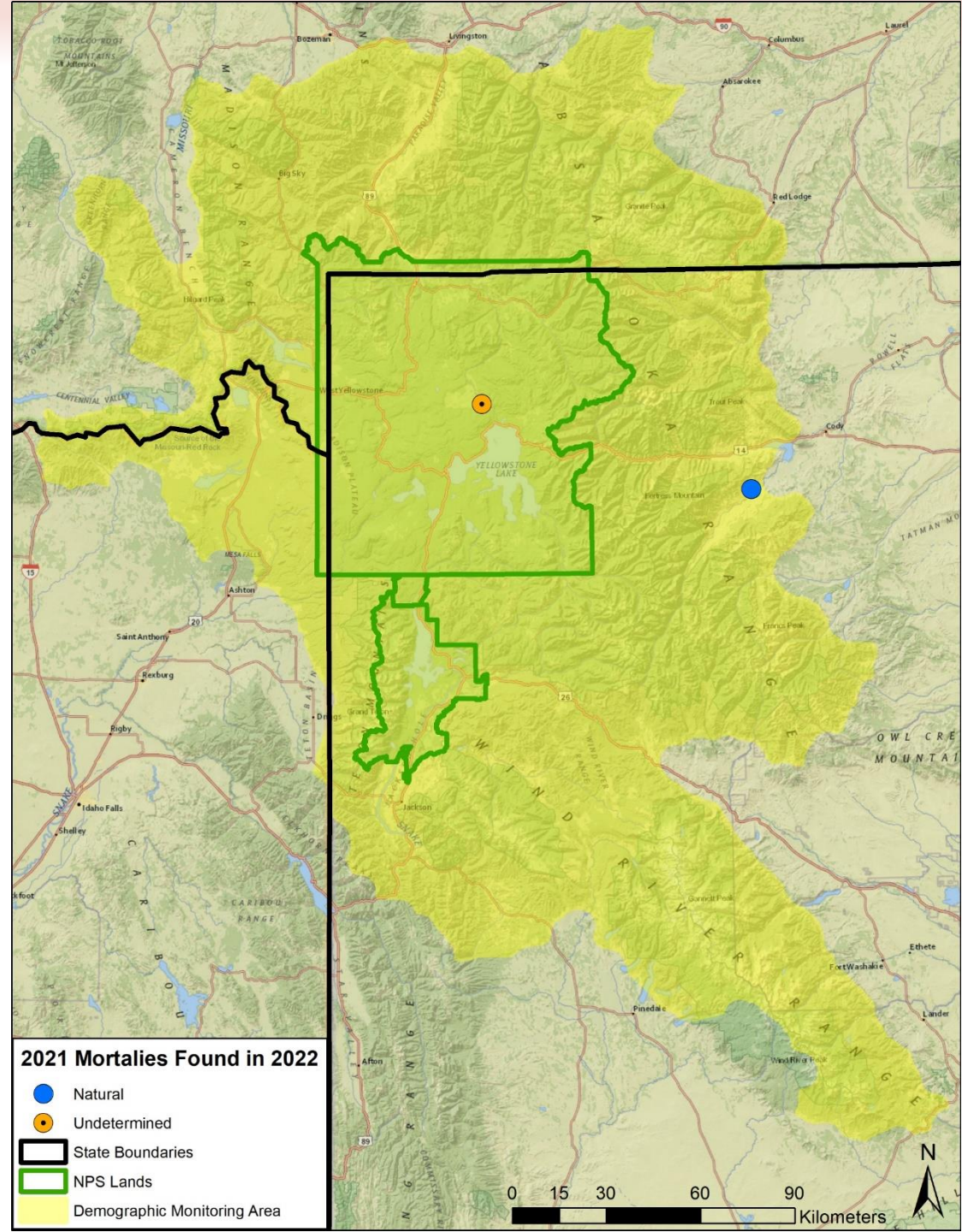
Mortalities as of 11/04/2022



# Known and probable mortalities 2022

- **27 in DMA**
  - 21 Human-caused
  - 6 Natural
  - 0 Undetermined cause
- **13 Outside DMA**
  - All human-caused
- **2 additional mortalities from previous years**

Mortalities as of 11/04/2022

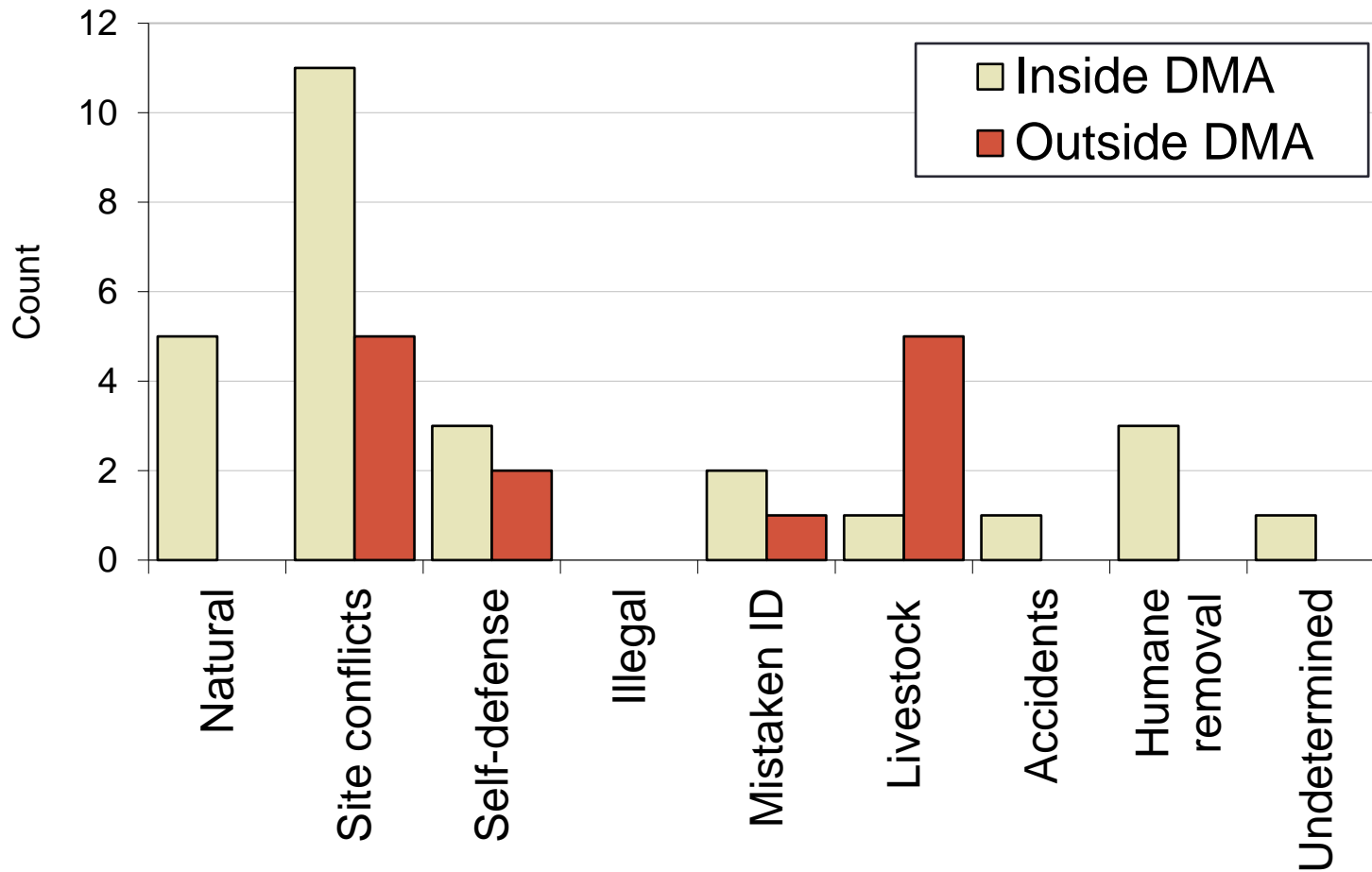


# Known and probable mortalities by area, sex, and age class 2022 (DMA)

Area	Sex	Age class		Total
		Dependent	Independent	
		(<2 years old)	(≥2 years old)	
Inside DMA	Female	3	9	12
	Male	5	9	14
	Unknown	1	0	1
	Total	9	18	27

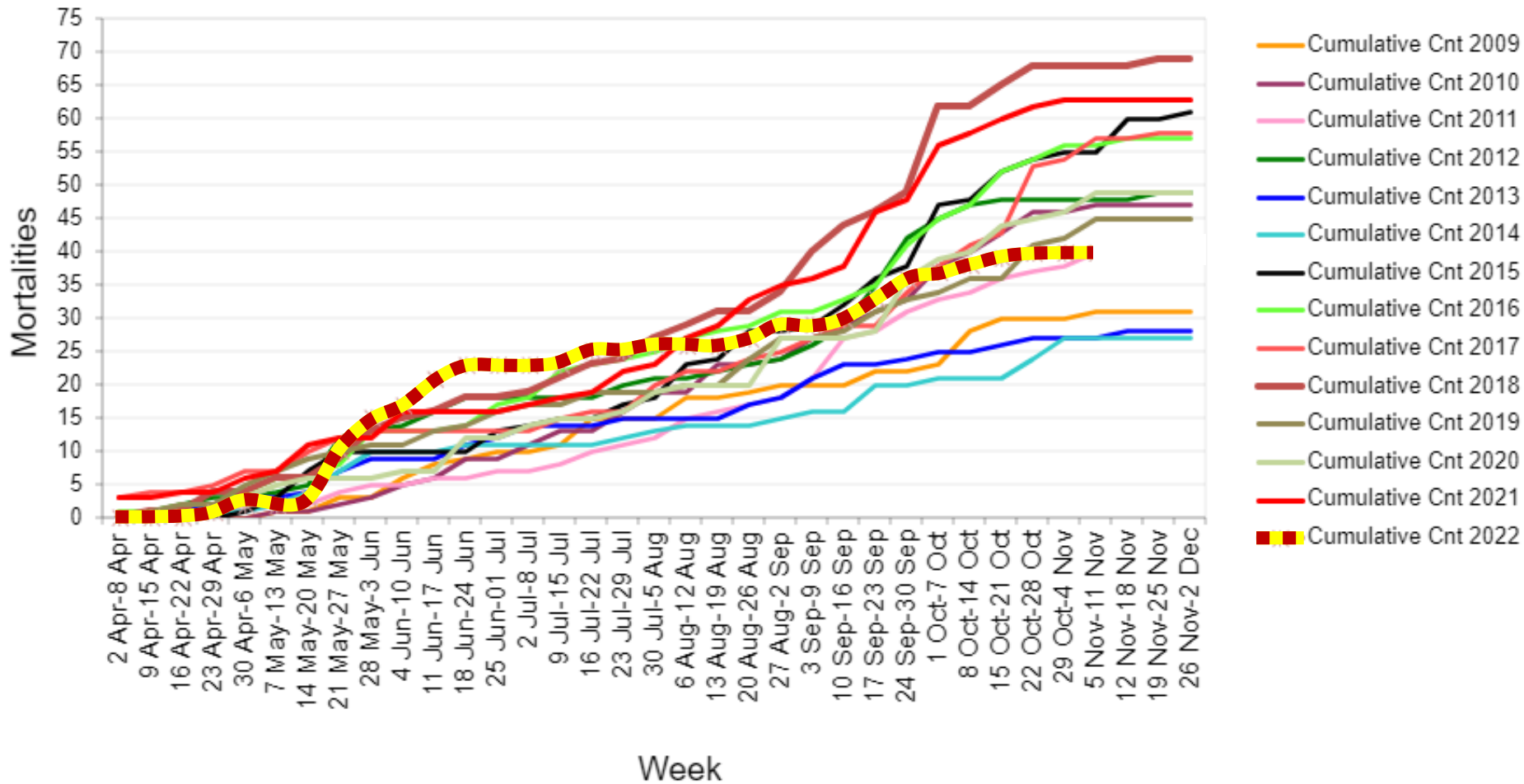
Mortalities as of 11/04/2022

# Mortalities inside/outside DMA by cause 2022



Mortalities as of 11/04/2022

# Cumulative documented mortalities by week 2009-2022



Mortalities as of 11/04/2022



# Other Monitoring Data



*Photo: J. Hadley/USGS (remote camera)*

# Captures and Known-Fate Monitoring

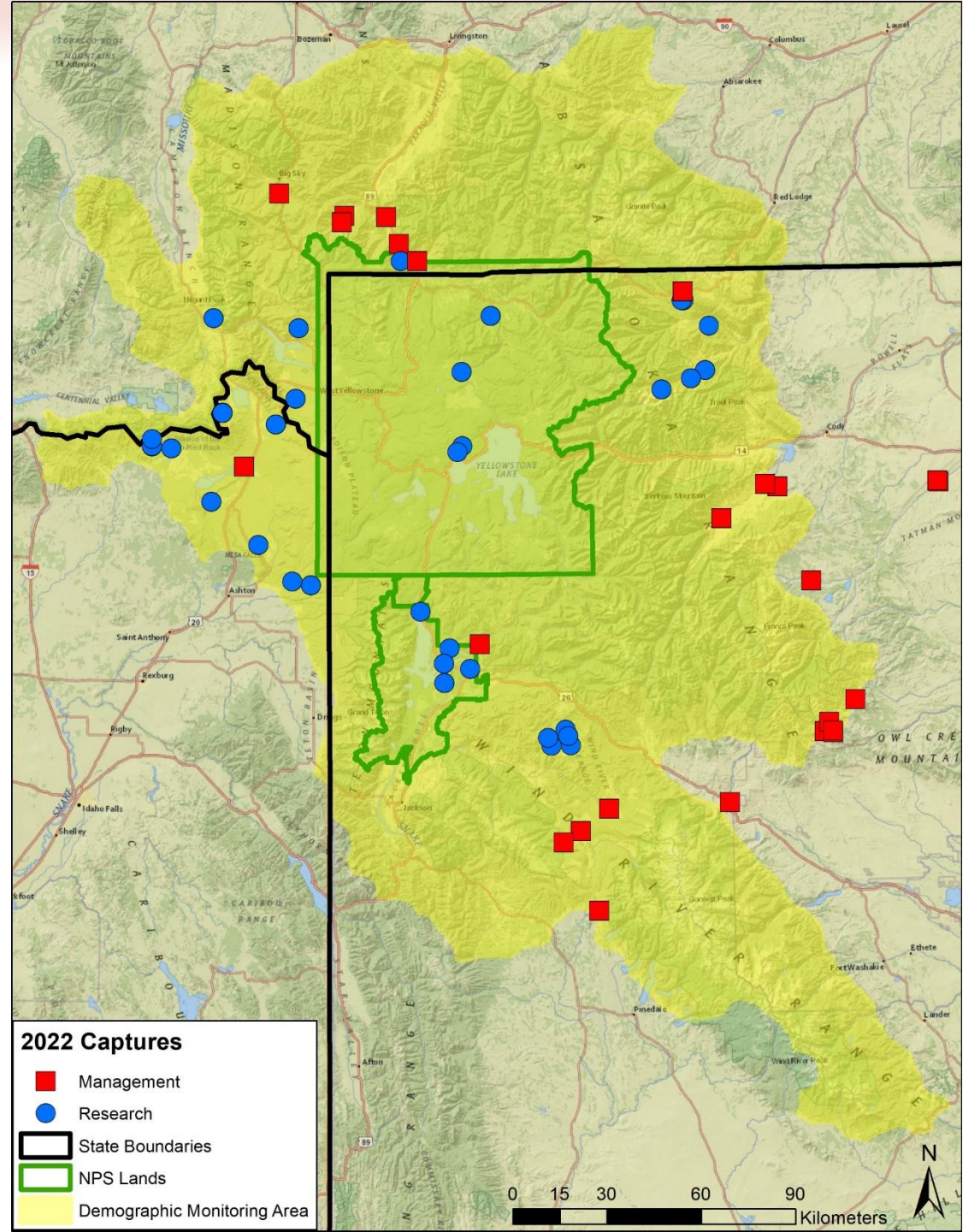


*Photo: F. T. van Manen/USGS*

# Grizzly bear captures 2022

- **Total captures = 96**
  - Research = 60
  - Management = 36
- **Individual bears = 83**
  - Females = 26
  - Males = 53
  - Unknown = 4
- **New bears = 52**

Captures as of 11/04/2022



# Grizzly bears radio monitored 2022

**Total monitored = 112**

Adult females = 43

**Current = 73**

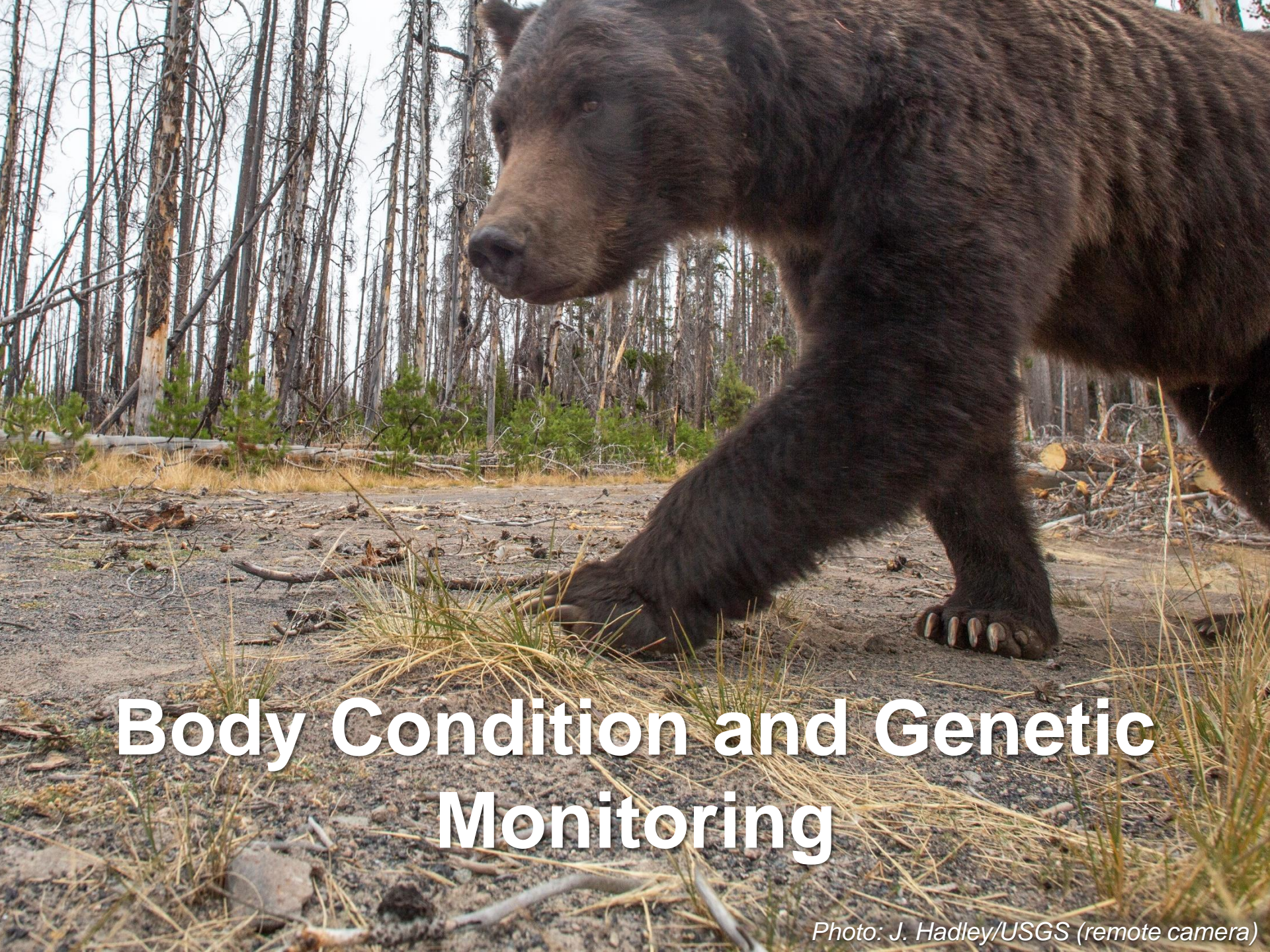
Females = 37

Males = 36

Bears missing = 0



Monitored as of 11/02/2022



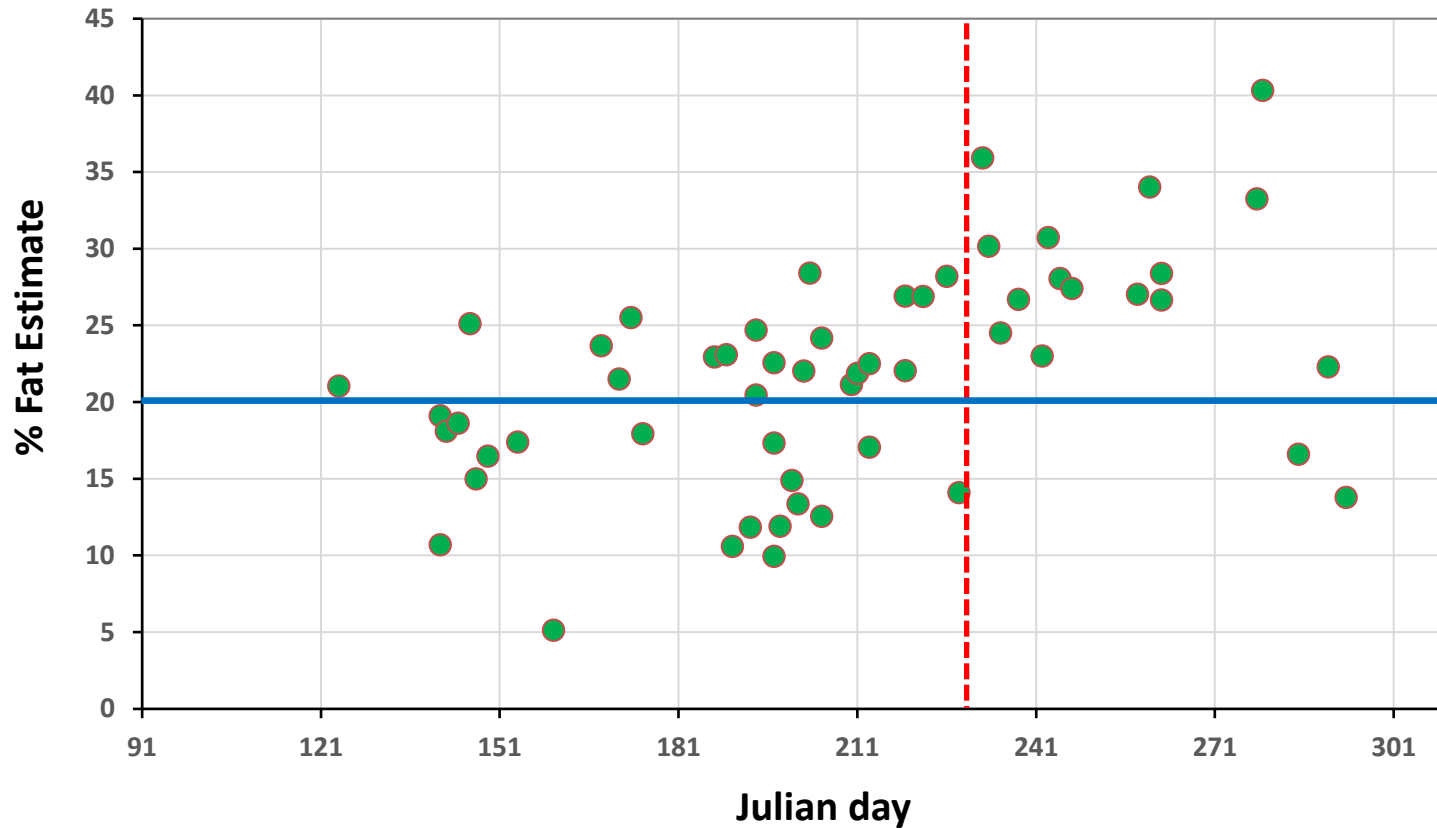
# Body Condition and Genetic Monitoring

*Photo: J. Hadley/USGS (remote camera)*

# Estimating body condition (% body fat)



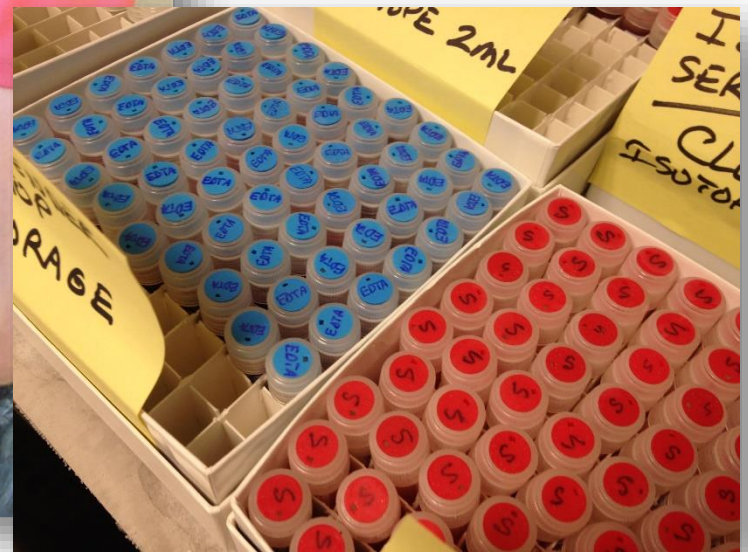
# % body fat by Julian date 2022



Monitored as of 11/04/2022

# Genetic monitoring

- Results for 1983-2020
- **1,331** individuals genotyped (20 microsatellite markers)
- No evidence of non-GYE ancestry in any of the individuals genotyped to date





# Summary

## Population

- 16-km distance criteria used to estimate numbers of unique females with cubs in DMA ( $n = 84$ )
- 2002-2022 time series: no statistical evidence of change

## Mortality

- Primary causes inside DMA: site conflicts, natural, humane removals
- 32.5% of documented mortalities occurred outside the DMA

## Food supply

- Slightly above average whitebark pine cone production, generally better in the southern transects
- Localized good berry production
- Good moth production

A large brown bear is walking from left to right across a dirt path in a forest. The bear's fur is thick and dark brown. The background shows tall, thin trees, some of which appear to be dead or charred, under a clear blue sky. The bear's mouth is slightly open, and it is looking towards the right.

**Study Team website:  
search “IGBST”**

**Annual/Technical reports:  
IGBC website  
(IGBCOnline.org)**

# Acknowledgments

- **IDFG:** C. Anderson, J. Brower, R. Cavallaro, H. Davie, N. Dickan, J. Heald, C. Hendricks, J. Hussman, C. Johnson, M. Lee, J. Locke, E. Lowrimore, D. Newman, J. Nicholson, T. Nicholson, A. Sorensen, T. Swearingen
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- **MTFWP:** M. Becker, S. Brozovich, H. Burt, C. Costello, J. Cunningham, D. Fagone, K. Frey, M. Heaton, K. Kimbel, B. Lloyd, K. Orozco, R. Pickens, R. Pohle, J. Ramsey, J. Smith, D. Scott, S. Stewart, G. Todd, M. Wemple, D. Waltee
- **YNP:** A. Bramblett, M. Curtis, O. Dalling, K. Gunther, M. Gutt, Z. Haroldson, M. King, W. Larson, E. Loggers, E. Reinertson, K. Schafer, P.J. White, J. Wright, T. Wyman
- **GTNP:** B. Apel, L. Apel, T. Brasington, C. Butler, M. Clark, R. Clark, S. Dewey, C. Faustman, C. Faustman, L. Fisher, T. Fisher, G. Gonsiewski, N. Gonsiewski, C. Greenbaum, S. Greenbaum, C. Hayden, T. Hayden, C. Hutson, A. Langford, J. Lieb, J. Lodge, R. Mascia, T. Mascia, J. Mohr, L. Muir, J. Potter, A. Ryan, S. Ryan, J. Schwabedissen, J. Stephenson, R. Swift, S. Textor, R. Thomas-Kuzilik, D. Titley, K. Titley, P. Waite, A. Willemain, C. Willemain, J. Willemain, K. Wilmot, A. Zuckerman
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- **WGFD:** C. Atkinson, B. Baker, D. Bjornlie, C. Bowlin, M. Boyce, J. Clapp, T. Crane, A. Courtemanch, B. DeBolt, E. Davis, C. Dukes, C. Evans, L. Ellsbury, B. Frude, K. Garrett, G. Gerharter, M. Gocke, Z. Gregory, H. Haley, J. Hunter, R. Kindermann, J. Kraft, B. Kroger, K. Lash, R. Lyon, G. Metzen, T. Mong, C. Queen, P. Quick, S. Ryder, C. Schoonover, D. Smith, J. Stephens, S. Stingley, D. Thompson





# 2022 Demographic Workshop

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INTERAGENCY GRIZZLY  
BEAR STUDY TEAM



# What are “vital rates”?

Survival

Reproduction

Female reproductive  
states

Sex ratio

Litter size

Parameters used to derive estimates of total population size ( $N$ ) from annual Chao2 estimate of females with cubs

# IGBST demographic workshops

## Previous workshop: 2012

- Objectives
  - Revise population estimation protocol
  - Re-evaluate mortality thresholds
  - Geographic zoning of mortality thresholds
  - Conduct demographic review (triggered by monitoring protocol)
  
- Outcomes and implications
  - Considered, but abandoned, alternatives to unique females with cubs clustering
  - Developed and implemented Mark-Resight technique
  - Revised sustainable mortality thresholds
  - Established DMA
  - Improved understanding of vital rate relationships with intrinsic and extrinsic factors

# 2022 Workshop

## Objectives

- 1) Review demographic data to update vital rates (YES task)
- 2) Update demographic parameters and estimates in the 2016 Conservation Strategy (YES task)
- 3) Evaluate ability of monitoring program to detect population trends
- 4) Final evaluation of Integrated Population Models (IPM) as primary demographic monitoring tool

# 2022 Workshop

## External experts

Josh Nowak, SpeedGoat/University of Montana

Ryan Wilson, USFWS Polar Bear Program

Karyn Rode, USGS Polar Bear Program

Joseph Clark, USGS, Southeastern Black Bear Research Program

Dan Bjornlie, unaffiliated (formerly WGFD)



# 2022 Workshop

## Preliminary outcomes and implications

- 1) Vital rates: moving away from discrete periods to “moving windows” of data (e.g., 15 years)
- 2) Some vital rates remain steady, some show trends
- 3) Further evidence of density-dependent effects
- 4) IPM is (almost) ready for implementation

# Integrated Population Models

- Started investigations in 2018
- Potentially ready in spring 2023
- Preparing publication for peer-reviewed journal
- Implementation likely requires further revisions to Conservation Strategy
- Fundamentally an extension of current monitoring
- Allows for a more unifying and flexible monitoring and management framework



*Photo: J. Davis*