

Interagency Grizzly Bear Study Team



Summary of 2014 Research and Monitoring



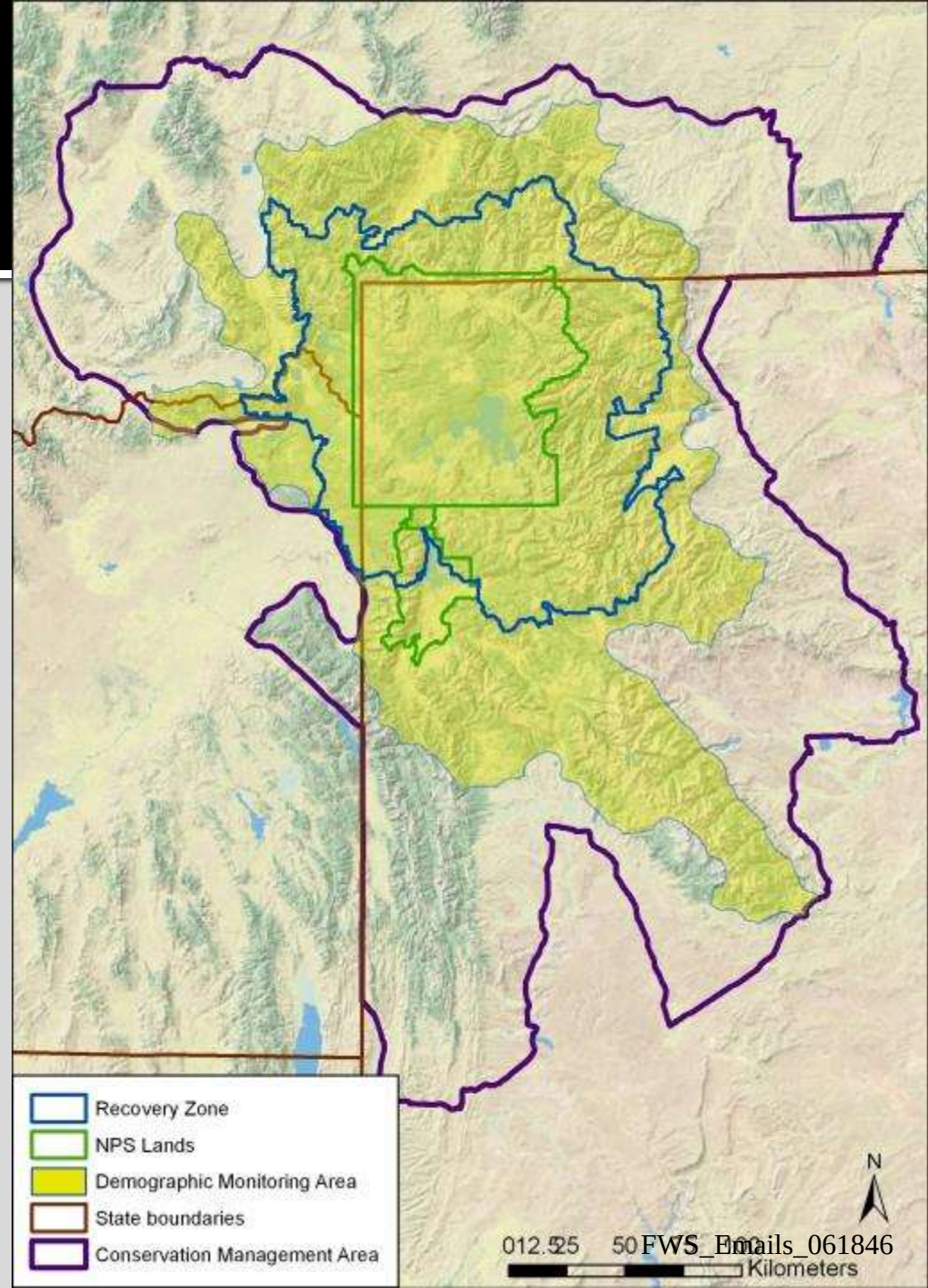
IGBST remote camera

Overview

- Population estimation and trend
 - Females with cubs-of-the-year
 - Mark-resight
- Grizzly bear mortalities
- Occupancy by females with offspring
- Known-fate monitoring
- Food monitoring
- Summary

Greater Yellowstone Ecosystem

- National Park lands = 10,344 km²
- Recovery Zone = 23,828 km²
- Conservation Management Area = 95,225 km²
- Demographic Monitoring Area = 49,931 km² (88 % Federal)

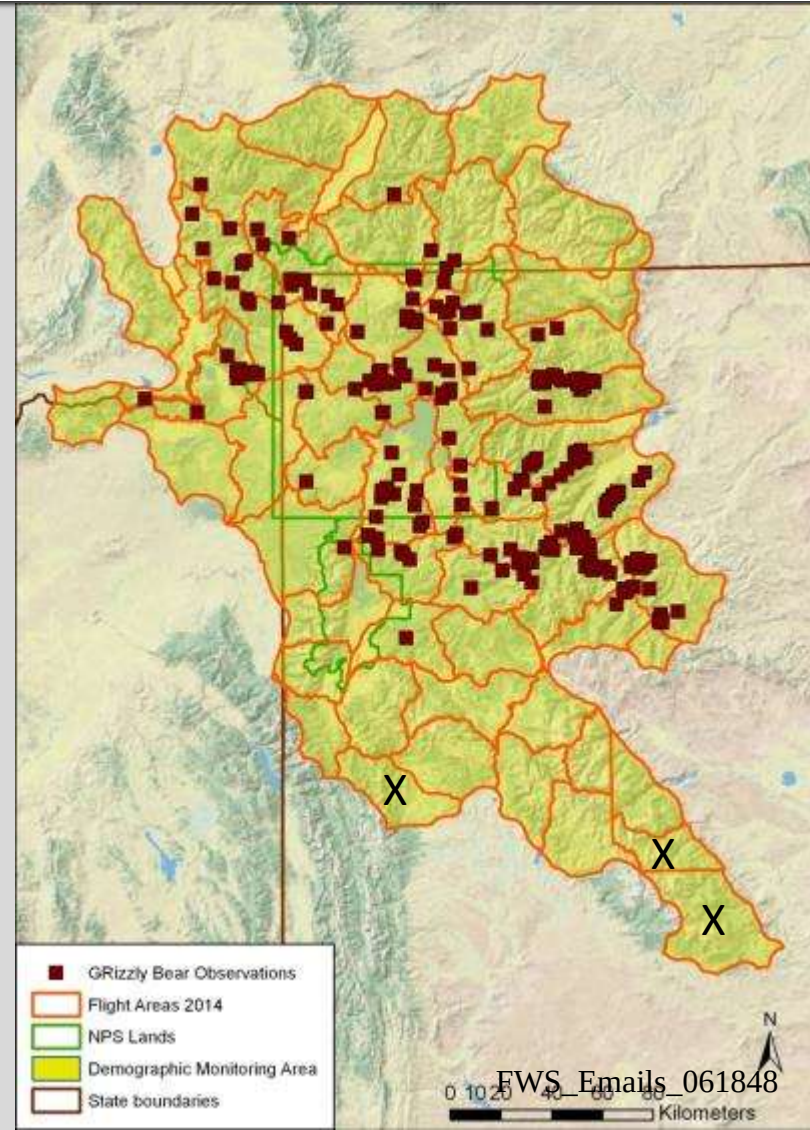


Population and Trend Estimation from Females with Cubs-of-the-Year (F_{COY})

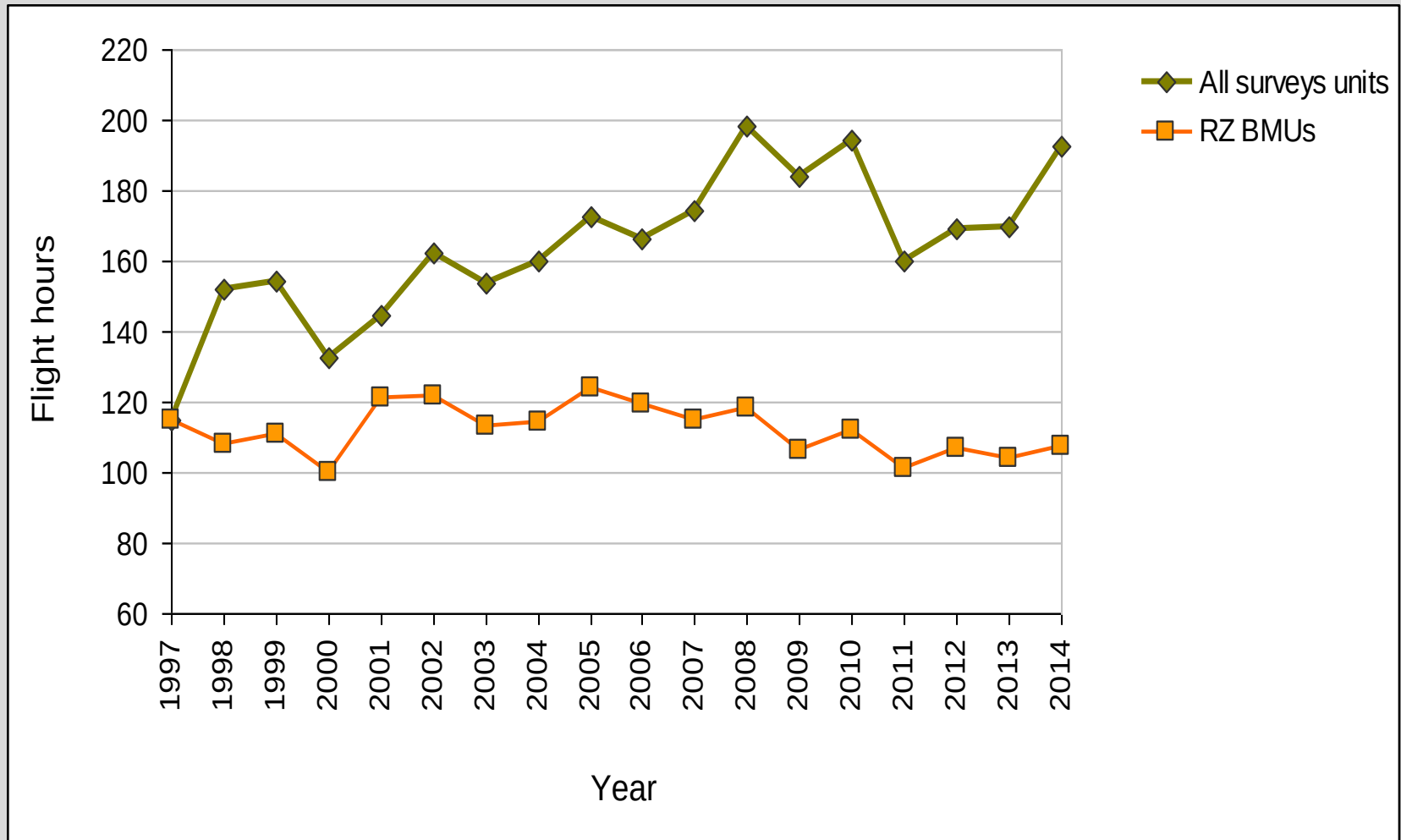


Observation Flights 2014

- 54 aerial observation areas
 - Round 1: 51 units, 104 hours
 - Round 2: 43 units, 89 hours
 - 3 units not flown (X)
- 473 groups (679 grizzly bears)
- 52 observations of F_{COY}
- 58 observations of females with older young

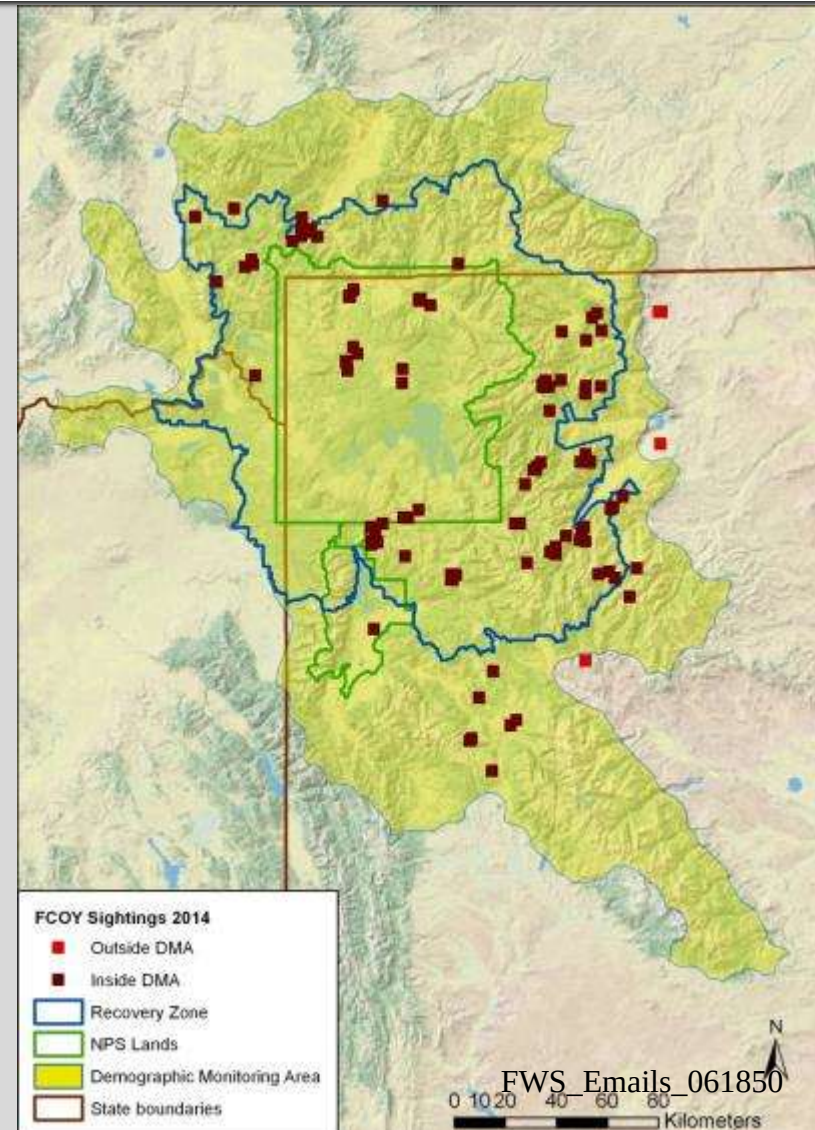


Observation Flight Hours 1997-2014



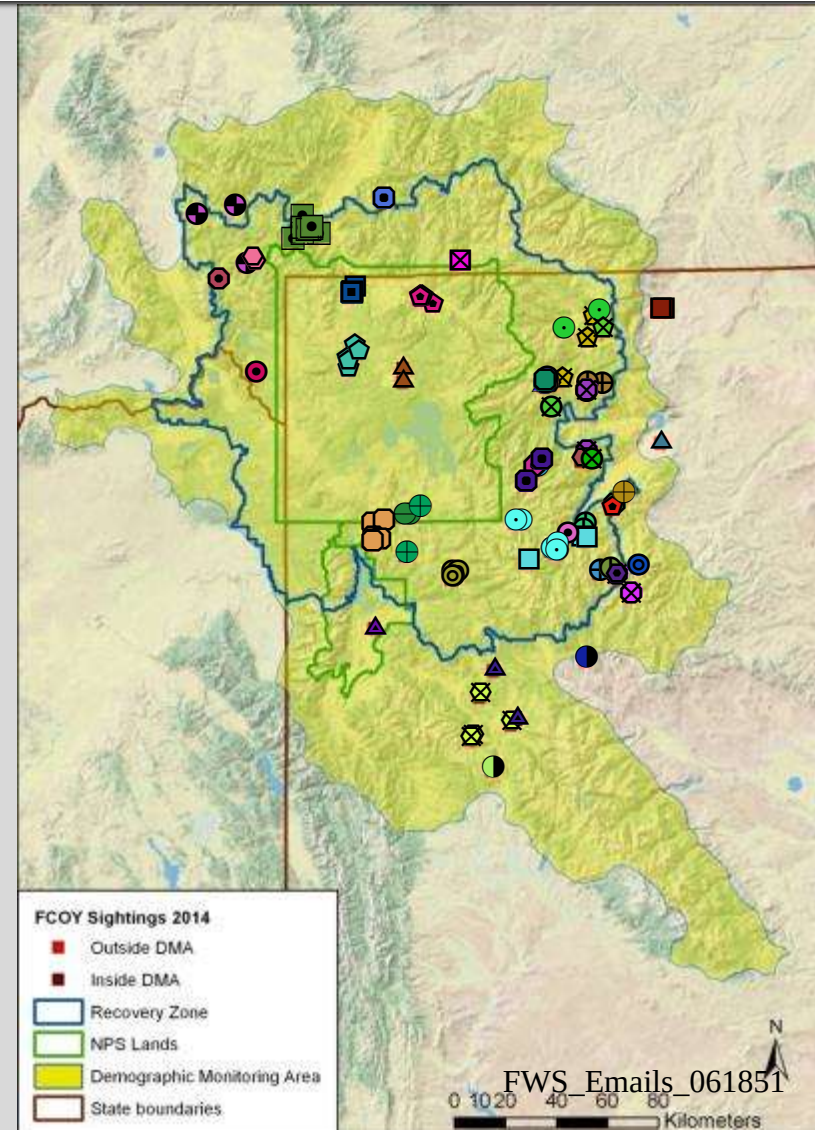
2014 Sightings of Females with Cubs

- 119 observations
 - 78 aerial (66%)
 - 41 ground (34%)
- 3 unique F_{COY} (4 sightings) outside demographic monitoring area (DMA)



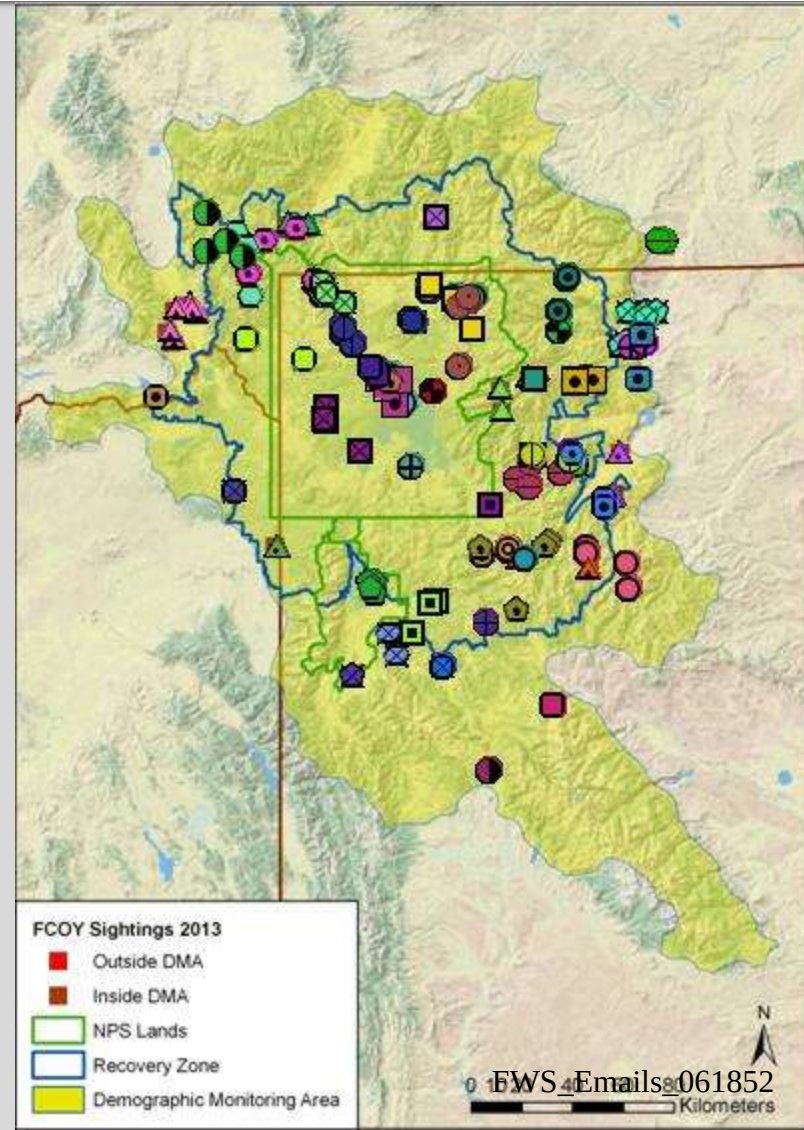
2014 Sightings of Females with Cubs

- 50 unique F_{COY}
 - Mean litter size = 1.92
 - Litter sizes
 - 16 single (32%)
 - 22 twins (44%)
 - 12 triplets (24%)



2013 Sightings of Females with Cubs

- 58 unique F_{COY} (new high)
 - Mean litter size = 2.17
 - Litter sizes
 - 8 single (14%)
 - 35 twins (60%)
 - 14 triplets (21%)
 - 3 quartets (5%)



Number of Females with Cubs 2014

Parameter	Count or estimate
Number of unique F_{COY}	47
Chao2 estimator	
Model-averaged estimate	

Number of Females with Cubs 2014

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Chao2 estimator	59
Model-averaged estimate	

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Chao2 estimator	59
Model-averaged estimate	60

Total Population Estimate 2014

Population segment	Estimate
Independent females (≥ 2 years old)	263
Independent males (≥ 2 years old)	
Dependent young (cubs and yearlings)	
Total	

Total Population Estimate 2014

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Total Population Estimate 2014

Population segment	Estimate
Independent females (≥ 2 years old)	263
Independent males (≥ 2 years old)	263
Dependent young (cubs and yearlings)	230
Total	

Total Population Estimate 2014

Population segment	Estimate
Independent females (≥ 2 years old)	263
Independent males (≥ 2 years old)	263
Dependent young (cubs and yearlings)	230
Total	757*

Total Population Estimate 2014

Population segment	Estimate
Independent females (≥ 2 years old)	263
Independent males (≥ 2 years old)	263
Dependent young (cubs and yearlings)	230
Total (95% confidence interval)	757* (674 – 839)

Simulations:

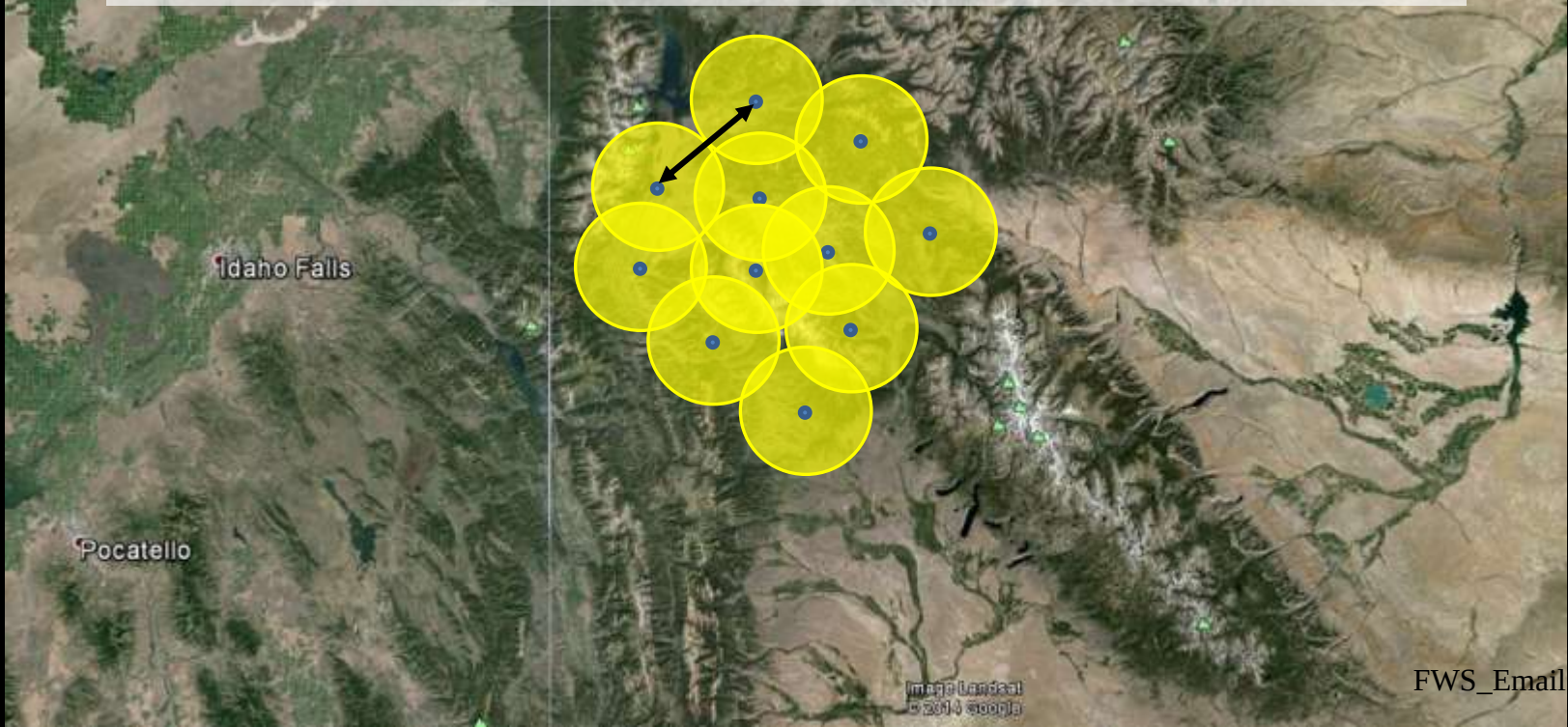
20 counted $\approx$ 25 known F_{COY}

30 counted $\approx$ 45 known F_{COY}

40 counted $\approx$ 70 known F_{COY}

50 counted $\approx$ 95 known F_{COY}

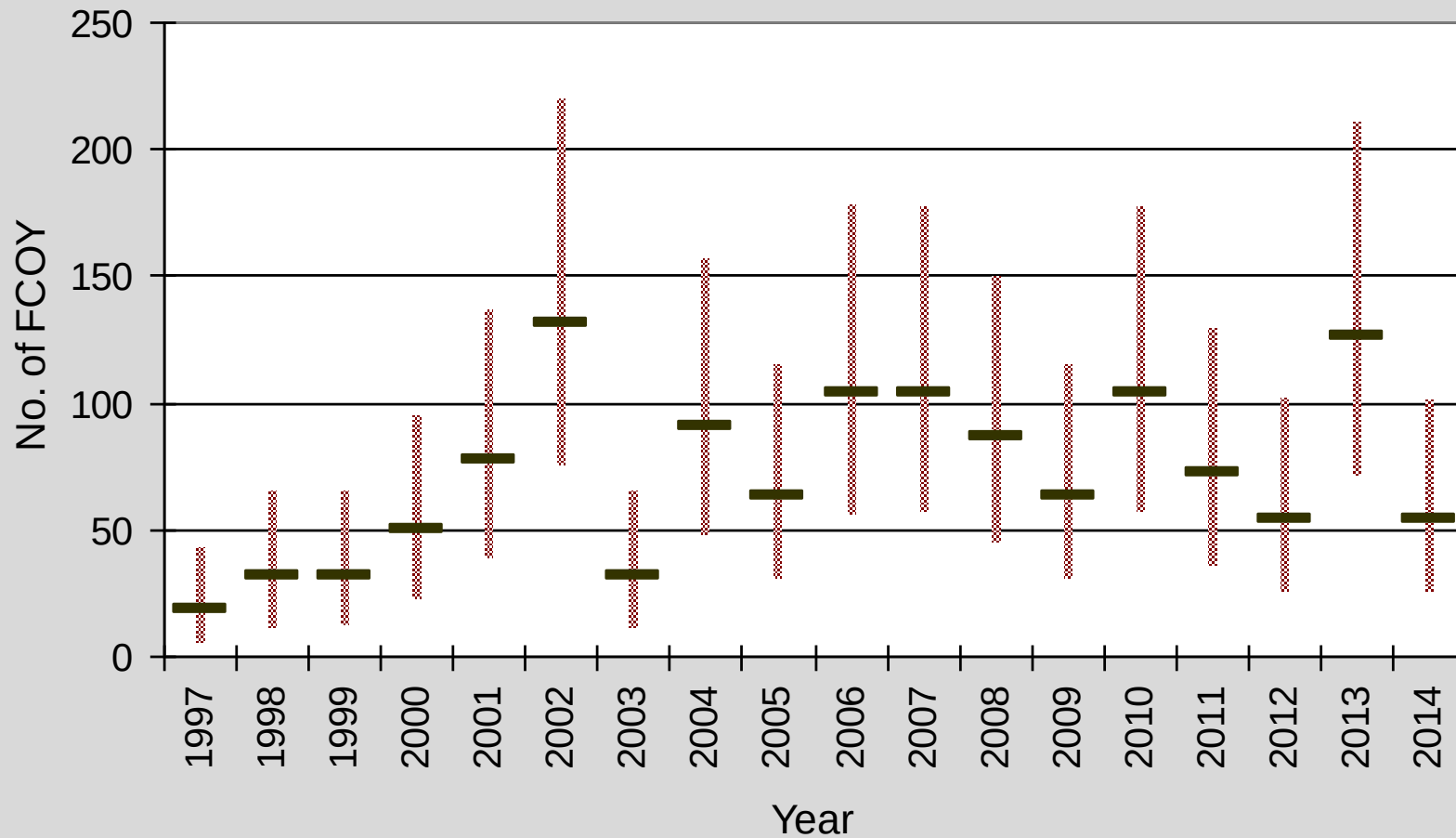
Schwartz et al. (2008)



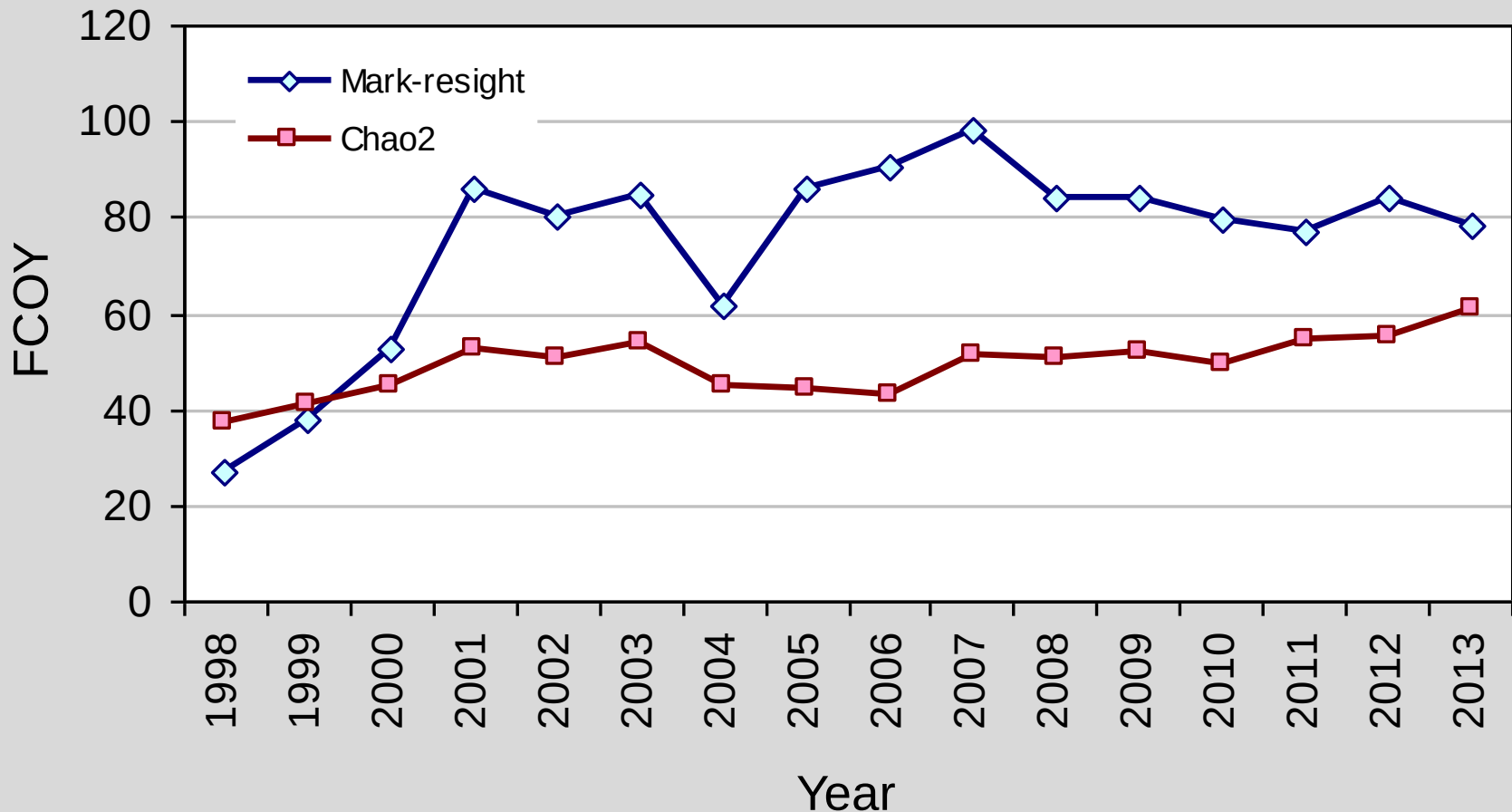
Mark-Resight to Estimate Females with Cubs

- Higgs et al. 2013. *Journal of Agricultural, Biological, and Environmental Statistics*
- Uses numbers of unmarked and radio-marked F_{COY} seen during observation flights (conducted since 1997)
- Moth site considerations: greater sightability, but few radio-marked bears
- Small number of sightings of marked F_{COY} affects precision
- Variation in annual estimates requires smoothing of trend data

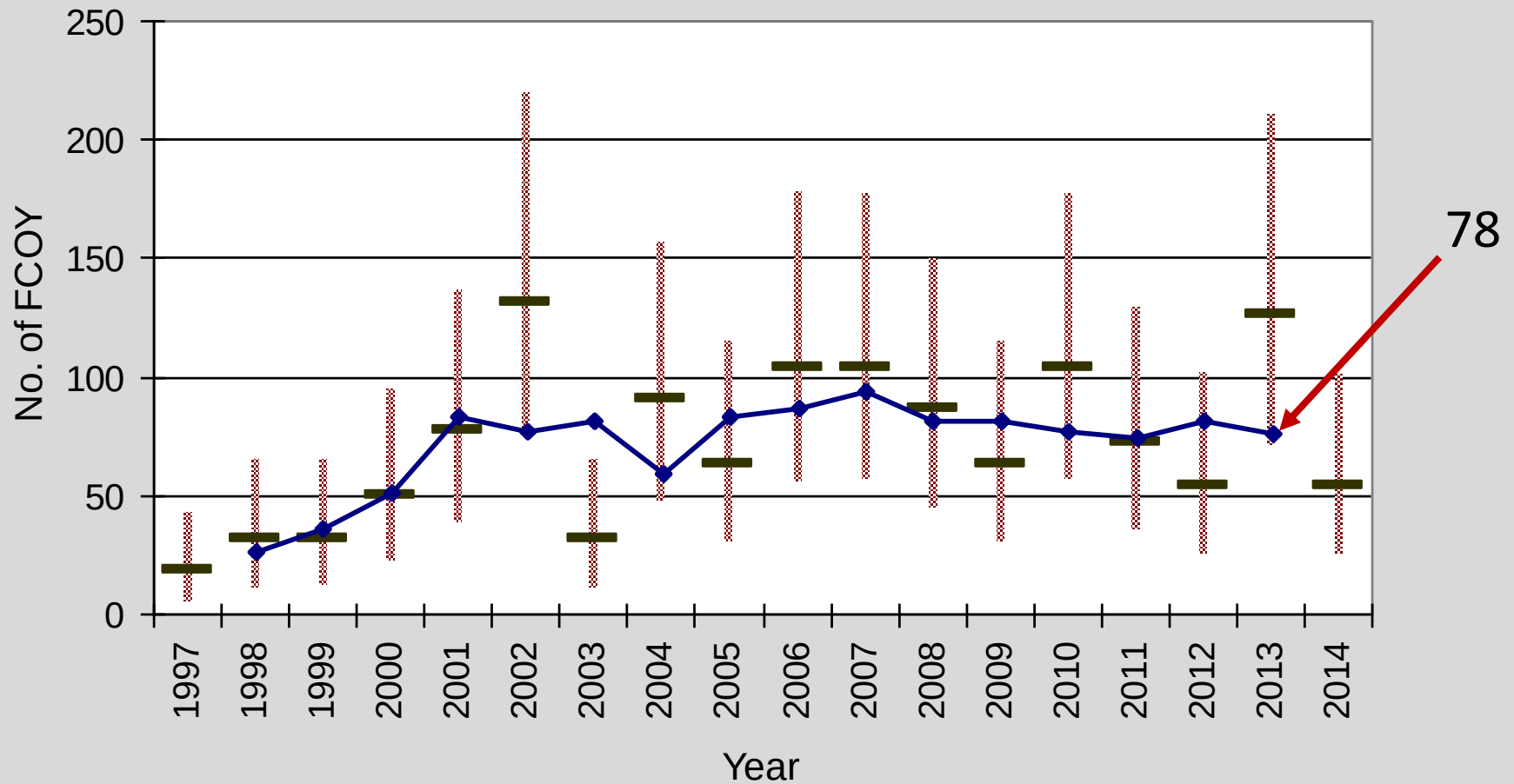
Mark-Resight Estimates of Females with Cubs 1997-2014



Three-year Running Average Chao2 vs. Mark-Resight 1998-2013



Mark-Resight Estimates of Females with Cubs 1997-2014



Population Estimate Derived from Mark-Resight Estimate

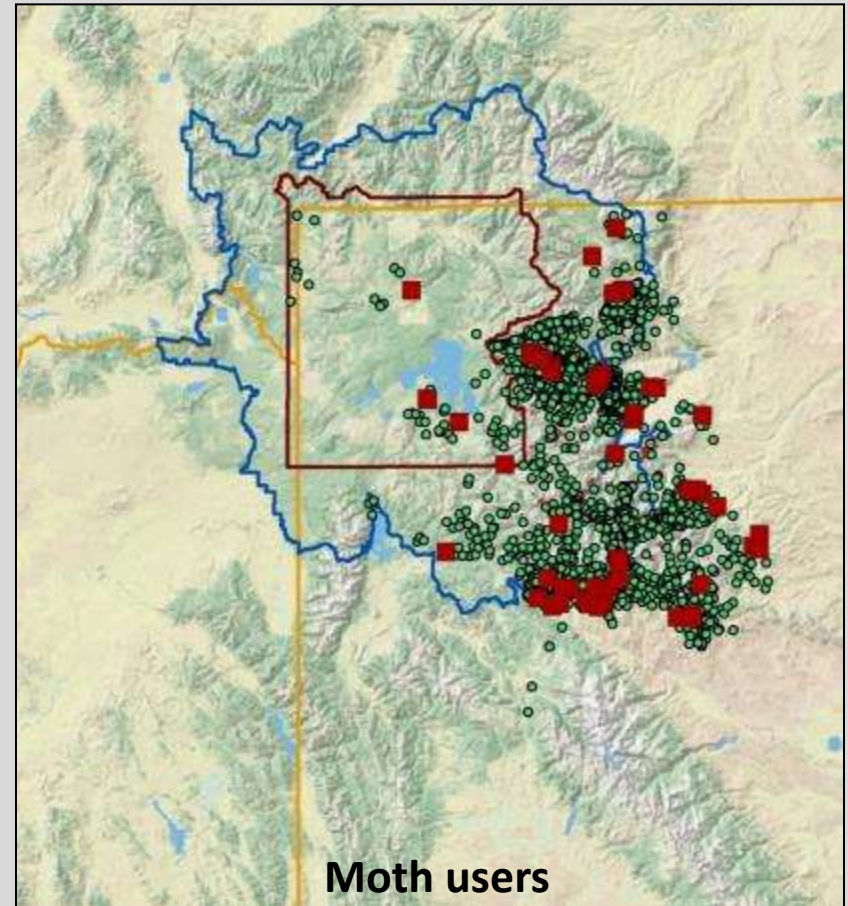
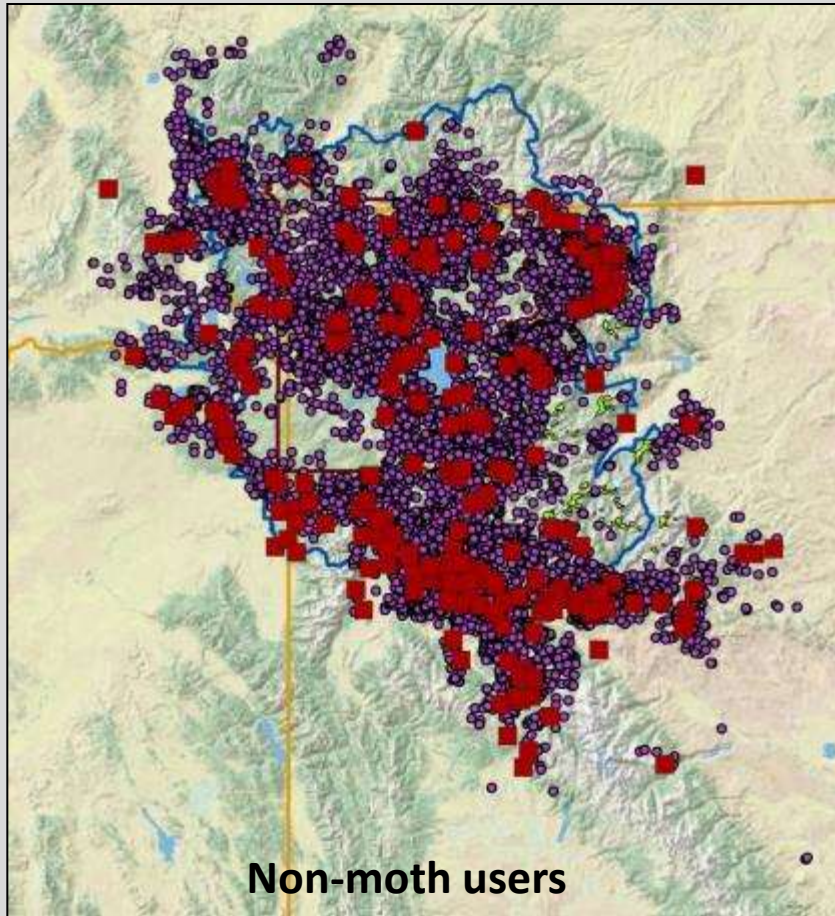
2013 estimates

- Mark-resight estimate (3-yr running average) = $78 F_{COY}$
 $\approx 1,000$ total population

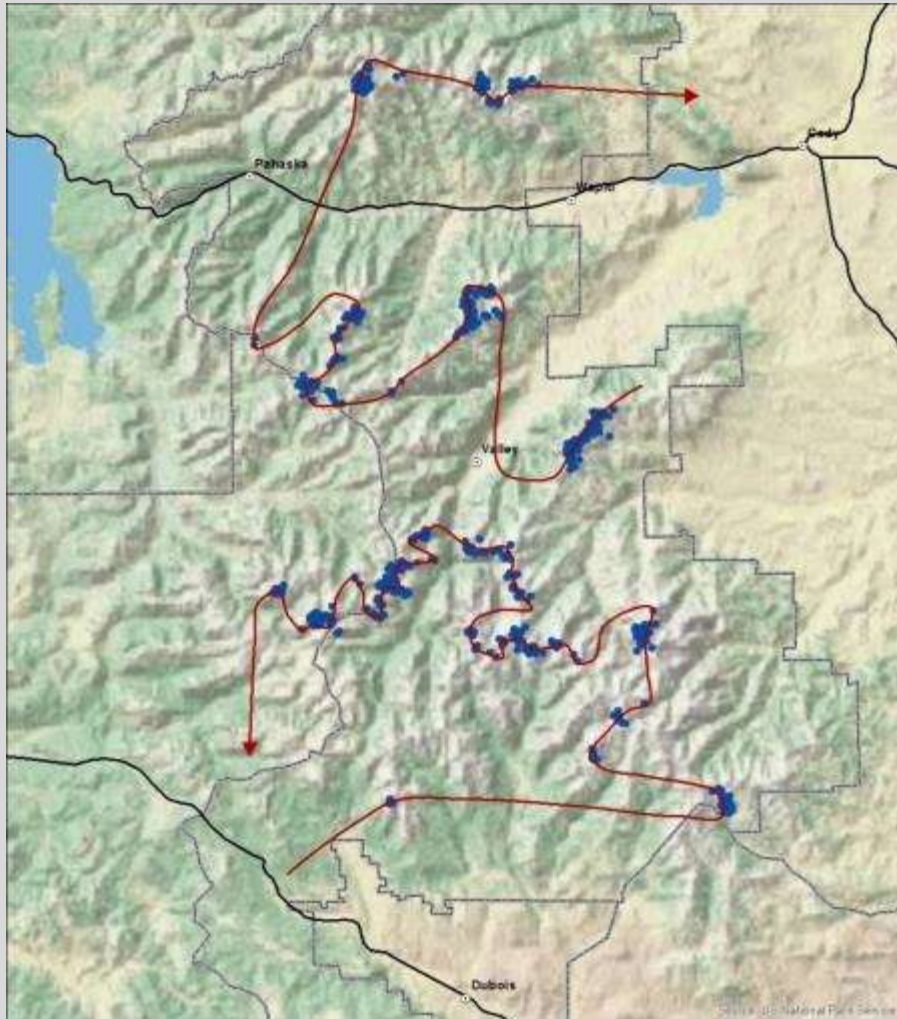
Model Assumption Issue: Grizzly Bears Foraging at Moth Aggregation Sites



Capture Sites and VHF Locations of Grizzly Bears: Non-moth vs. Moth Users 1986-2013



Grizzly Bear Sightings on Moth Aggregation Sites (Moth Site-only Surveys) 2012-2014



Year	Bears	F _{COY}
2012*	100	10
2013	140	14
2014	220	19

* 2012 flight did not include all sites

FWS_Emails_061869

Implementation Steps for Mark-Resight Estimator

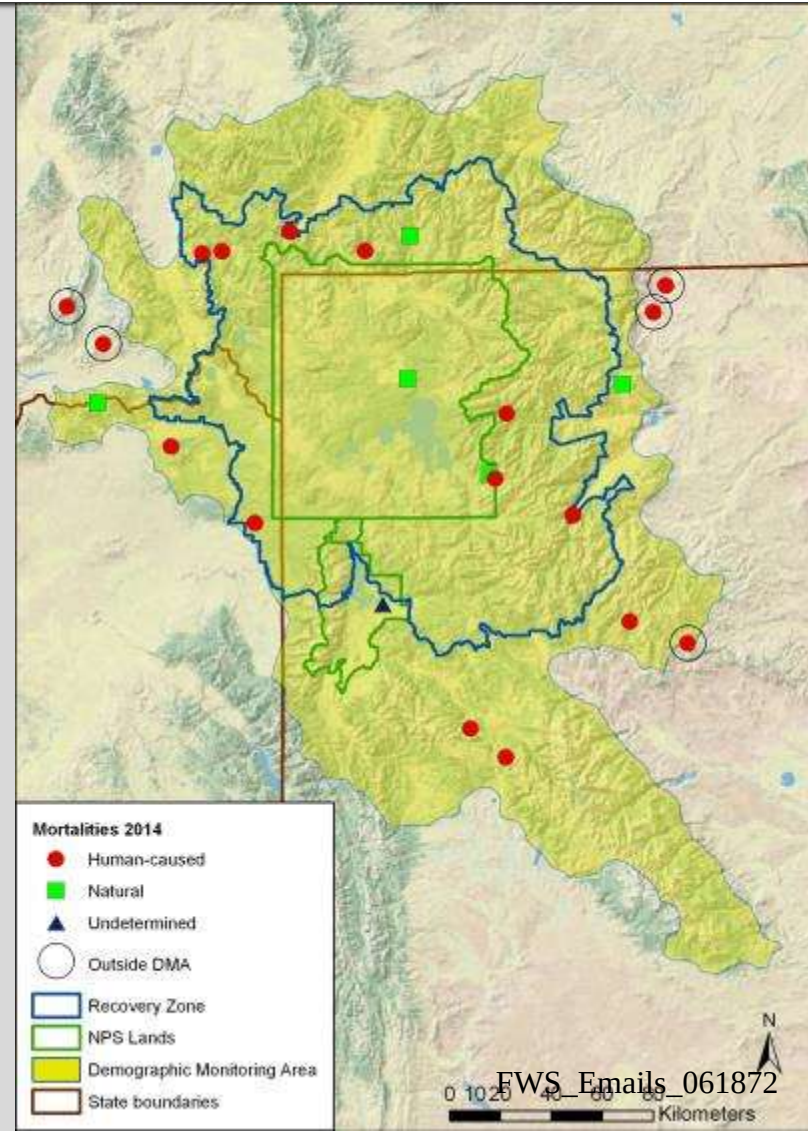
- 1) Study Team consensus to start implementation
 - Address how to incorporate uncertainty into overall population estimate
- 2) Independent data: effective population size (N_e)
 - Evaluate if effective population size analyses support mark-resight results
 - Publish findings in peer-review journal
- 3) Presentation to YES and IGBC – Summer 2015
 - Requires maintaining current sample (>25) of radio-marked, adult females; preferably more
 - Continuation of Chao2 technique for comparison

Documenting Grizzly Bear Mortalities and Evaluating Annual Mortality Limits

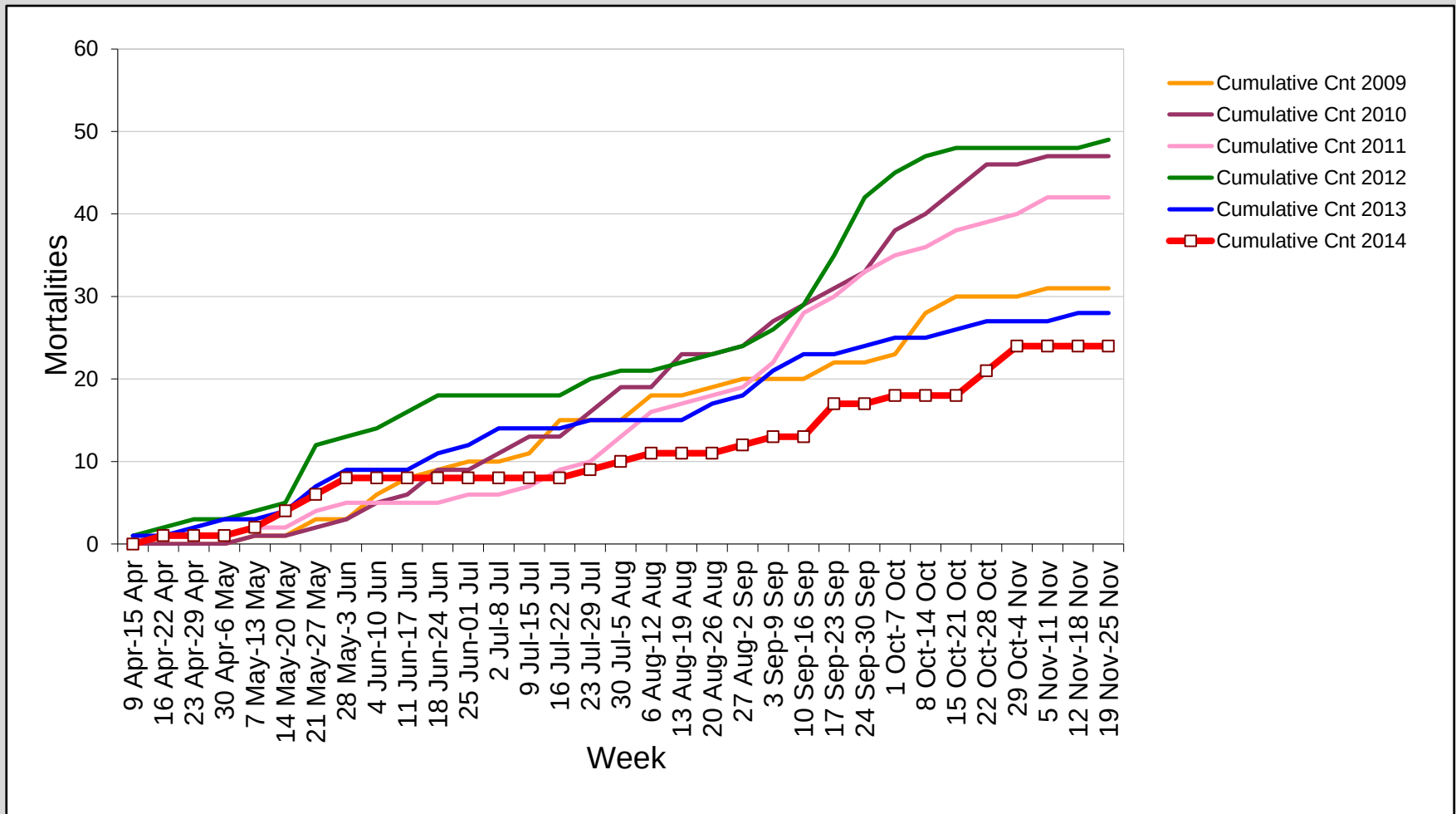


Known and Probable Mortalities 2014

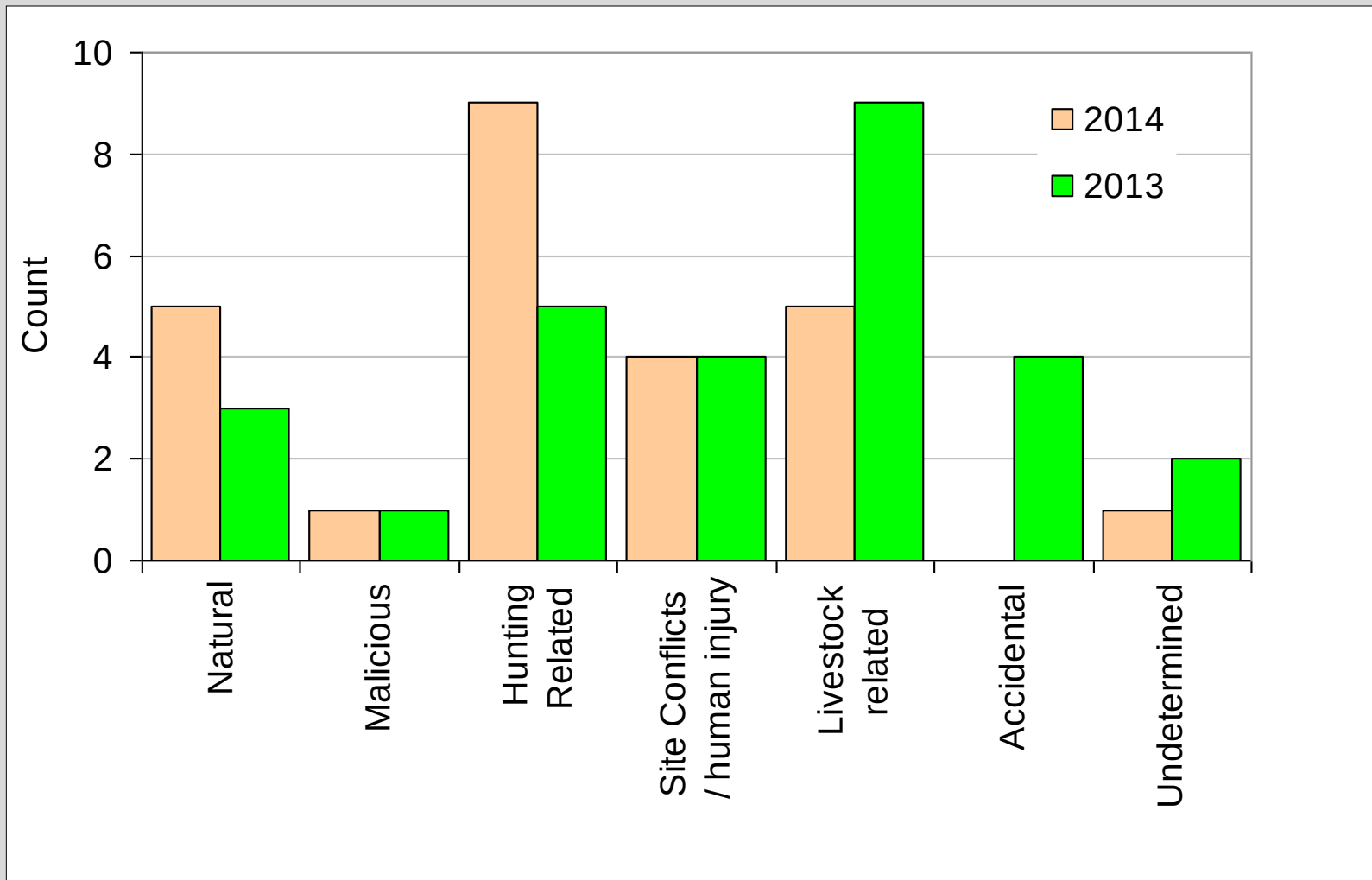
- 24 known and probable mortalities during 2014
 - 19 human-caused
 - 5 natural (1 sex unknown)
- 5 (4 M, 1 F) outside Demographic Monitoring Area
- 1 additional known mortality from 2013
 - Cub-of-the-year in Grand Teton NP
 - Undetermined cause



Cumulative Count of Known and Probable Mortalities by Week 2009-2014



Counts of Known and Probable Mortalities by Cause 2013-2014



Sustainable Mortality Limits

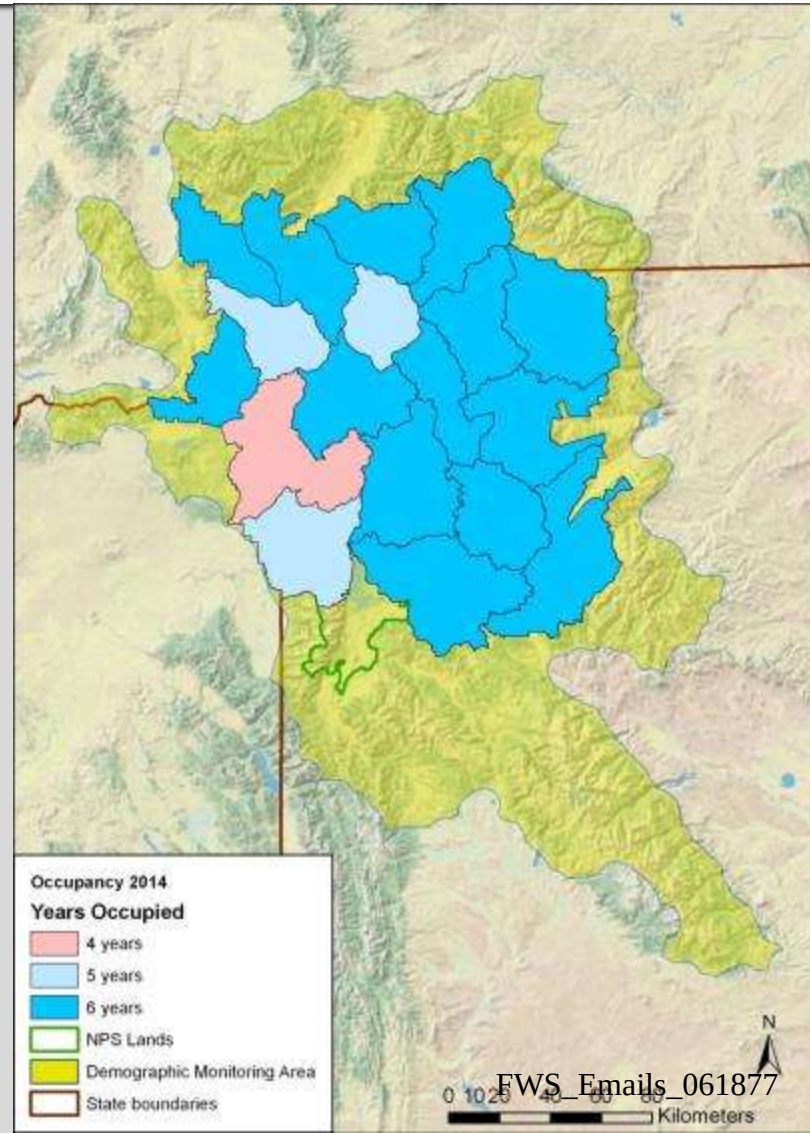
- Count mortalities within Demographic Monitoring Area (DMA)
- F_{COY} sighted within DMA used for population estimate
- Mortality limits
 - 7.6 % independent females
 - 15.0 % independent males
 - 7.6 % dependent young (human-caused only)

Mortality Limits 2014

Population segment	Estimated total mortality	Sustainable mortality limit	Year result
Independent females (≥ 2 years old)	7	20	Under
Independent males (≥ 2 years old)	17	39	Under
Dependent young (cubs and yearlings)	2	18	Under

Occupancy by Females with Young (cubs, yearlings, or 2-year-olds) 2014

- 18 of 18 Bear Management Units (BMUs) occupied during 2014
- 18 of 18 BMUs occupied at least 4 of last 6 years (2009-2014)

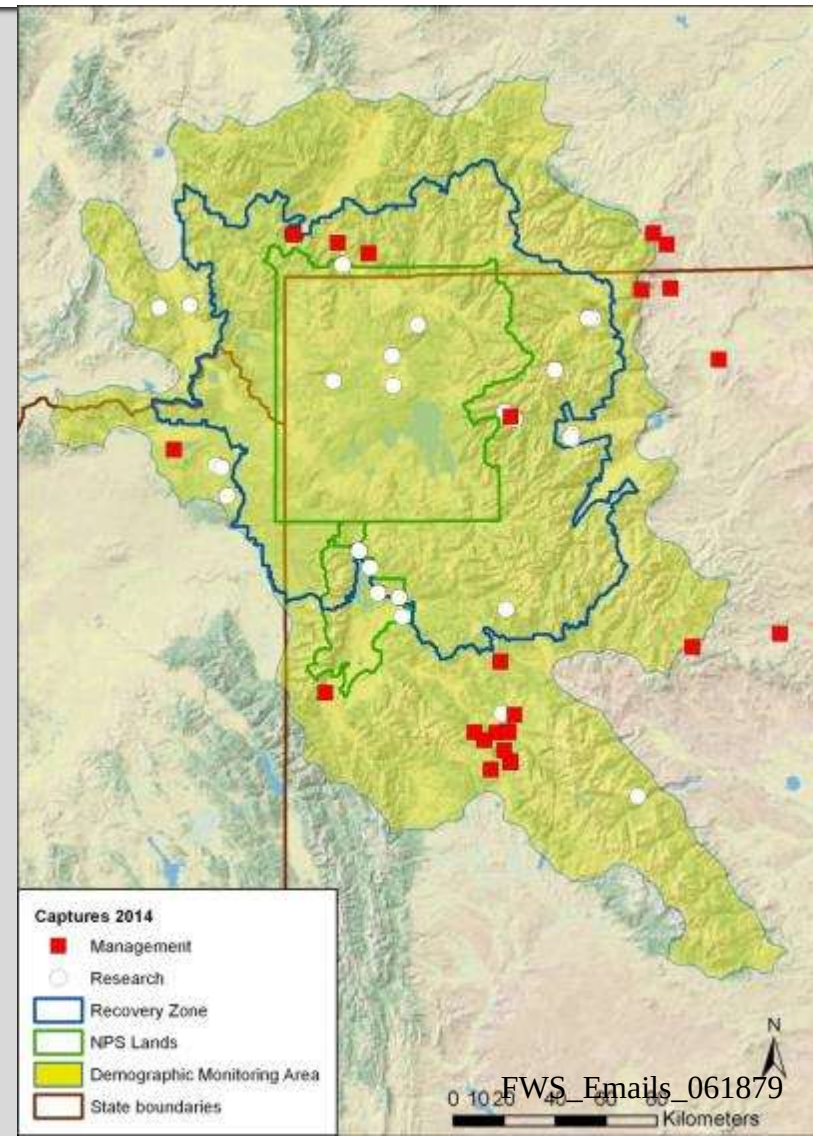


Grizzly Bear Captures and Monitoring for Known Fate Estimation of Population Trend

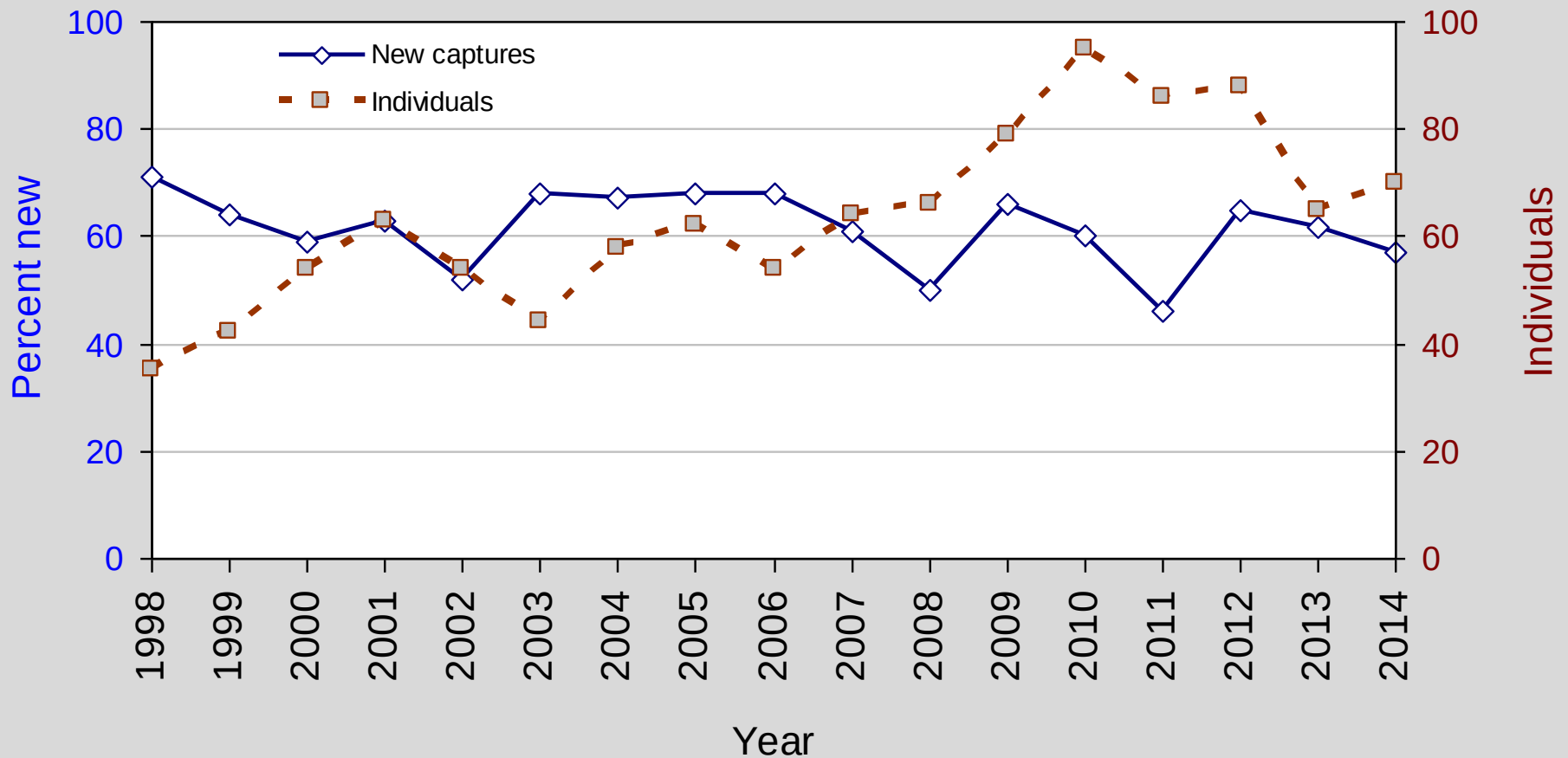


Distribution of Grizzly Bear Captures 2014

- Total captures = 81
 - Research = 51
 - Management = 30
- Individuals bears = 70
 - Females = 16 (8 adults)
 - Males = 54 (36 adults)
- New bears = 40



Percent of Previously Unmarked Grizzly Bears Captured 1998-2014



Grizzly Bears Radio-Monitored 2014

Total monitored = 94

- Adult females = 33

Currently radio-marked = 60

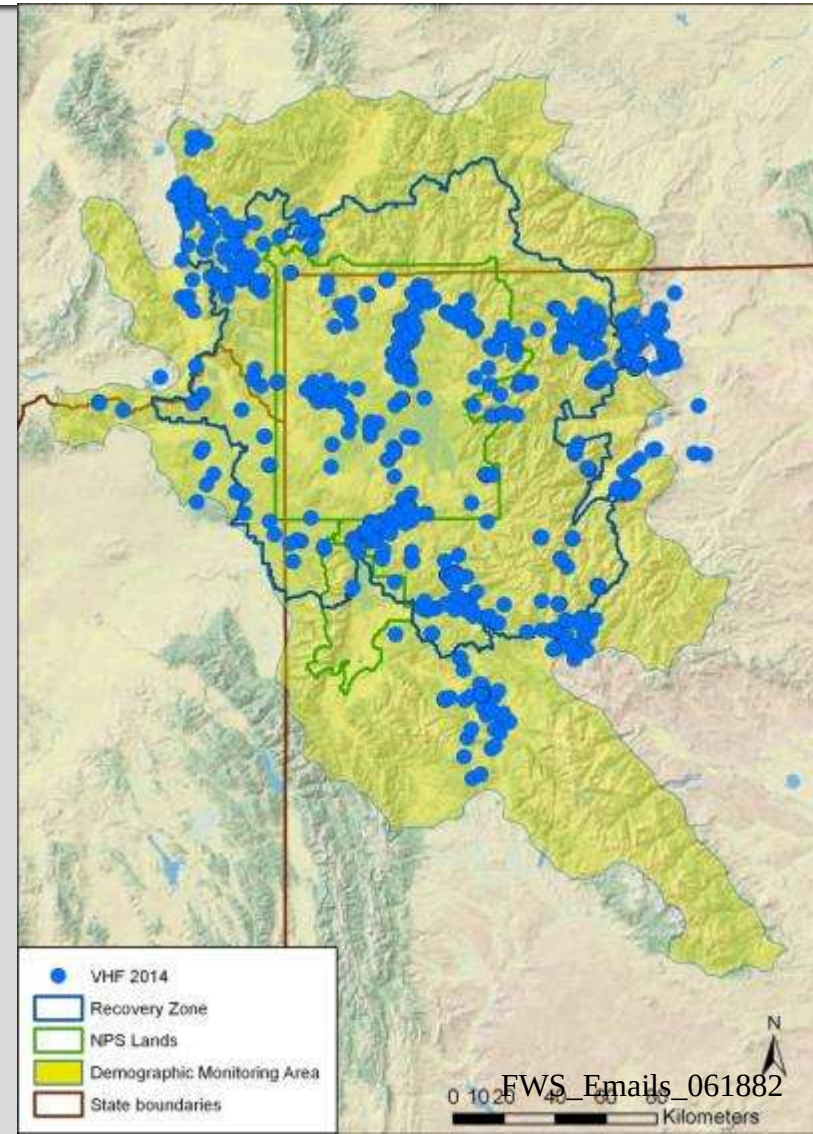
- Females = 24 (21 adults)
- Males = 36 (27 adults)
- Bears missing = 5



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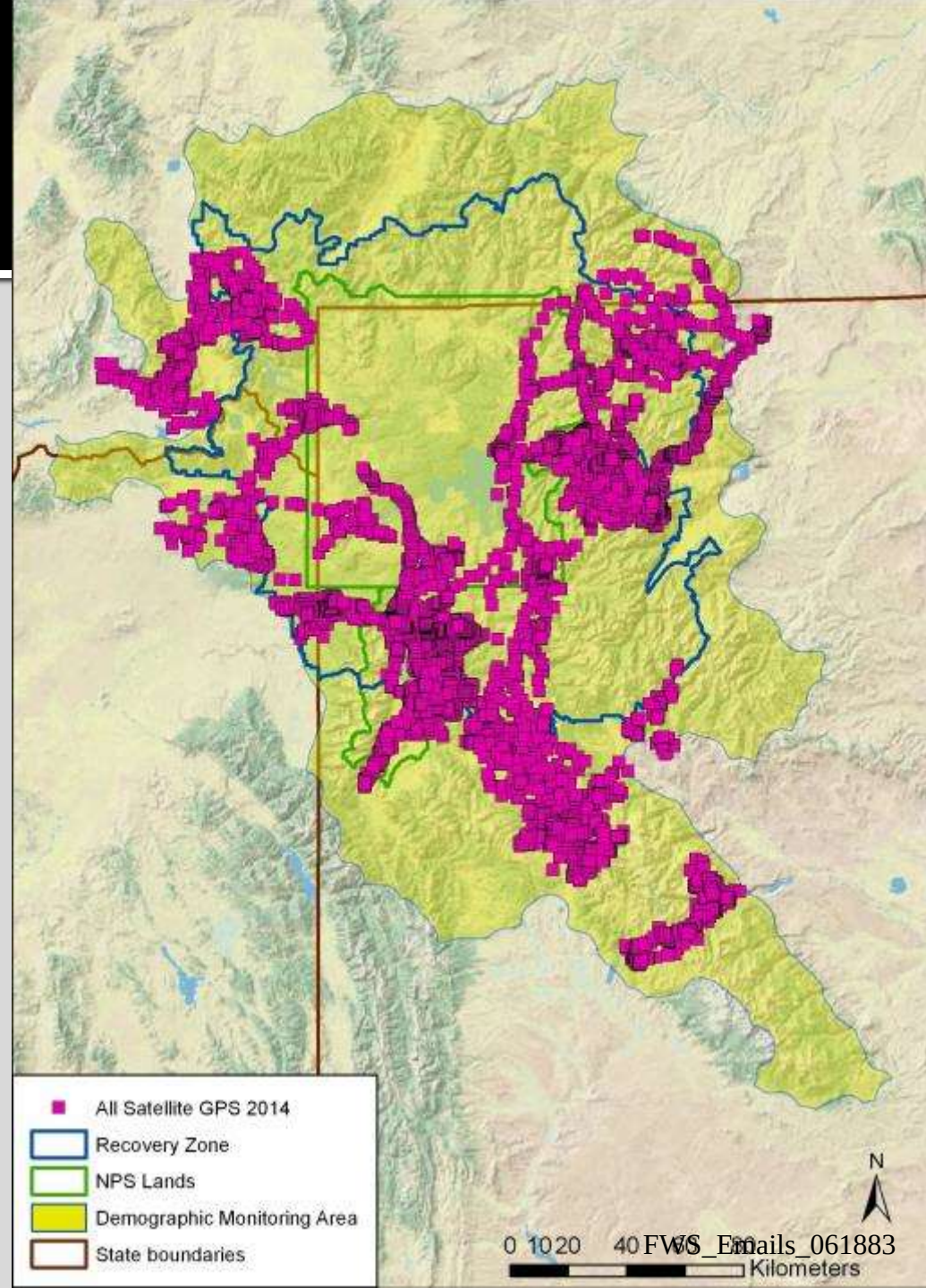
Telemetry Flights 2014

- 313 flight hours
- 1017 radio locations
- 146 observations of radio-marked bears

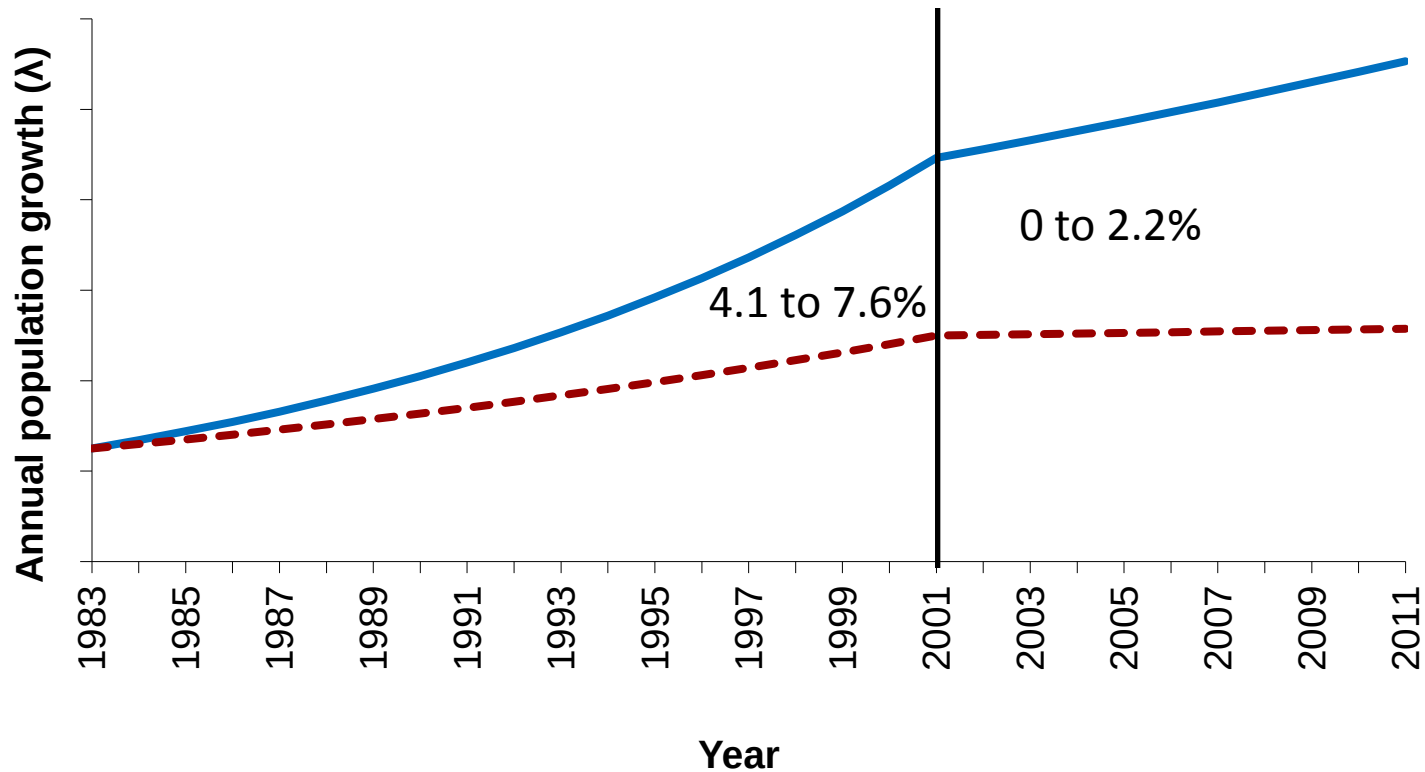


Satellite GPS locations 2014

- 29 Satellite GPS collars deployed (22 Iridium, 7 Argos)
- 184,856 locations



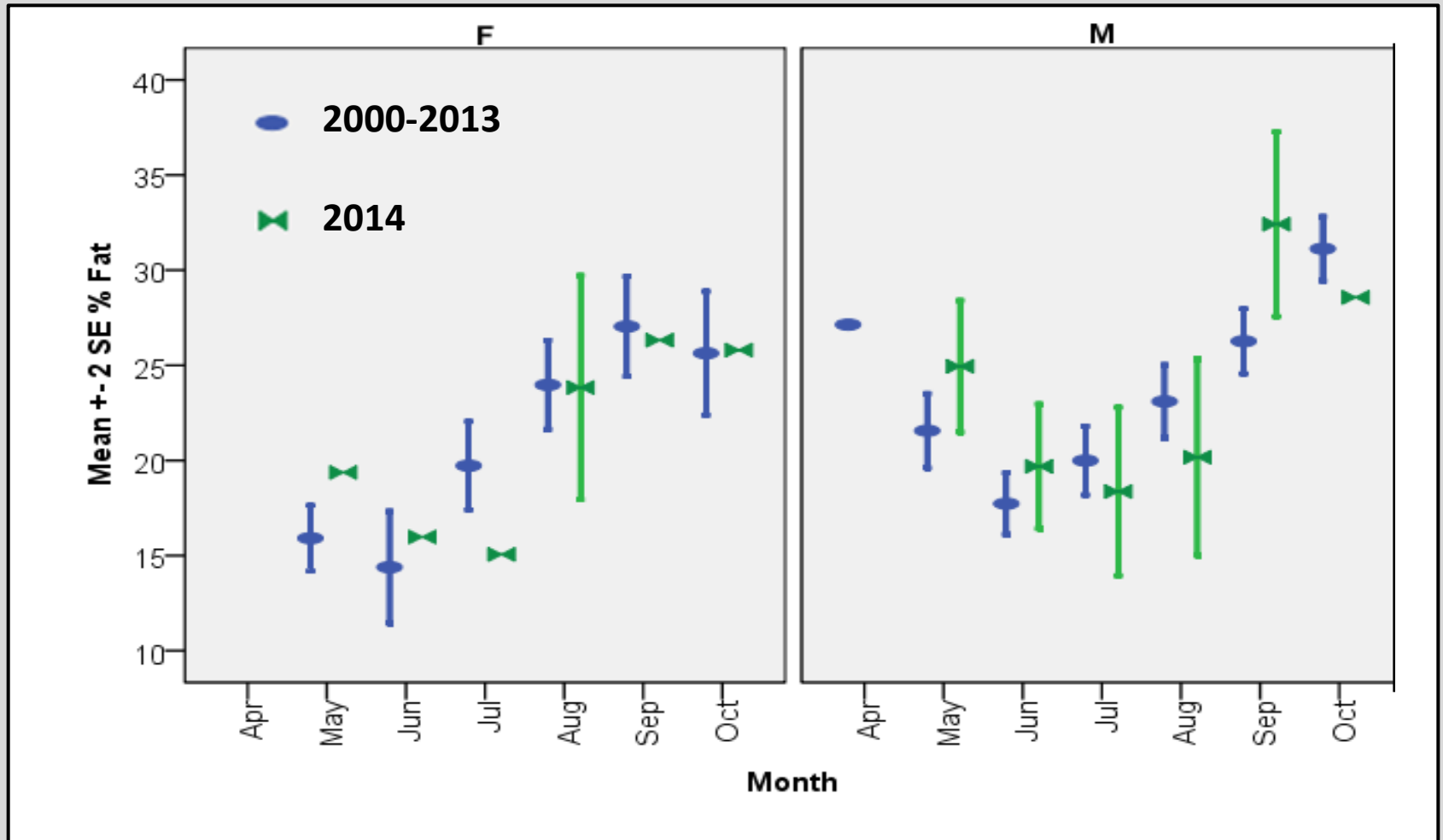
Known-Fate Monitoring: Projected Population Growth



Bioimpedance to Estimate % Body Fat



% Body Fat by Month for Independent-aged Grizzly Bears 2000-2013 vs. 2014



Genetic Monitoring 1984-2013

- 853 individuals genotyped (20 microsatellite markers) through the end of the 2013 field season
- No evidence of non-GYE ancestry in any of the individuals genotyped to date



IGBST

Monitoring of High-Calorie Foods



Foods Monitoring 2014 - Summary

- Winter kill carcass surveys: 0.19/km survey (low to moderate)
- Cutthroat trout: positive trend in numbers of spawning trout and grizzly bear activity on front-country streams
- Army cutworm aggregation sites: 470 bear observations on 29 different sites (new high)
- Whitebark pine: mean of 20 cones/tree (175 trees surveyed; 11th rank out of 35 years); 75% mortality among mature, cone-producing trees)
- Qualitatively: very good berry production

Summary

- Greater than expected F_{COY} count
 - Highest number of F_{COY} observed in 2013
 - 2013 count followed good whitebark pine cone production during 2012
- Implementation of mark-resight estimator
- Low mortality for second year in a row
 - 2014 mortality limits not exceeded
- Population and food monitoring support findings of food synthesis report

A close-up photograph of a dense, shaggy coat of fur, likely from a wild animal. The fur is a mix of dark brown, tan, and light brown strands, creating a textured, layered appearance. The lighting is natural, highlighting the individual hairs and the overall thickness of the coat.

**2013 Annual Report, data, maps,
and other products available at
IGBST website:**

Google “IGBST”

Acknowledgments

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