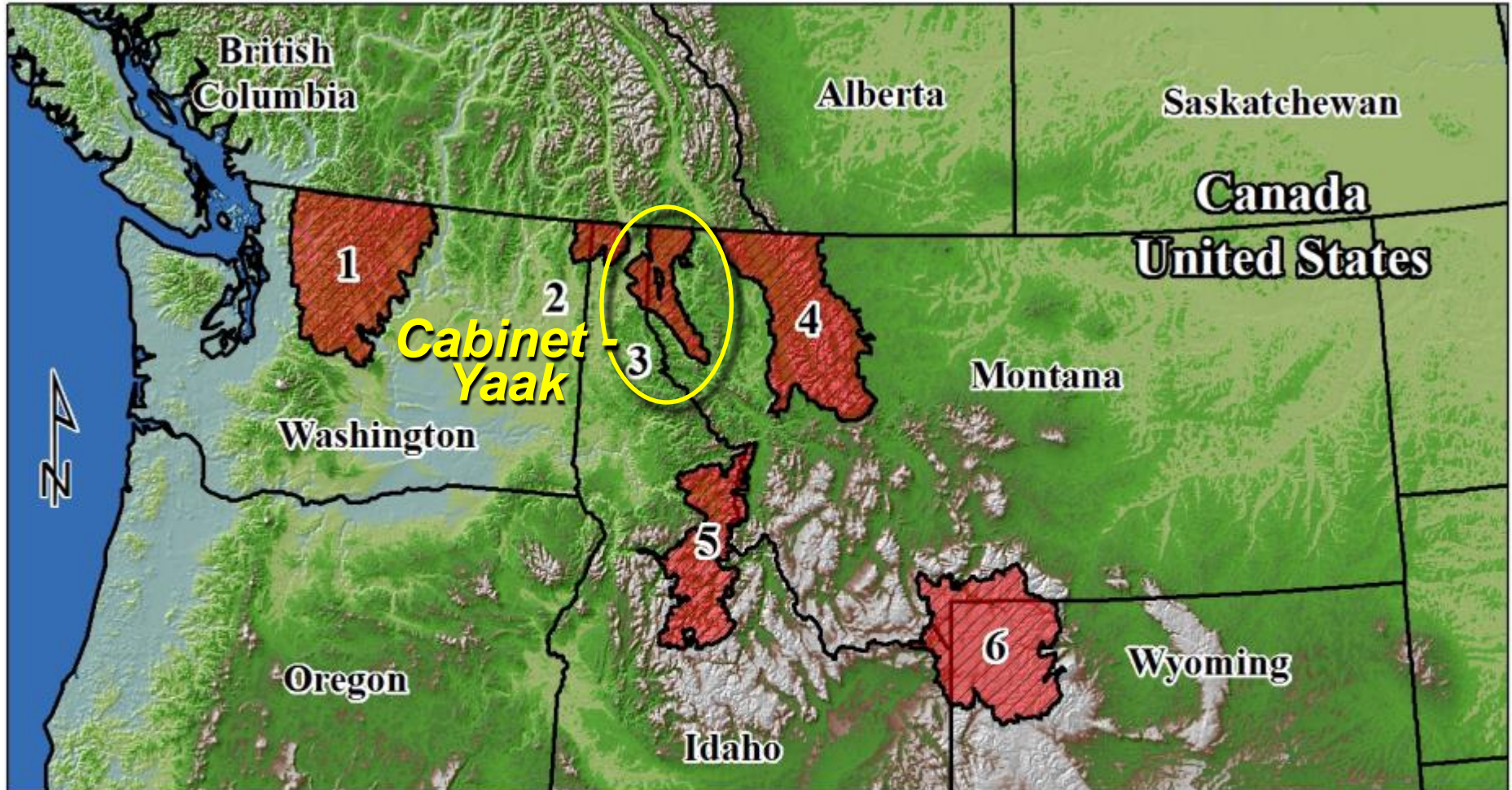


GRIZZLY BEAR ABUNDANCE AND Density IN CABINET-YAAK ECOSYSTEM PRELIMINARY RESULTS: MAR 2014

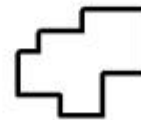


**Kate Kendall
Kris Boyd
Amy Macleod
John Boulanger
Wayne Kasworm
Kim Annis
Michael Proctor
CYE Grizzly Bear Study Team**

GRIZZLY BEAR RECOVERY ZONES



U.S. Grizzly Bear Recovery Zones

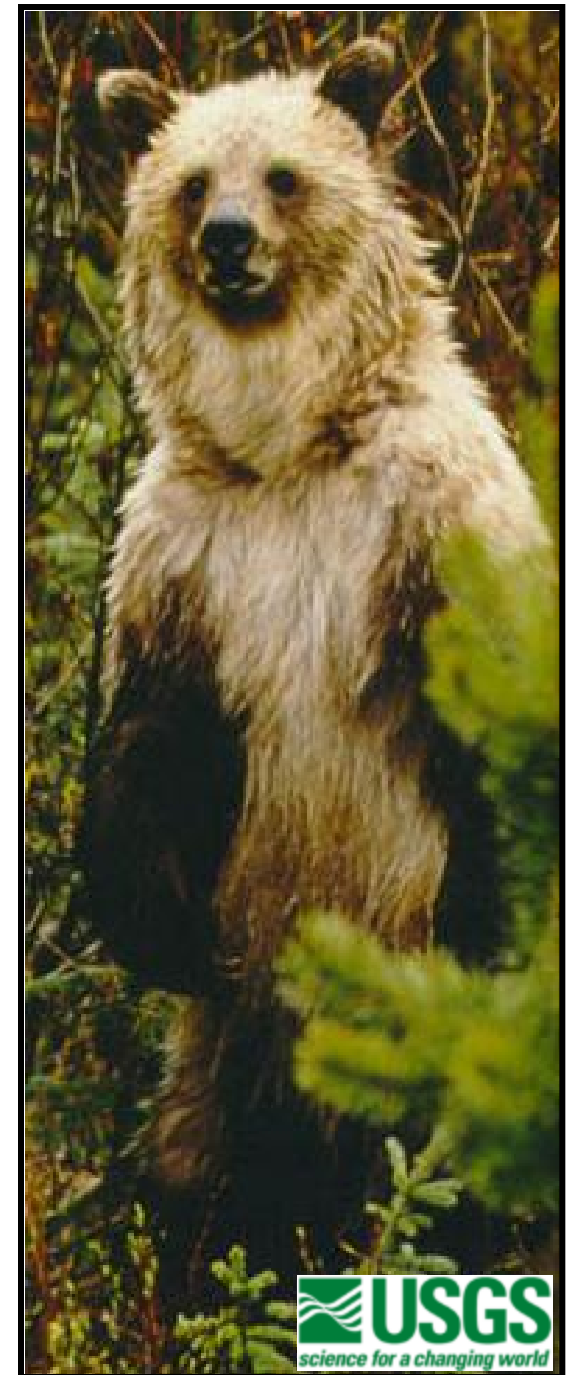


States and provinces



NEED FOR INFORMATION

- Population small and fragmented
- Estimates of abundance
— lack measure of precision
- Need baseline data on size to plan management



PREVIOUS AND ON-GOING WORK



US Fish and Wildlife Service & Idaho Fish and Game

Recovery Zone trapping
Hair snagging
Observations
(remote cameras & public reports)



Movements, Trend, Genetics,
Reproduction, Age, Mortality,
Distribution, Augmentation
success



Montana Fish Wildlife and Parks

Management
Augmentation trapping



Augmentation success,
Genetics, Reproduction
Movements, Age, Mortality

OBJECTIVES

- Population size
 - Distribution
 - Genetic structure
-

APPROACH

- Hair snaring
- Genetic analysis
- Mark-recapture modeling



CONCURRENT HAIR SAMPLING METHODS

Bear rubs

- 30% of grizzlies in NCDE only detected at rubs
- No avoidance due to previous capture



Hair corrals

- 50% of grizzlies in NCDE only detected at corrals



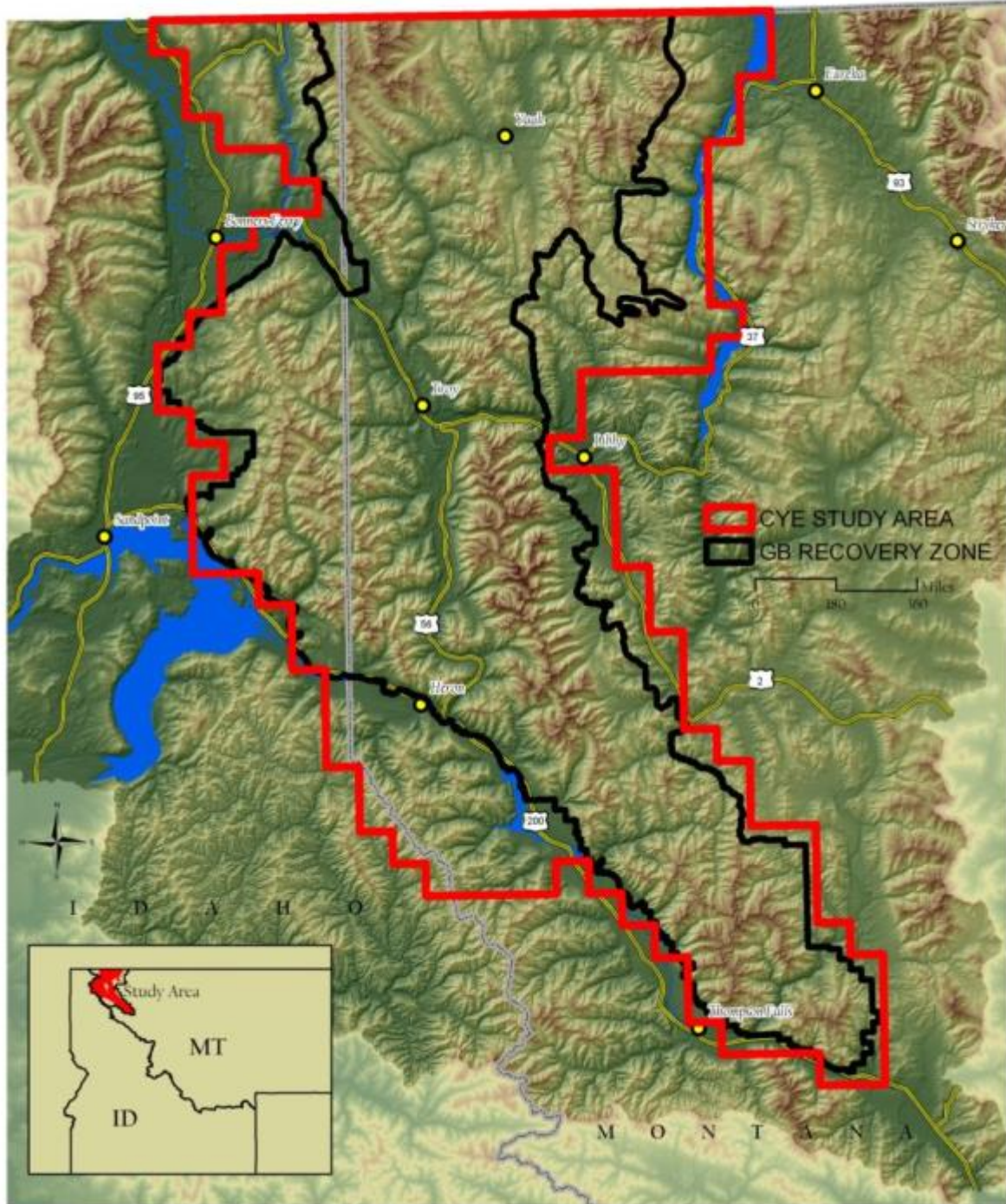
CABINET-YAAK DNA PROJECT

Study Area:

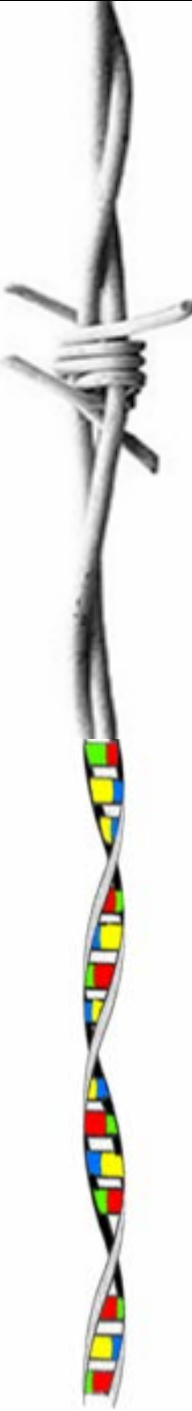
2.4 M acres
(9,900 km²)

Recovery Zone:

1.7 M acres
(6,800 km²)



PROJECT TIMELINE



	2011	2012	2013	2014
Set up rubs.....	X			
Select hair corral sites	X			
Set up corrals		X		
Collect hair from rubs & corrals.....		X		
Genetic analysis.....		X	X	
Analyze data and prepare report.....			X	X

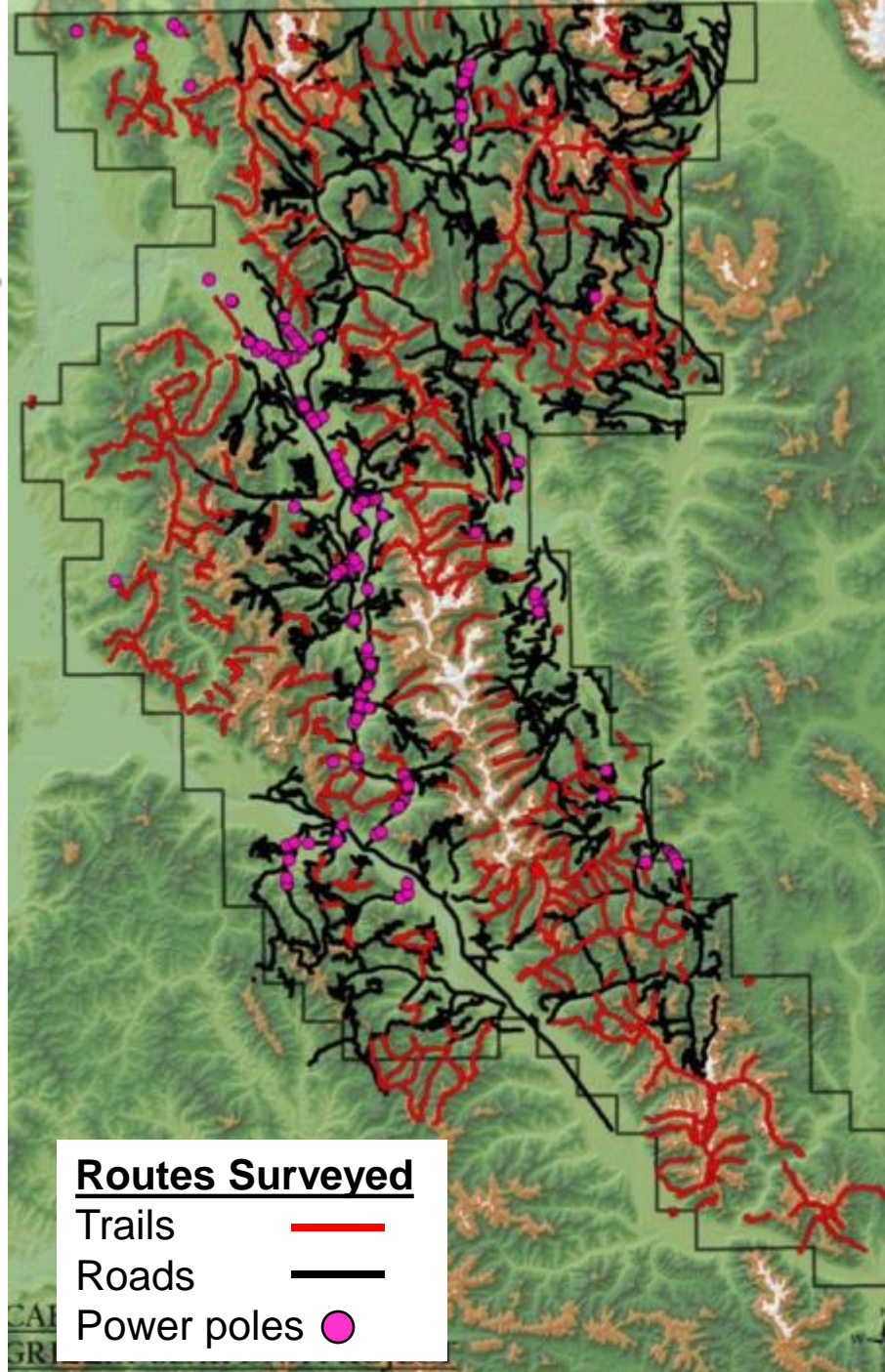
BEAR RUB IDENTIFICATION

2011 Field crew: **5**



Distance surveyed:
3,542 mi. (5,700 km)

Bear rubs established:
2011: **1,017**
Spr. 2012: **369**



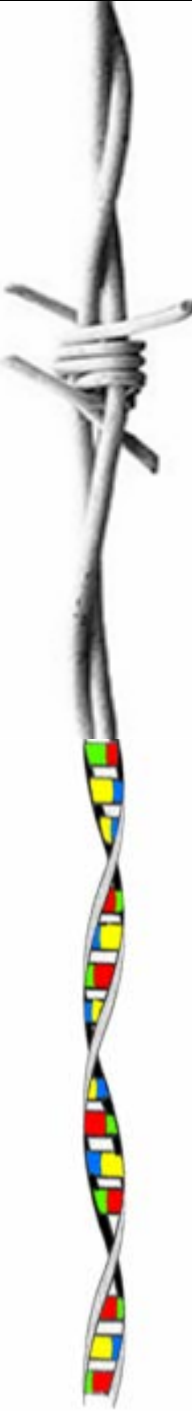
Routes Surveyed

- Trails ———
- Roads ———
- Power poles ●

HAIR CORRAL SITE SELECTION



TIMELINE



	2011	2012	2013	2014
Set up rubs; select corral sites...	X			
Recruit, hire, train employees, logistics.....		X		
Set up / collect hair from rubs & corrals....		X		
Genetic analysis, data base QC.....		X	X	
Analyze data and prepare report.....			X	X

2012 FIELD SEASON

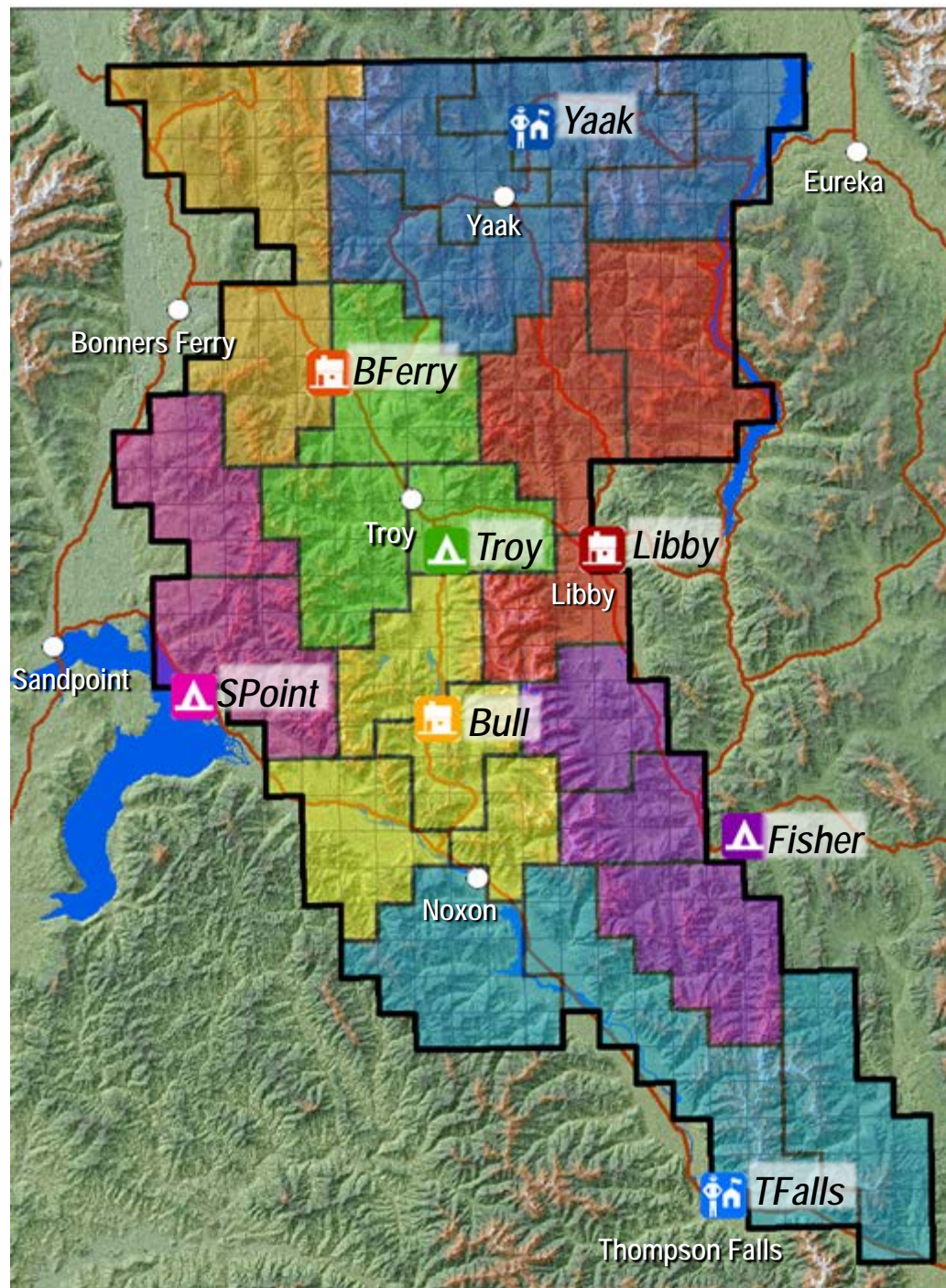


72 crew members

- 1 Project Manager
- 1 GIS/Database Specialist
- 2 Data Entry Techs
- 2 Tactical Field Techs with 2 Interns – Mixed Duties
- 8 Base Camp Managers with 8 Interns – Mostly Rubs
- 24 Lead Field Techs – Mostly Corrals
- 24 Assistant Techs – Mostly Corrals

2012 FIELD LOGISTICS

Field crews distributed
in 8 base camps



HAIR CORRAL SAMPLING

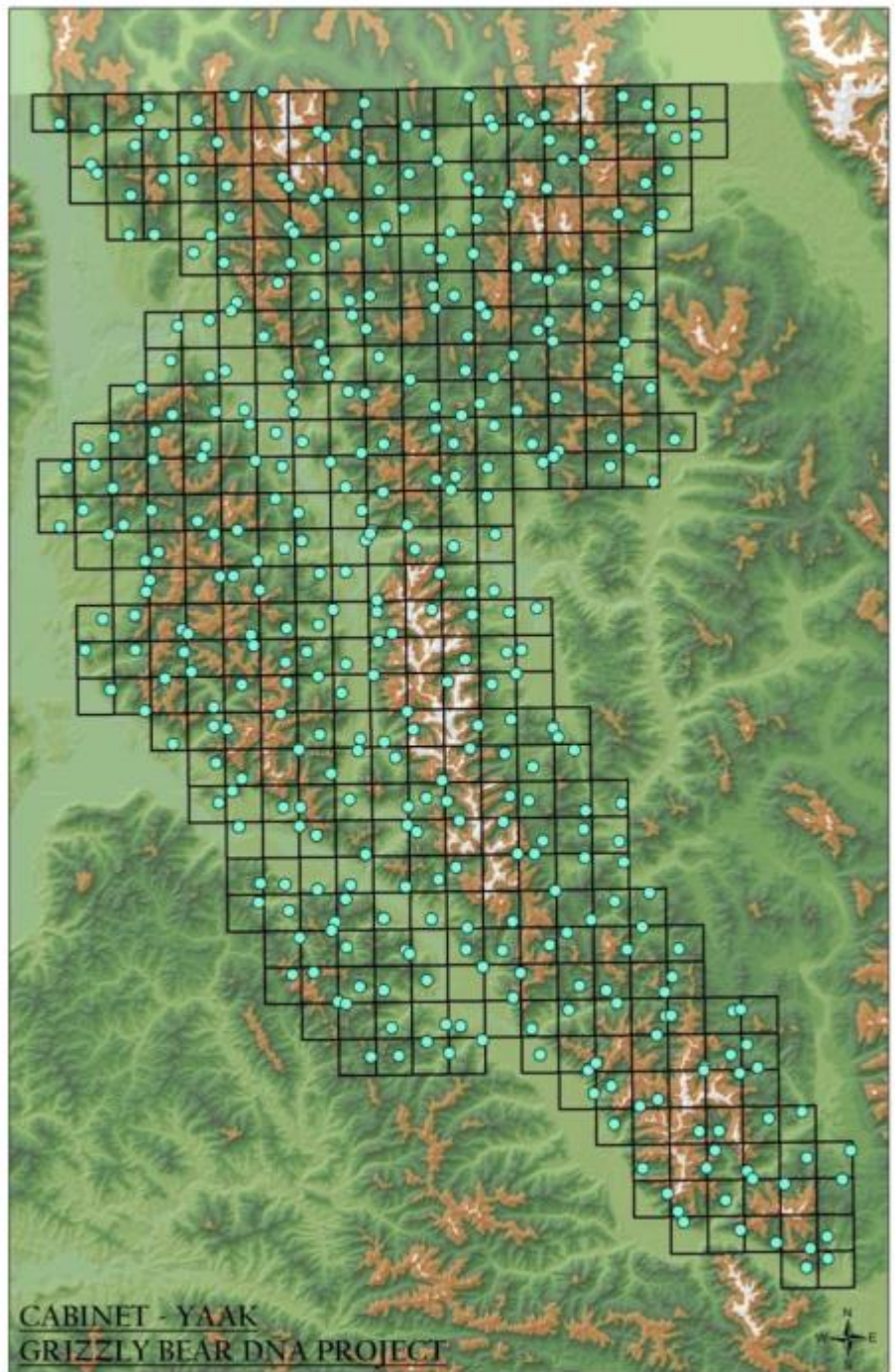
- 100 ft barbed wire
- Baited w/ scent lure



HAIR CORRALS: EARLY

- Grid : 5 x 5 km
- Cells: 395
- 5 14-day sessions
- Early and late sites
- Early sites used for 1st 3 sessions

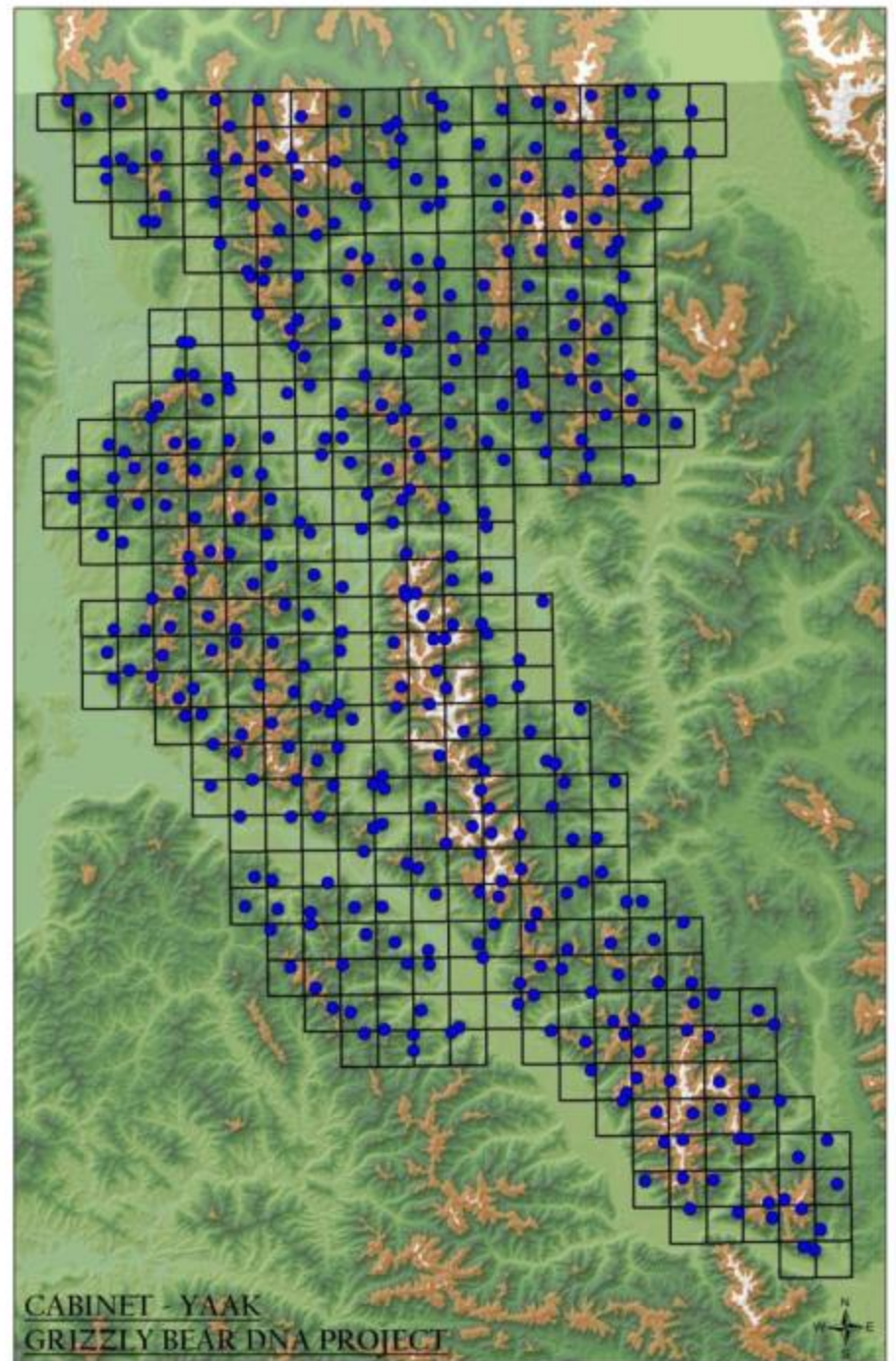
Early season sites 



HAIR CORRALS: LATE

- Late sites used for sessions 4 & 5

Late season sites 

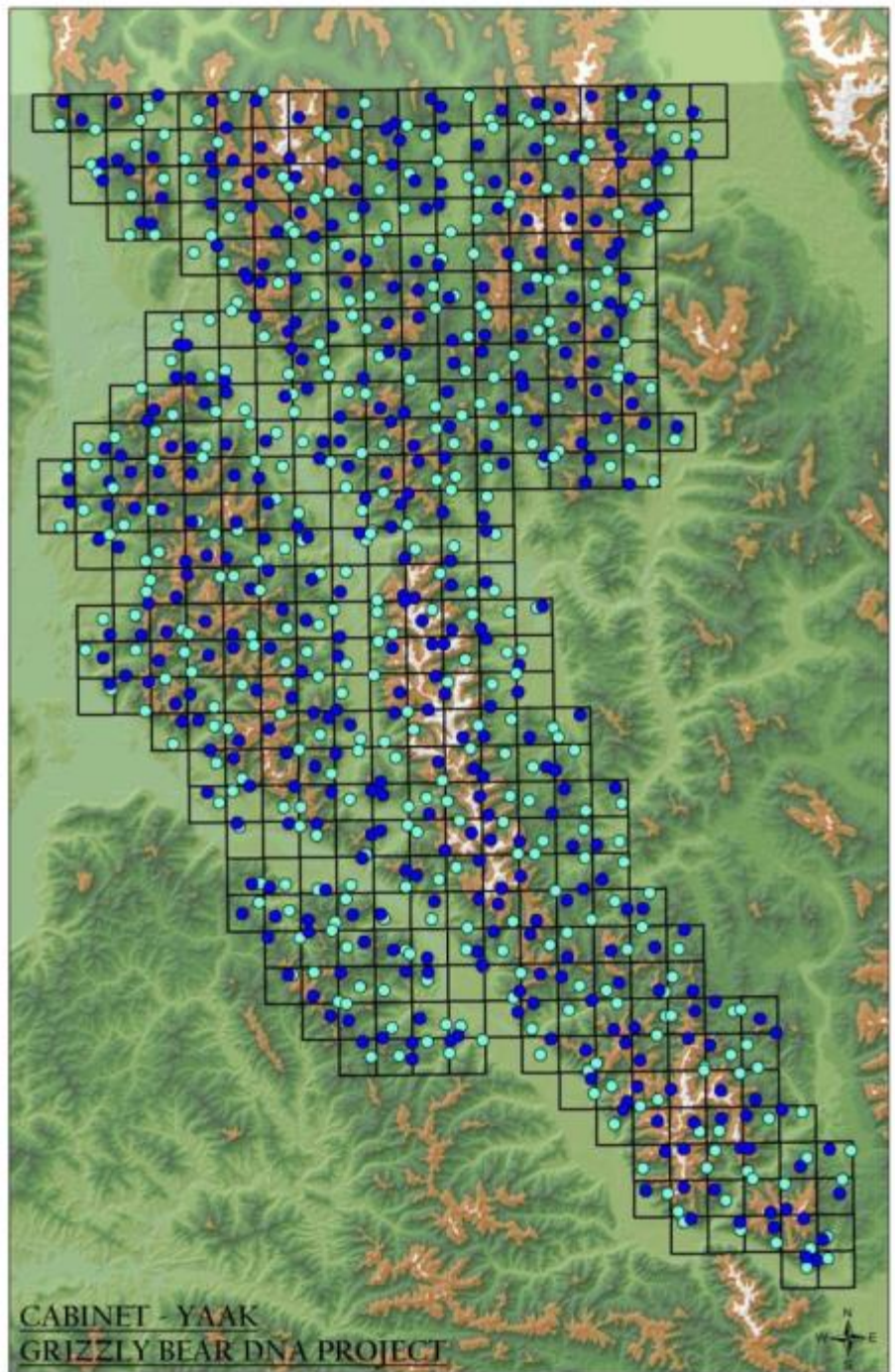


HAIR CORRALS: ALL

- Cells: 395
- 2 corral locations/cell

Early season 

Late season 



LURE PRODUCTION

- 55-gallon steel drums: **75**
- Fish: **1,300 gallons**
- Blood: **2,400 gallons**
- Age fish/blood 1 year.
- Fish juice & blood > bottle
- Yield: **3,000 gallons of lure**
- Used: **4 quarts/corral**
- Secondary scent lures:
anise^{s2}, skunk^{s3}, cherry^{s5}



CYE CATTLE EXCLUSION FENCES



- 21 fences built to protect hair corrals in grazing allotments

BEAR RUB SURVEYS

- Trees, power poles, sign posts
- Natural rubs; no attractants used
- Barbed wire yields better hair samples



BEAR RUBS ESTABLISHED



Trees (57%)



Sign Posts (21%)



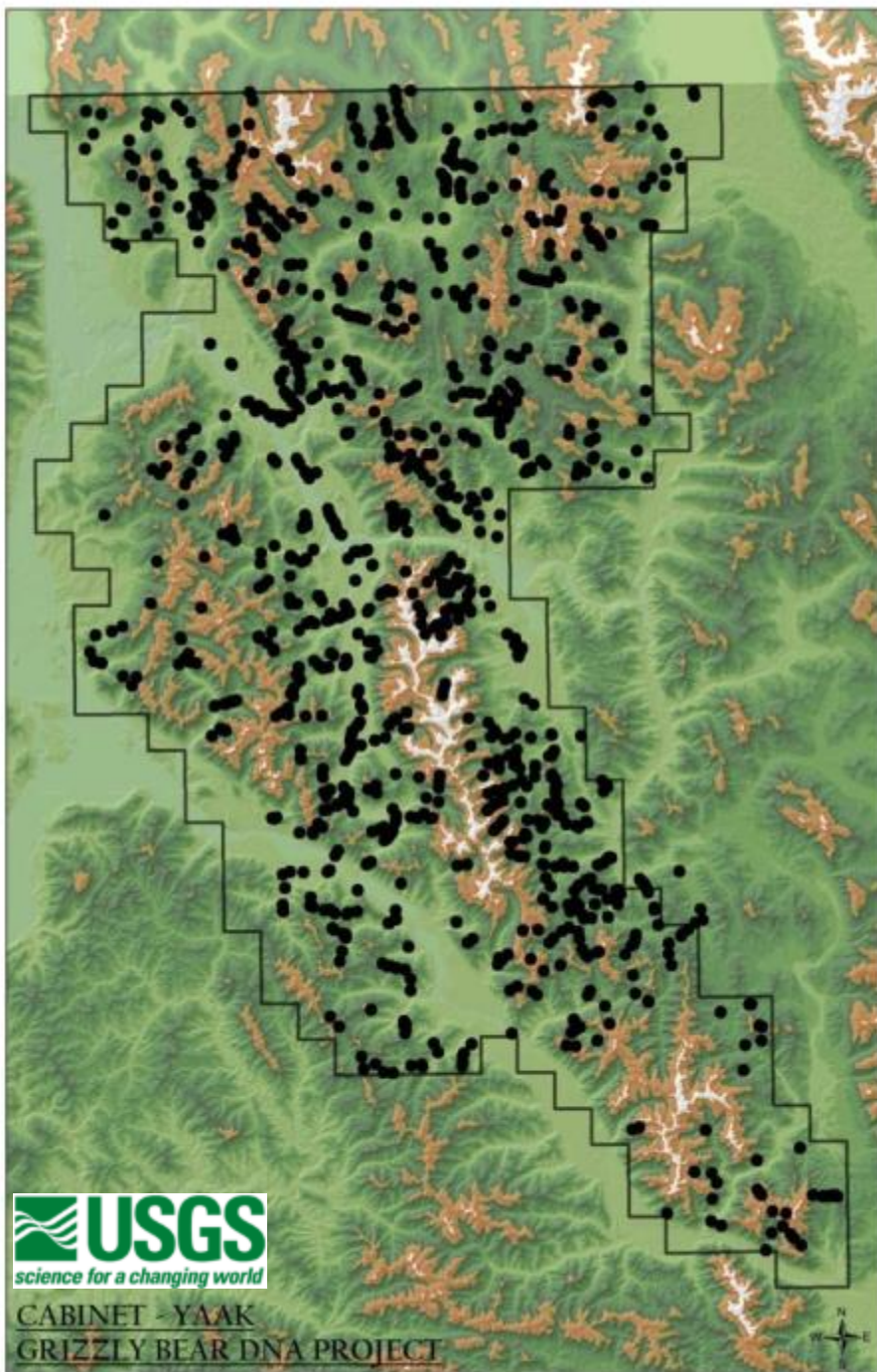
Power Poles (20%)



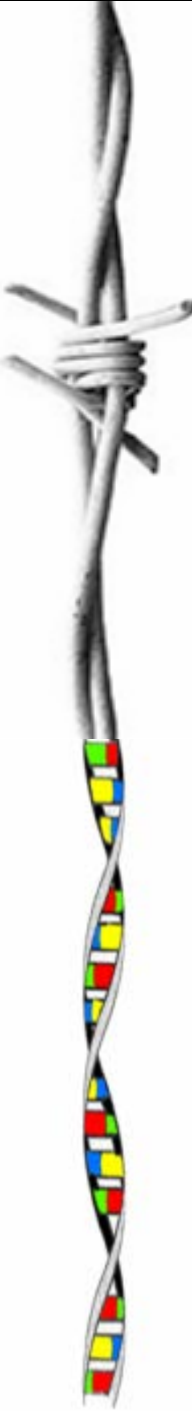
**Fences, bridges,
other (3%)**

RUB SAMPLE SITES

Rubs monitored: **1,386**
Survey interval: **14 days**
Sampling occasions: **8**



TIMELINE



	2011	2012	2013	2014
Set up rubs.....	X			
Set up corrals		X		
Collect hair from rubs & corrals.....		X		
Genetic analysis.....		X	X	
Analyze data and prepare report.....			X	X

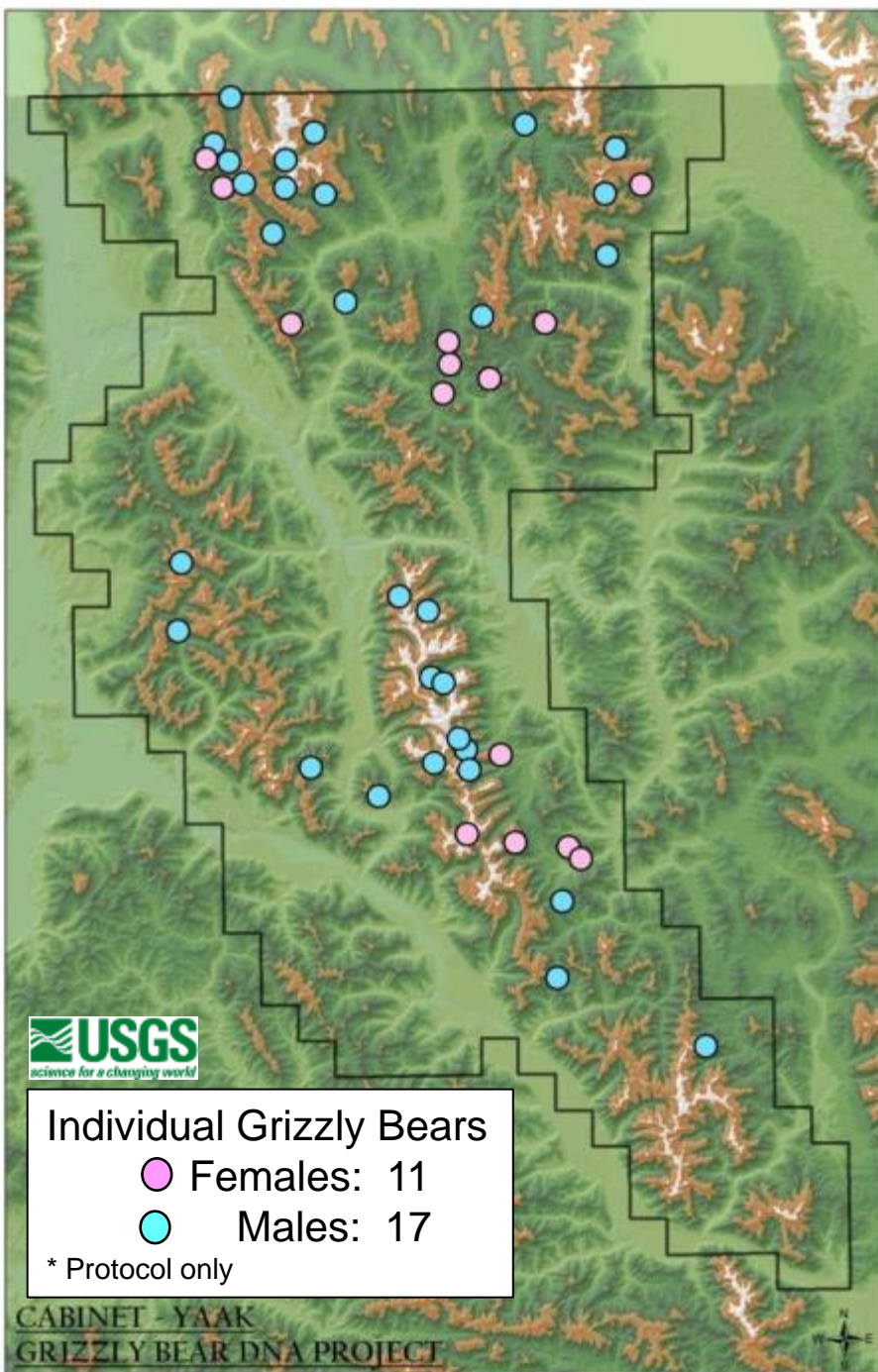
HAIR SAMPLE SUBSELECTION

- Total no. hair samples: **18,761**
- Samples sent for genetic analysis: **11,280** (60%)
- Minimize cost while maximizing no. individual bears



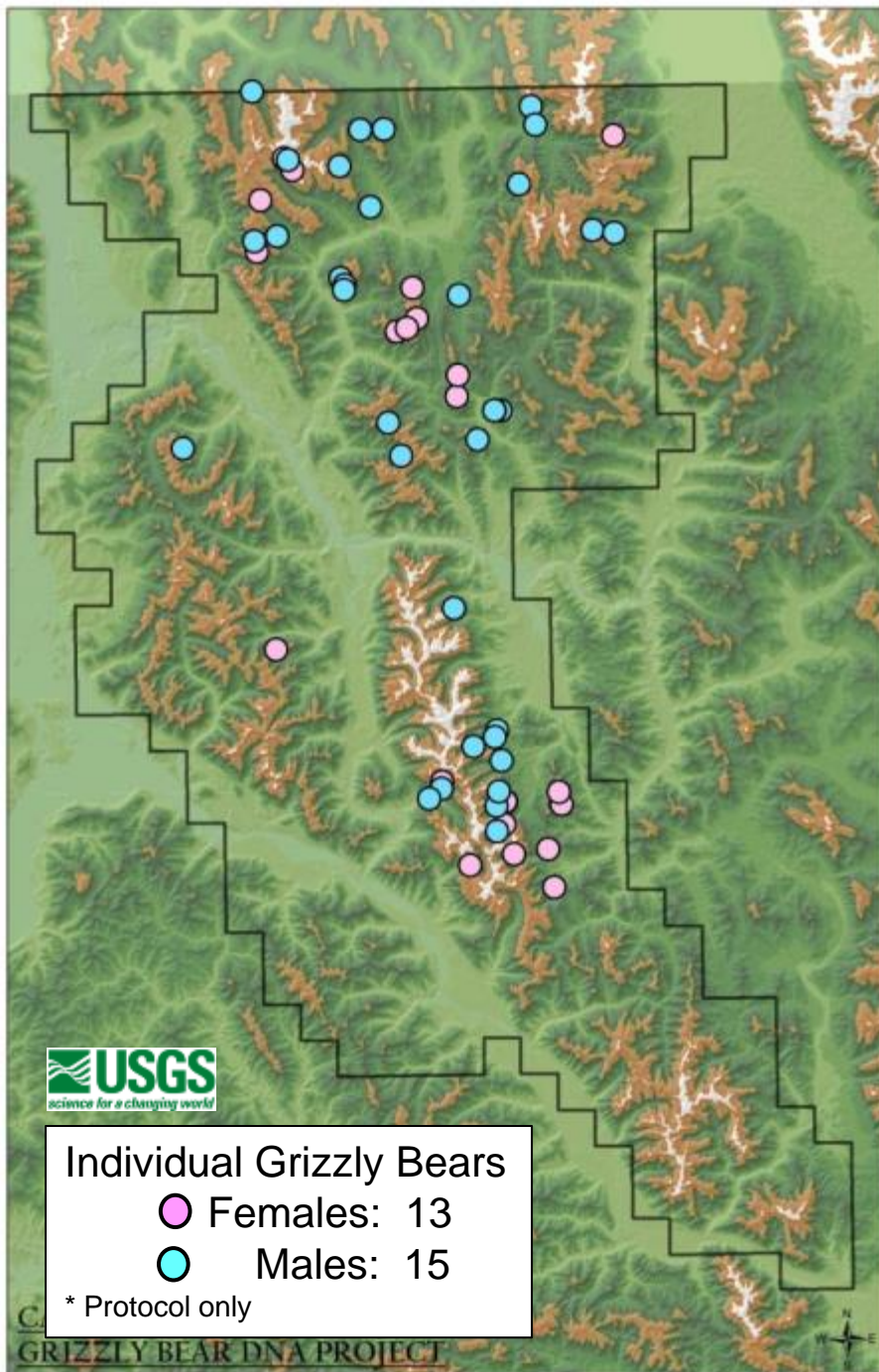
CORRAL RESULTS

- Hair trap visits: **1,975**
- Bear hair samples: **10,405**
- Grizzlies detected: **28***



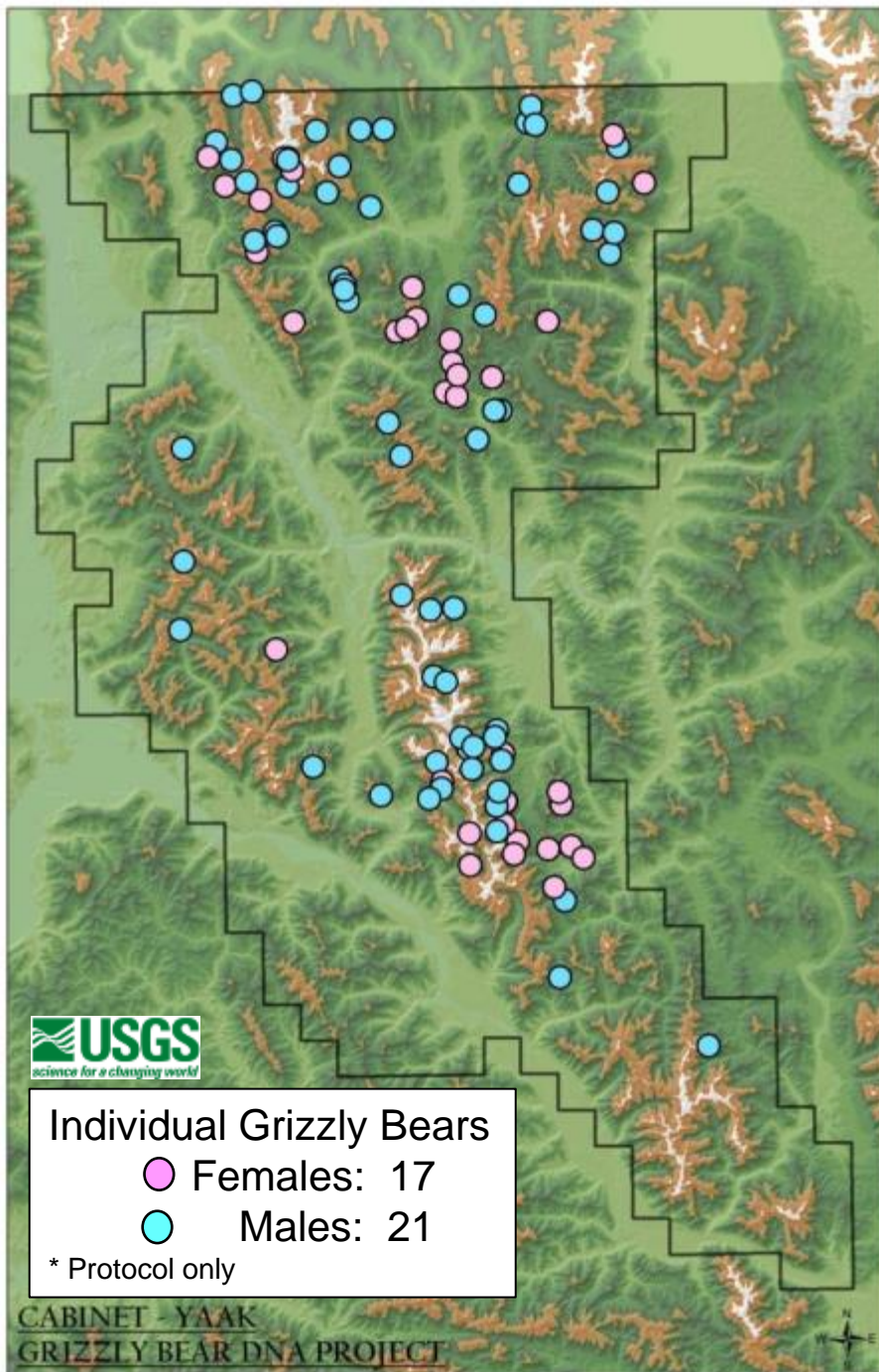
BEAR **RUB** RESULTS

- Bear hair samples: **8,356**
- Grizzlies detected: **28***



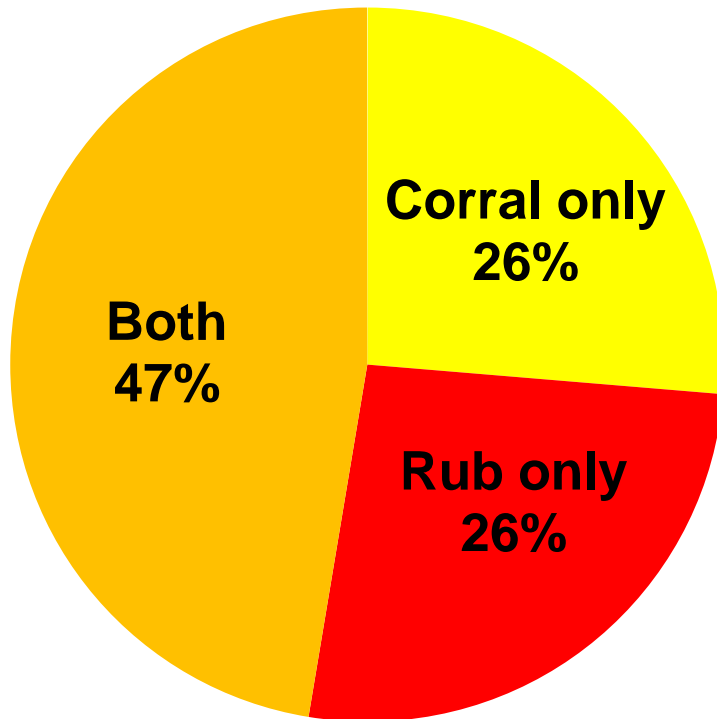
CORRALS **AND** RUBS

Grizzlies detected via
DNA: **38***

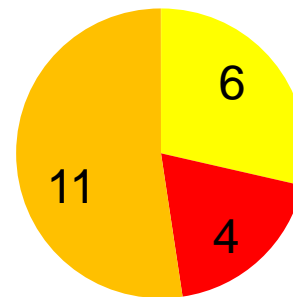


DNA DETECTION TYPE

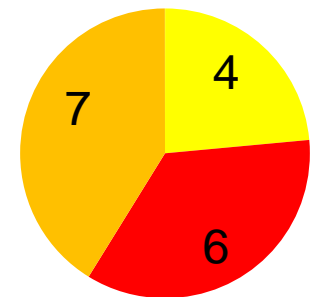
Grizzly bears detected by hair snagging: **38**



Males



Females



GRIZZLY BEARS DETECTED 2012



	<u>Definite*</u>	<u>With Possibles</u>
DNA minimum count	38	40¹
Bears detected by other methods	4²	5³
Total <u>minimum</u> on grid 2012	42²	45^{1,3}

* Bears known to be on the grid during the Jun 7 - Sep 26 study period.

¹ 2 GBs detected from 1st pass rub collections ∴ unknown if deposited in '11 or '12.

² 2 collared full-time residents

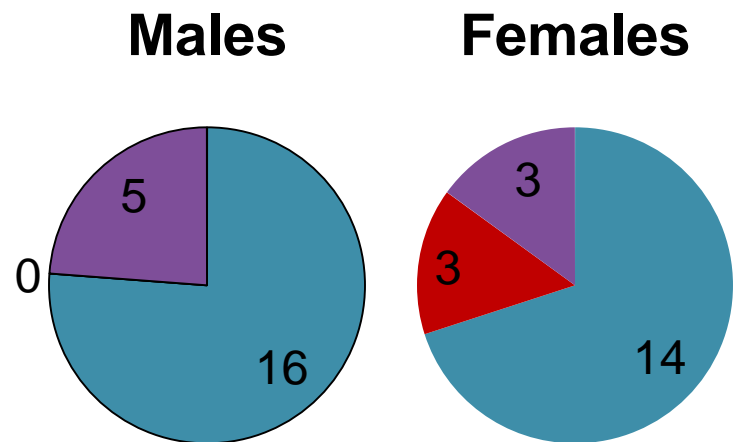
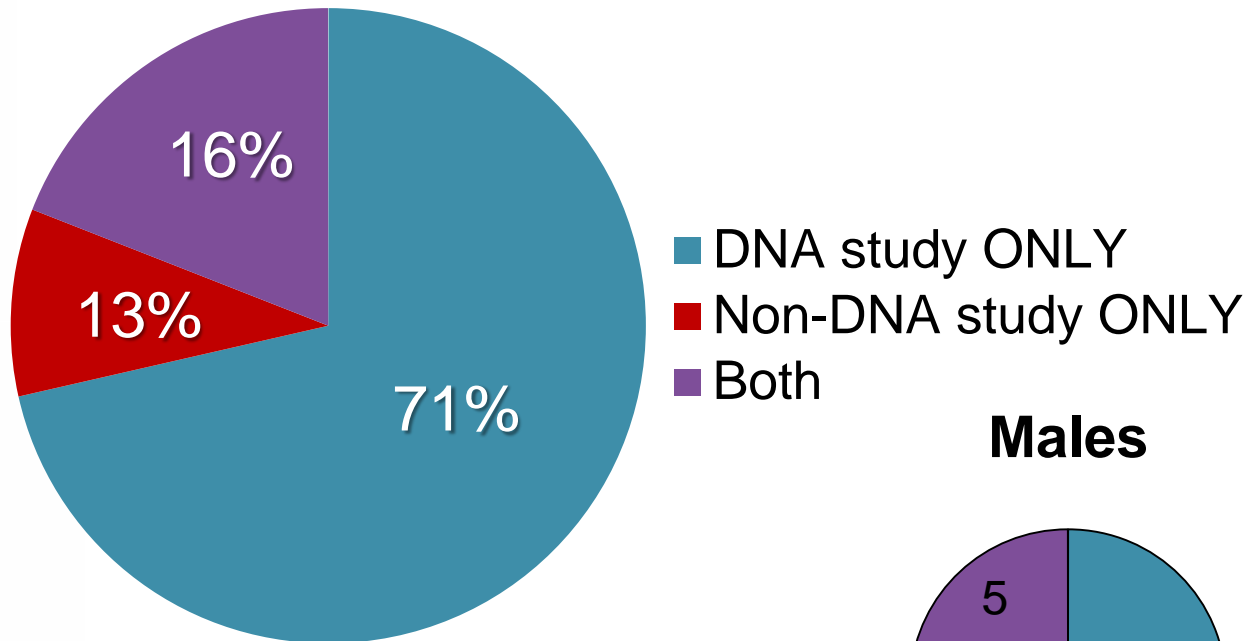
1 2011-augmentation GB which was present in CYE 8/22/12 – end of yr

1 2-yr-old observed w/ collared mom ∴ on grid Jun-Sep but no genotype so sex unknown.

³ 1 GB with telemetry until mid-May then possible collar failure or dead.

DETECTIONS BY SAMPLE TYPE

Grizzly bears detected: **42***



*one grizzly of unknown sex

2 WAYS to ESTIMATE POPULATION SIZE

N_{avg} : Average population size

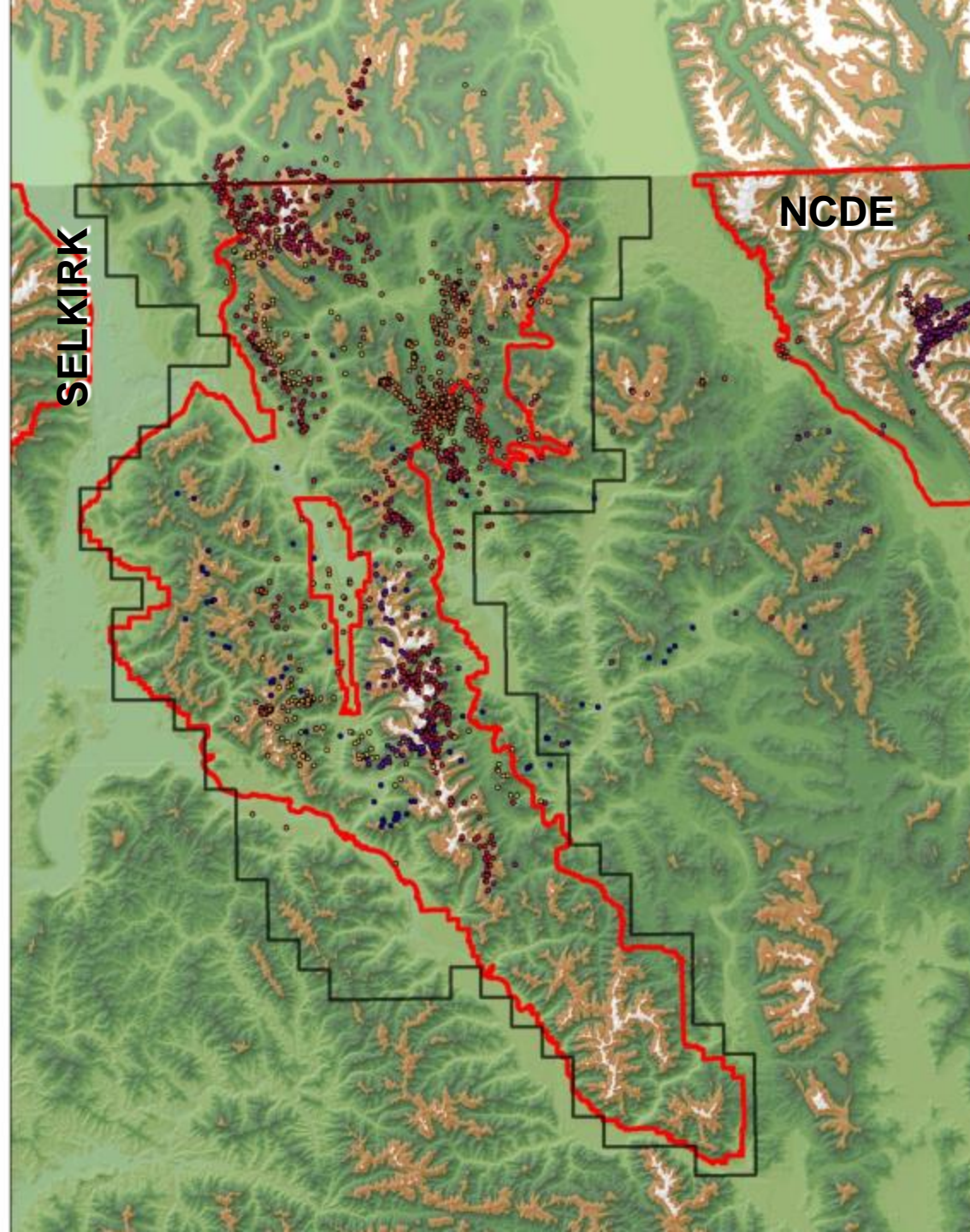
- mean number of bears present on study area at any one time
- corrected for bears that are part-time residents
- a standardized way to compare populations free from closure violation issues

N_{super} : Super population size

- total number of full- and part-time bears using the area during study period
- cumulative number of bears that traverse the area

RESIDENCY ANALYSIS

- Kasworm et al. telemetry data
- 20 collared grizzly bears
- 2008 - 2012
- Jun 7 - Sep 26
- calculate time on grid for:
native vs augmented
females vs males

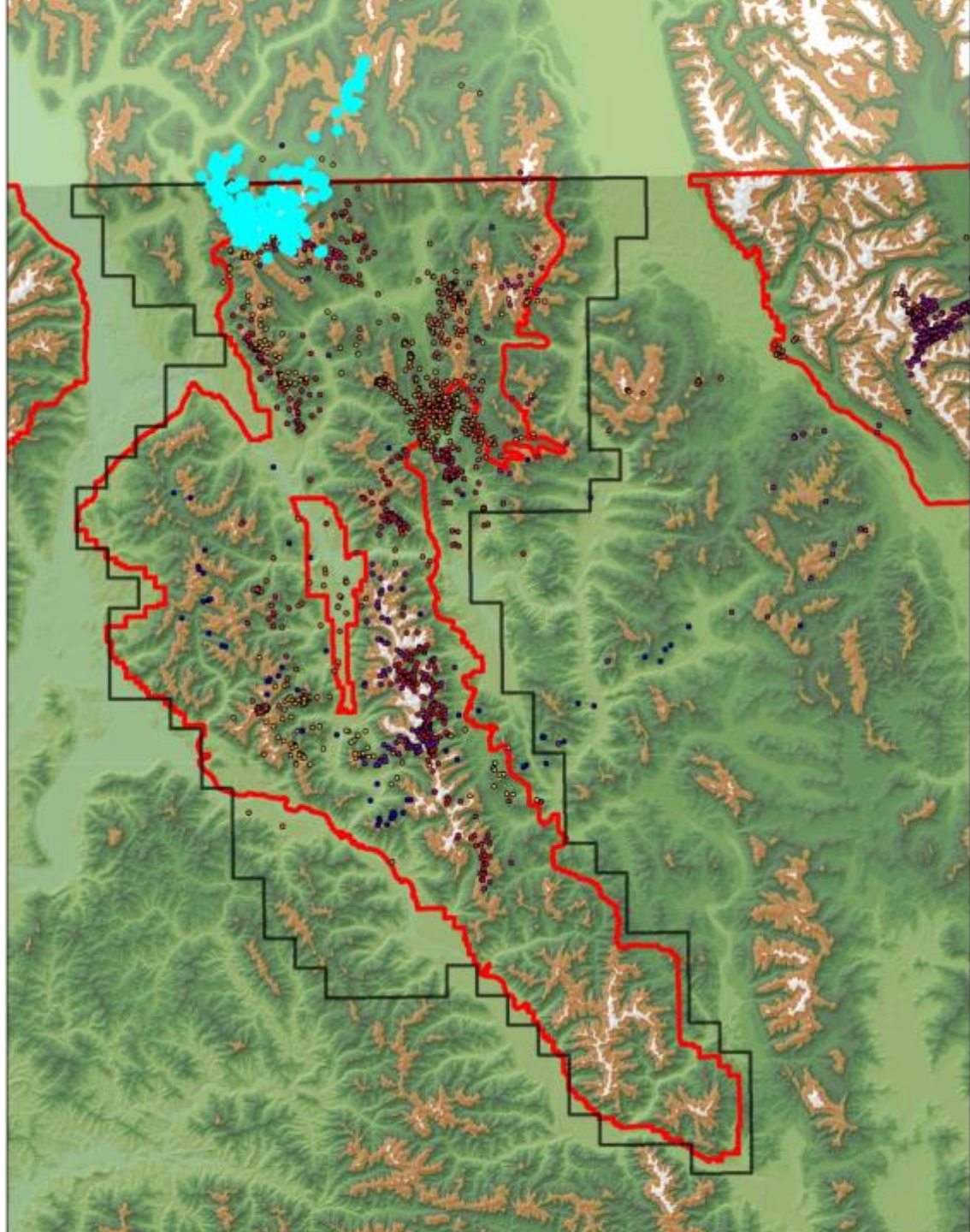


RESIDENCY ANALYSIS

Example: 675F

- Yaak native
- Female
- 71% points on grid

Kasworm et al.
telemetry data
Jun 7 – Sep 26

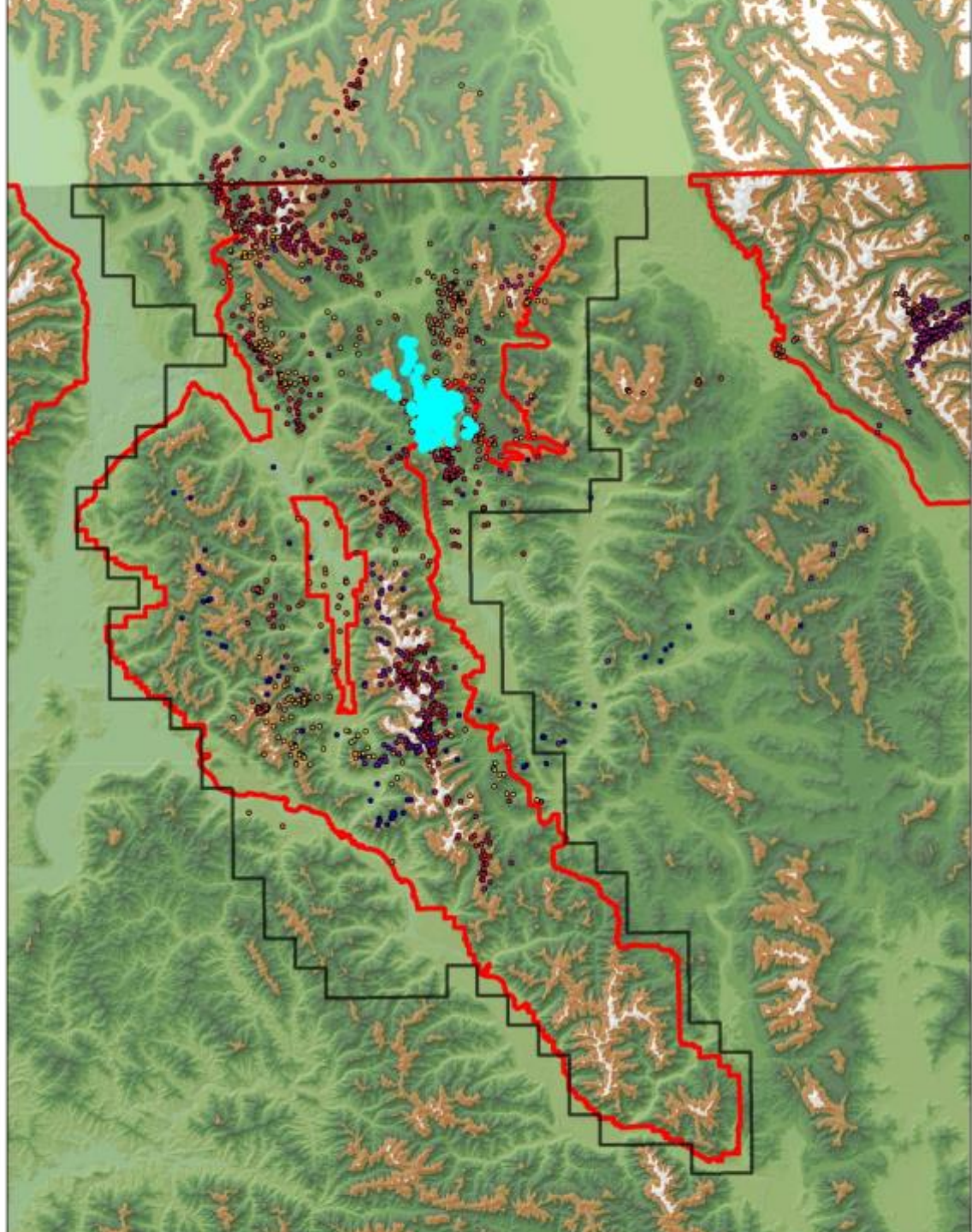


RESIDENCY ANALYSIS

Example: 303F

- Yaak native
- Female
- 100% points on grid

Kasworm et al.
telemetry data
Jun 7 – Sep 26

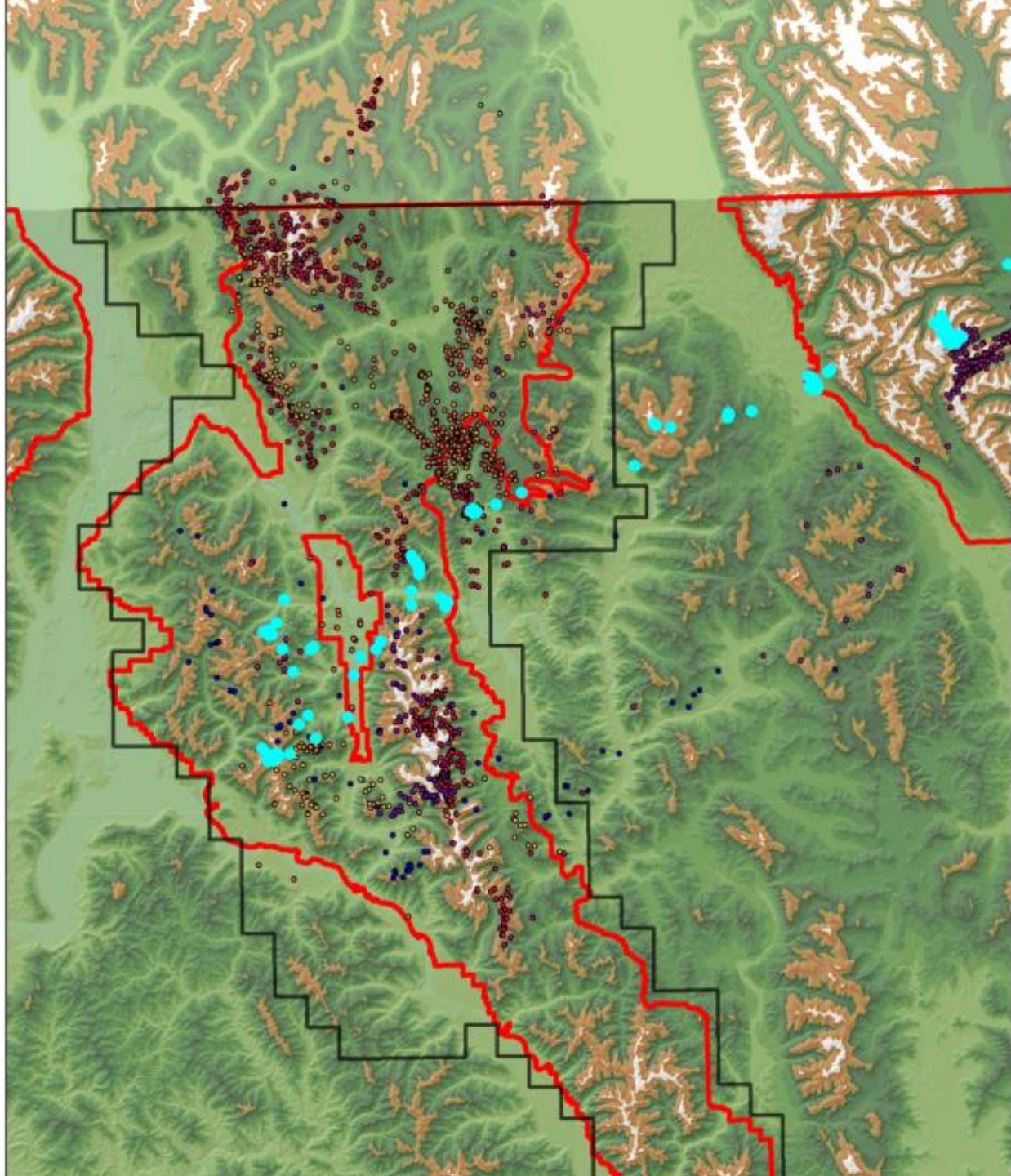


RESIDENCY ANALYSIS

Example: 725F

- Augmented bear
- Female
- 40% points on grid

Kasworm et al.
telemetry data
Jun 7 – Sep 26



GRIZZLY POPULATION SIZE IN THE CABINET-YAAK ECOSYSTEM

2012

Joint Analysis

95% Conf Interval

Sex	N	Lower	Upper	CV
Model-averaged density and size				
	N_{avg}			
Female	22	20	37	13.5%
Male	23	21	37	11.8%
Total	45	42 ^A	65	8.9%
Superpopulation				
	N_{super}			
Female	24	21	35	12.6%
Male	24	22	33	10.3%
Total	48	44 ^A	62	8.6%

^A The confidence limit was calculated assuming a minimum number of alive bears of 42 (including 1 additional bear of unknown sex known to be on the grid but not included in the sex-specific analysis).

DENSITY AND POPULATION SIZE FOR CABINET-YAAK ECOSYSTEM

2012

Joint Analysis

95% Conf Interval

Sex	N	Lower	Upper	CV
Model-averaged density and size				
	N_{avg}			
Female	22	20	37	13.5%
Male	23	21	37	11.8%
Total	45	42 ^A	65	8.9%
Superpopulation				
	N_{super}			
Female	24	21	35	12.6%
Male	24	22	33	10.3%
Total	48	44 ^A	62	8.6%

^A The confidence limit was calculated assuming a minimum number of alive bears of 42 (including 1 additional bear of unknown sex known to be on the grid but not included in the sex-specific analysis).

FEMALE : MALE RATIO

Population	Year	Species	% Female
Cabinet-Yaak	2012	Grizzly	50%
Greater GNP	2000	Grizzly	61%
NCDE	2004	Grizzly	62%
Glacier NP	2004	Black	52%

DENSITY AND POPULATION SIZE FOR CABINET-YAAK ECOSYSTEM

2012

Joint Analysis

95% Conf Interval

Sex	N	Lower	Upper	CV
Model-averaged density and size				
	N_{avg}			
Female	22	20	37	13.5%
Male	23	21	37	11.8%
Total	45	42 ^A	65	8.9%
Superpopulation				
	N_{super}			
Female	25	21	35	12.6%
Male	24	22	33	10.3%
Total	49	44 ^A	62	8.6%

^A The confidence limit was calculated assuming a minimum number of alive bears of 42 (including 1 additional bear of unknown sex known to be on the grid but not included in the sex-specific analysis).

REGION - SPECIFIC N_{avg} ESTIMATES

Joint Analysis	N_{avg}	95% CI lower	95% CI upper	CV
<u>Cabinets</u>				
Females	11	10	23	18.7%
Males	11	10	19	14.5%
Total	22	20	36	12.8%
<u>Yaak</u>				
Females	11	10	20	16.2%
Males	11	11	23	15.4%
Total	22	22	39	11.3%

SENSITIVITY ANALYSIS: ESTIMATES WITH UNKNOWN STATUS BEARS

Superpopulation estimates that include 4 add'l bears:

- 3 bears of not conclusively on sampling grid in 2012
- 1 bear of unknown sex = **Female**

Joint Analysis	No. Individ	N_{super}	95% CI lower	95% CI upper	CV
Unknown sex bear is female					
<u>Cabinets</u>					
Females	10	13	11	22	19.2%
Males	12	15	13	25	17.5%
Total	22	27	24	41	14.2%
<u>Yaak</u>					
Females	11	13	12	21	14.8%
Males	12	14	12	22	13.4%
Total	23	27	24	37	10.2%
Total (Cab+Yaak)	45	54	49	70	9.1%

SENSITIVITY ANALYSIS: ESTIMATES WITH UNKNOWN STATUS BEARS

Superpopulation estimates that include:

- 3 bears of not conclusively on sampling grid in 2012
- 1 bear of unknown sex = **Male**

Joint Analysis	No. Individ	N_{super}	95% CI lower	95% CI upper	CV
Unknown sex bear is male					
<u>Cabinets</u>					
Females	10	12	10	21	17.8%
Males	12	15	13	26	18.1%
Total	22	27	24	41	14.0%
<u>Yaak</u>					
Females	10	12	10	18	14.1%
Males	13	15	14	24	13.6%
Total	23	27	24	37	10.2%
Total (Cab+Yaak)	45	54	49	70	9.1%

DETECTION PROB. BY SAMPLE TYPE

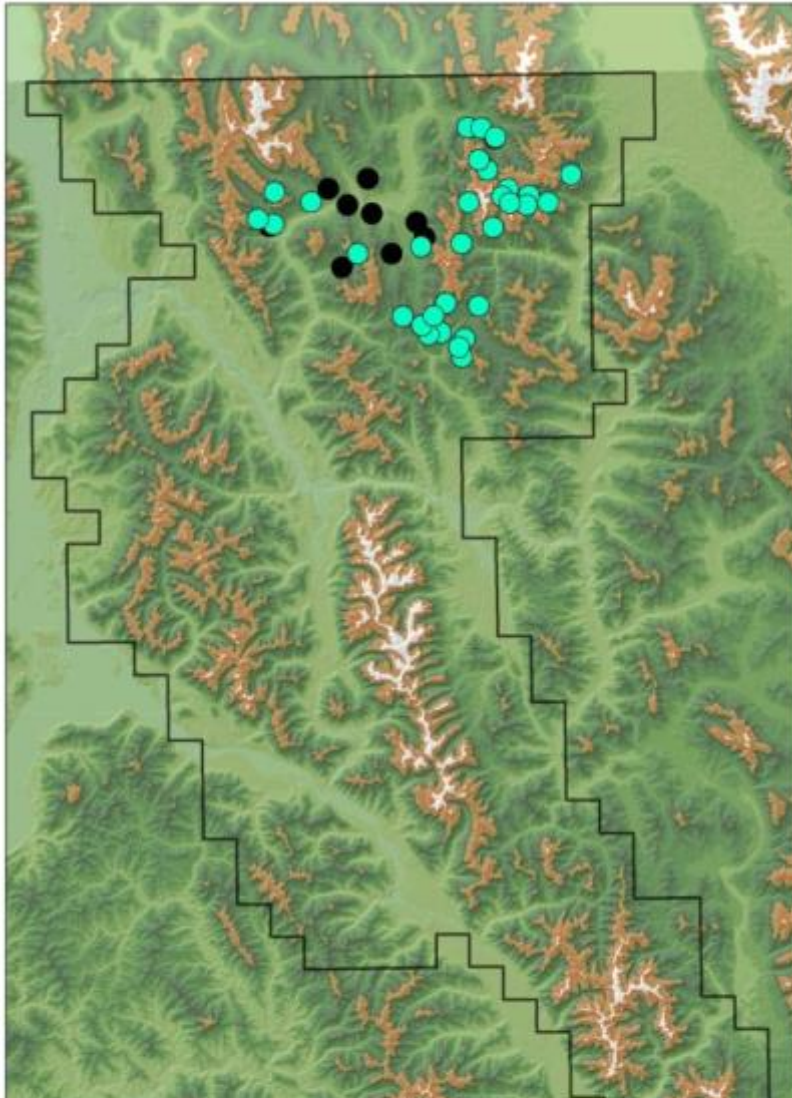
DATA TYPE	Mean probability per session	Cumulative probability (all sessions)
Rub Tree		
Female	0.23	0.88
Male	0.27	0.89
Hair Trap		
Female	0.15	0.57
Male	0.20	0.69
Opportunistic		
Female	0.26	0.26
Male	0.24	0.24

- Reasonable detection probabilities across all the data sources
- Cumulative detection probability high, especially for rubs

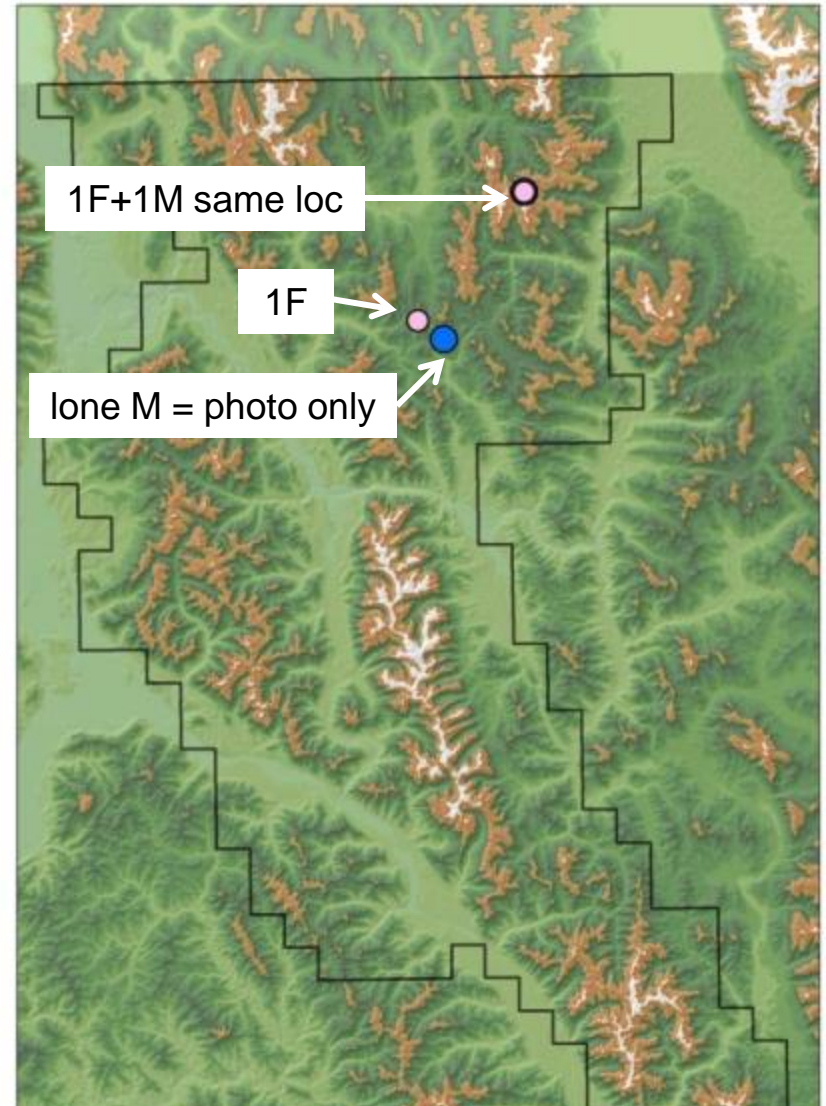
HISTORY LIVE OF CAPTURE IN CYE

Cabinets	Yaak
Kasworm et al: 1983-present	Kasworm et al: 1989-present

KASWORM 2012 LIVE CAPTURE SITES

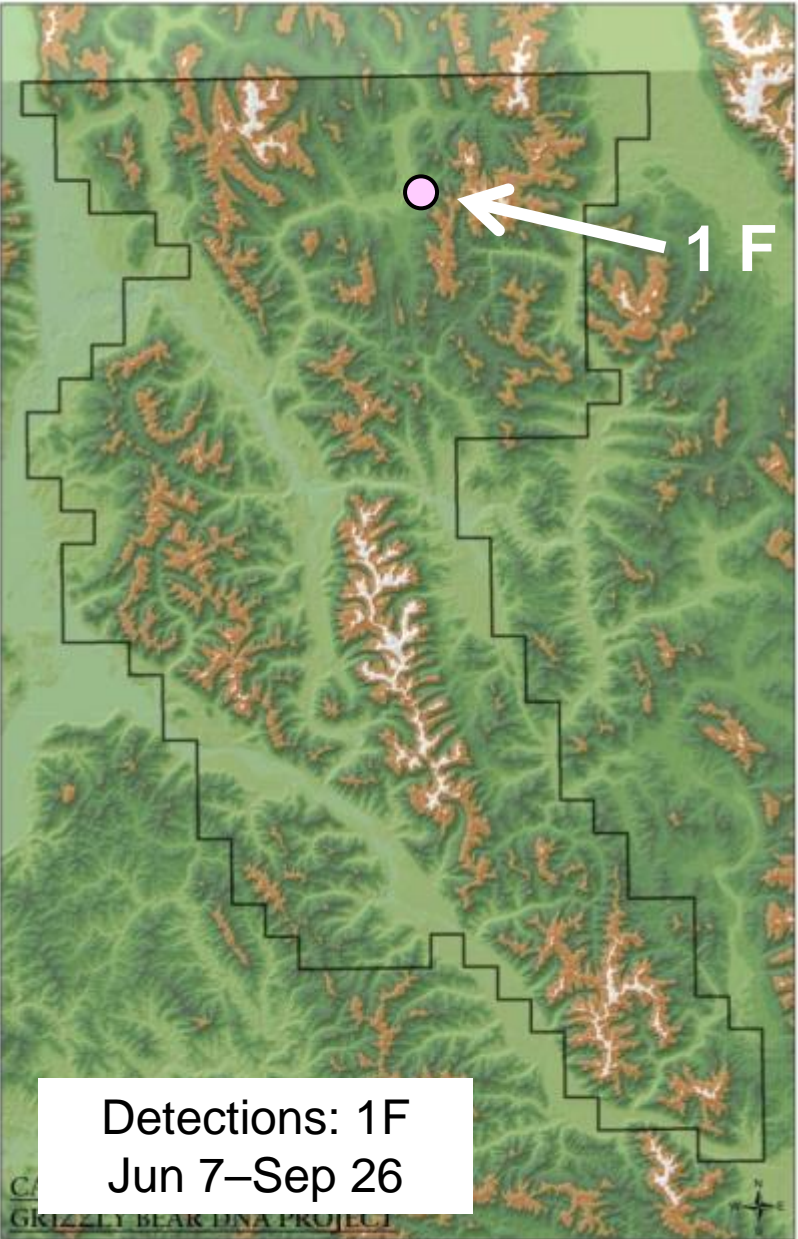
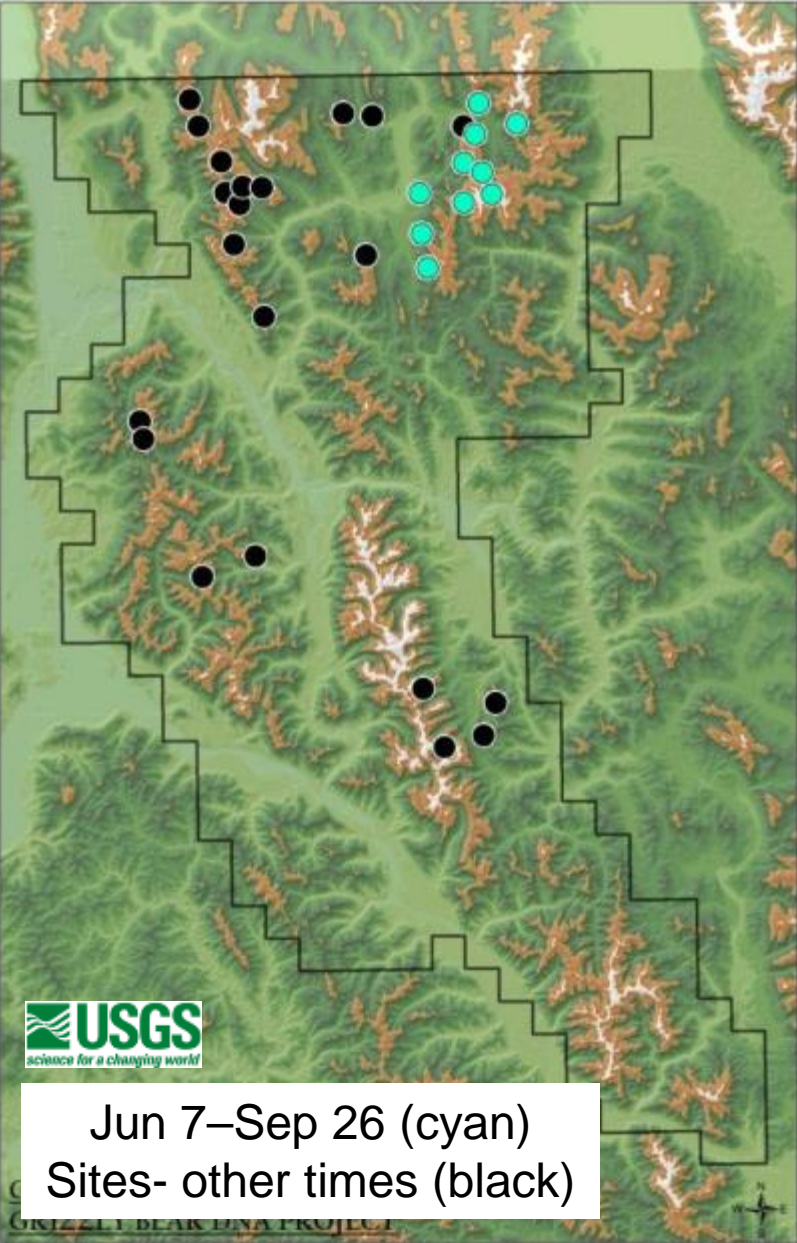


Sites active Jun 7–Sep 26 (cyan)
Sites at other times (black)



2F+1M caught
June 7 – Sep 26

KASWORM 2012 HAIR CORRAL SITES



2012 GRIZZLY BEAR DETECTIONS

JUN 7 – SEP 26

Sex	Hair snag	Rub tree	Other
Male	17	15	5
Female	11	13	7
Total	28	28	12

Other detections:

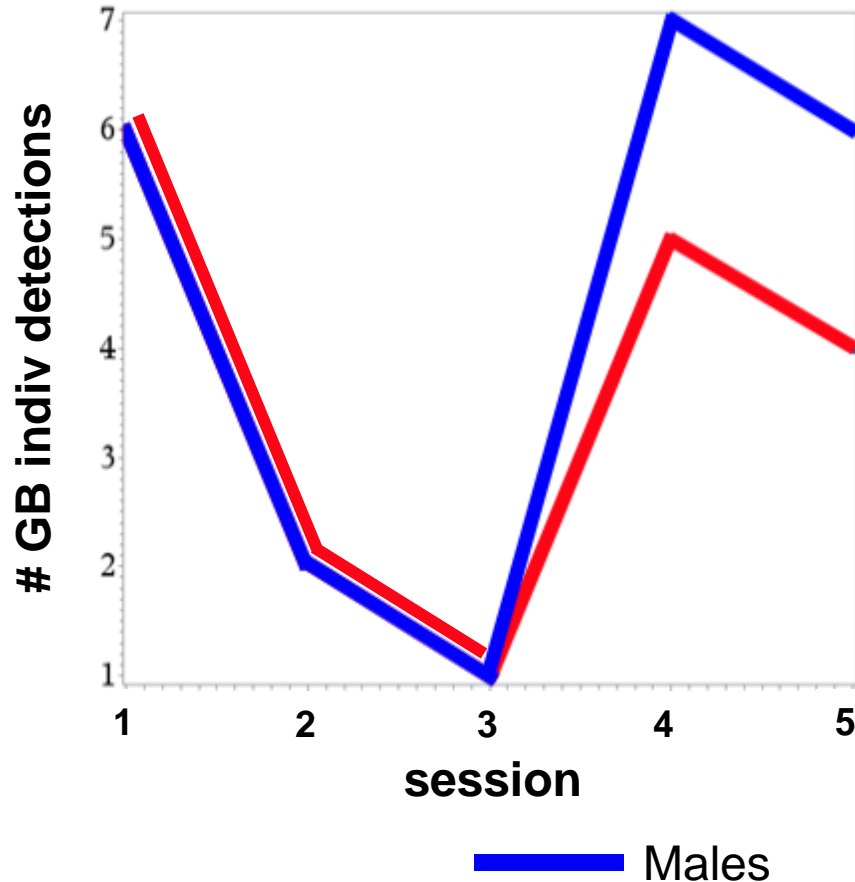
1. DNA study HT detection outside of protocol (HT not dismantled immediately after last session: Hair deposited after 14-days: on grid during study season)
2. Kasworm live trap site photos (2 photos, same bear different days)
3. Kasworm HT site photos (1 photo tied to detection from hair sample in late June)
4. Kasworm HT detection (1 DNA detection in late Sep tied to a HT site photo)
5. Kasworm collared bears (Aug Bears: 1M+1F ; Res Bears: 2M+2F)
6. Kasworm dependent bears known to be with collared female (2F with 2 dep young each, one of these dependent young is the unk sex bear which is NOT included in main MR analysis)

BEARS DETECTED BY SESSION & METHOD

HAIR SNAG ONLY

17M:11F

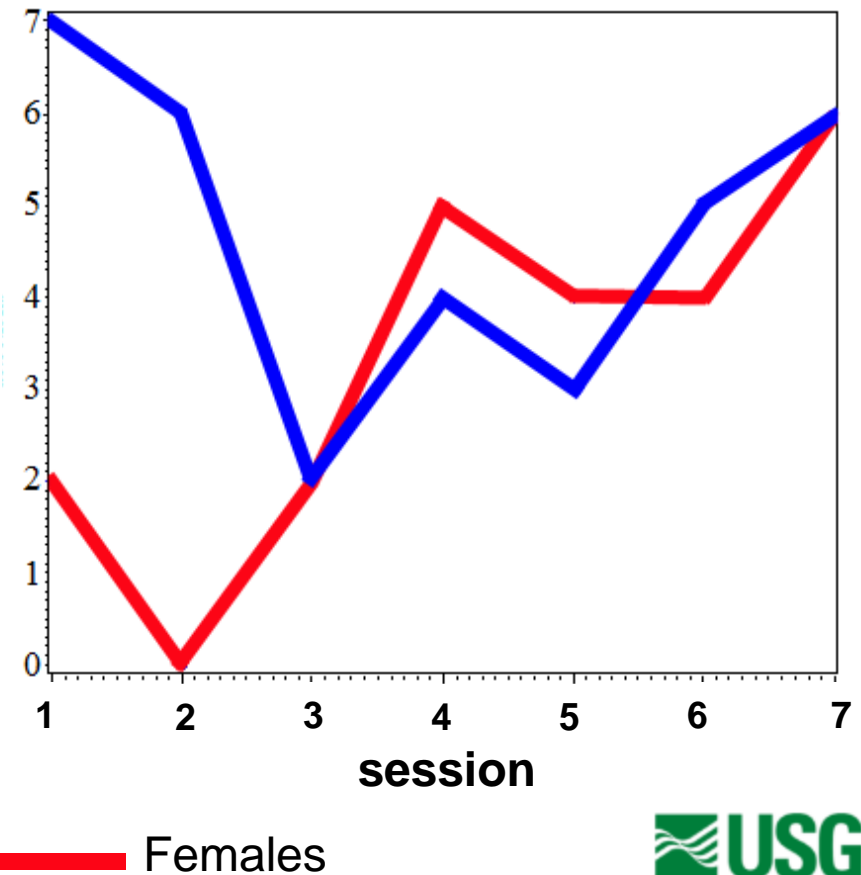
- most bears detected in only 1 session
- no bear detected in > 3 sessions



BEAR RUB ONLY

15M:13F

- effort increased with sampling session

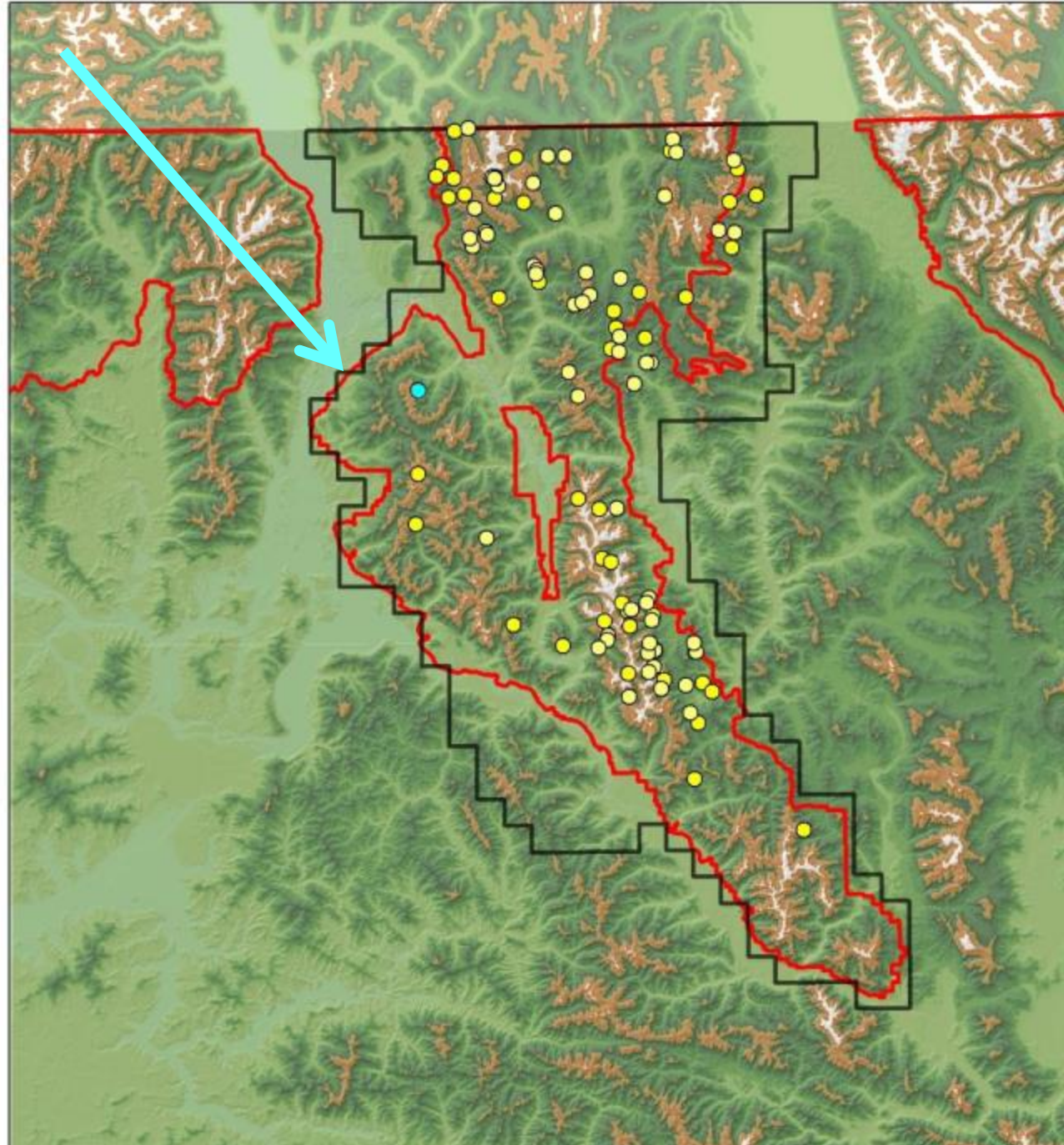


BEAR RUB SAMPLING EFFORT

Sample Session

	1	2	3	4	5	6	7
Sampling effort							
No. rubs	1086	1188	1263	1298	1322	1317	1333
Mean duration	14.0	14.1	14.1	14.1	14.1	14.2	14.3
S.D.	1.8	2.0	2.5	2.6	1.4	2.9	3.0
5th percentile	12	12	12	14	14	12	13
95th percentile	16	15	15	14	14	15	14

MIGRANT GRIZZLY FROM BC SELKIRKS



MIGRANT 323M FROM NCDE

○

Detection history: NCDE

Kendall 1998: Coal Cr

Kendall 2000: Striker Pk

Kendall 2004: Standard Pk

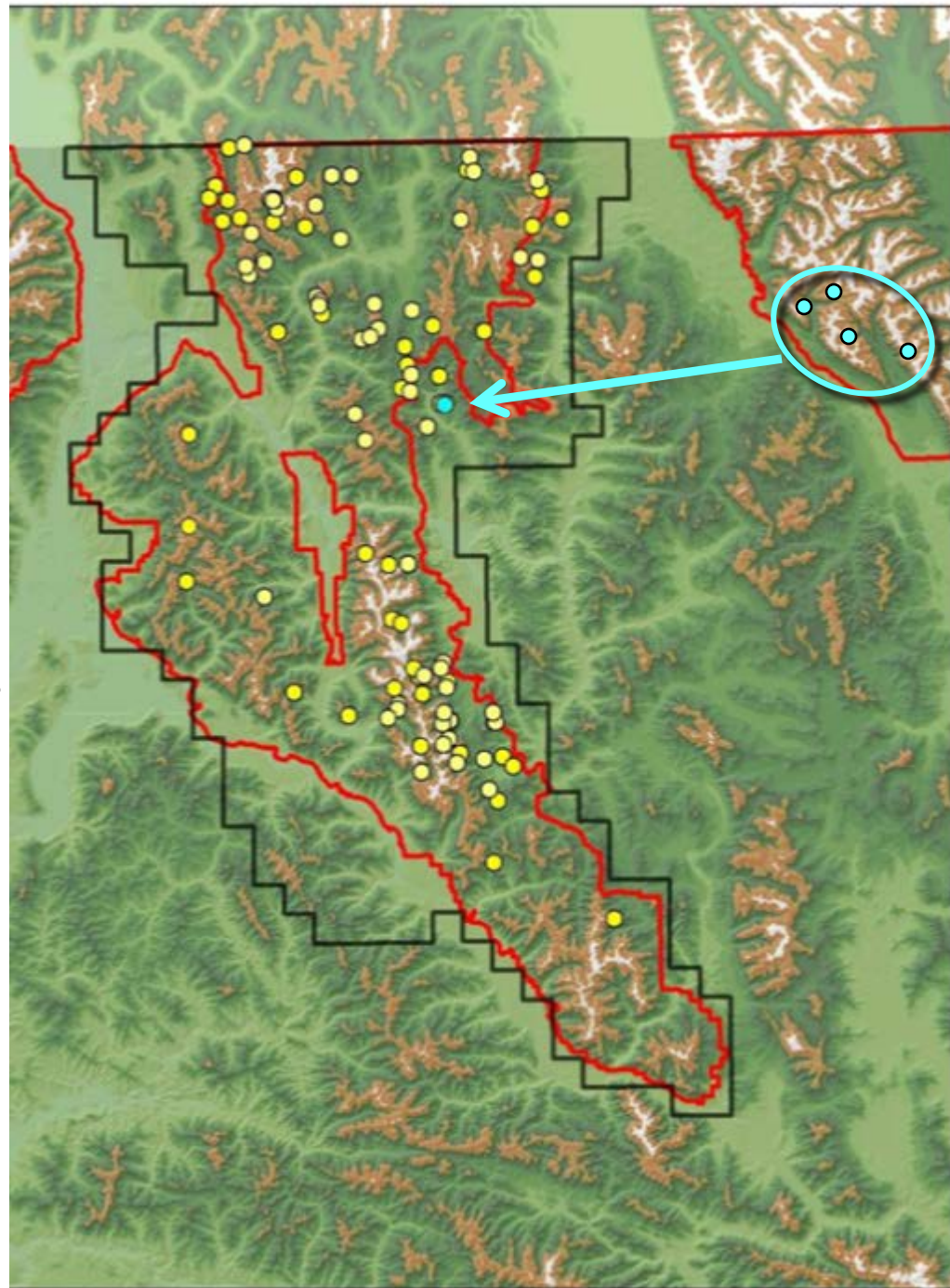
Manley 2006: Werner LO: est age = 20+

Detection history: Yaak

Kendall 2012: Turner Mtn

- 1st pass collection 6/13/12;
deposited 5/13/11 – 6/13/12

- no detections by USGS or USFWS
Jun 7-Sep 26, 2012.



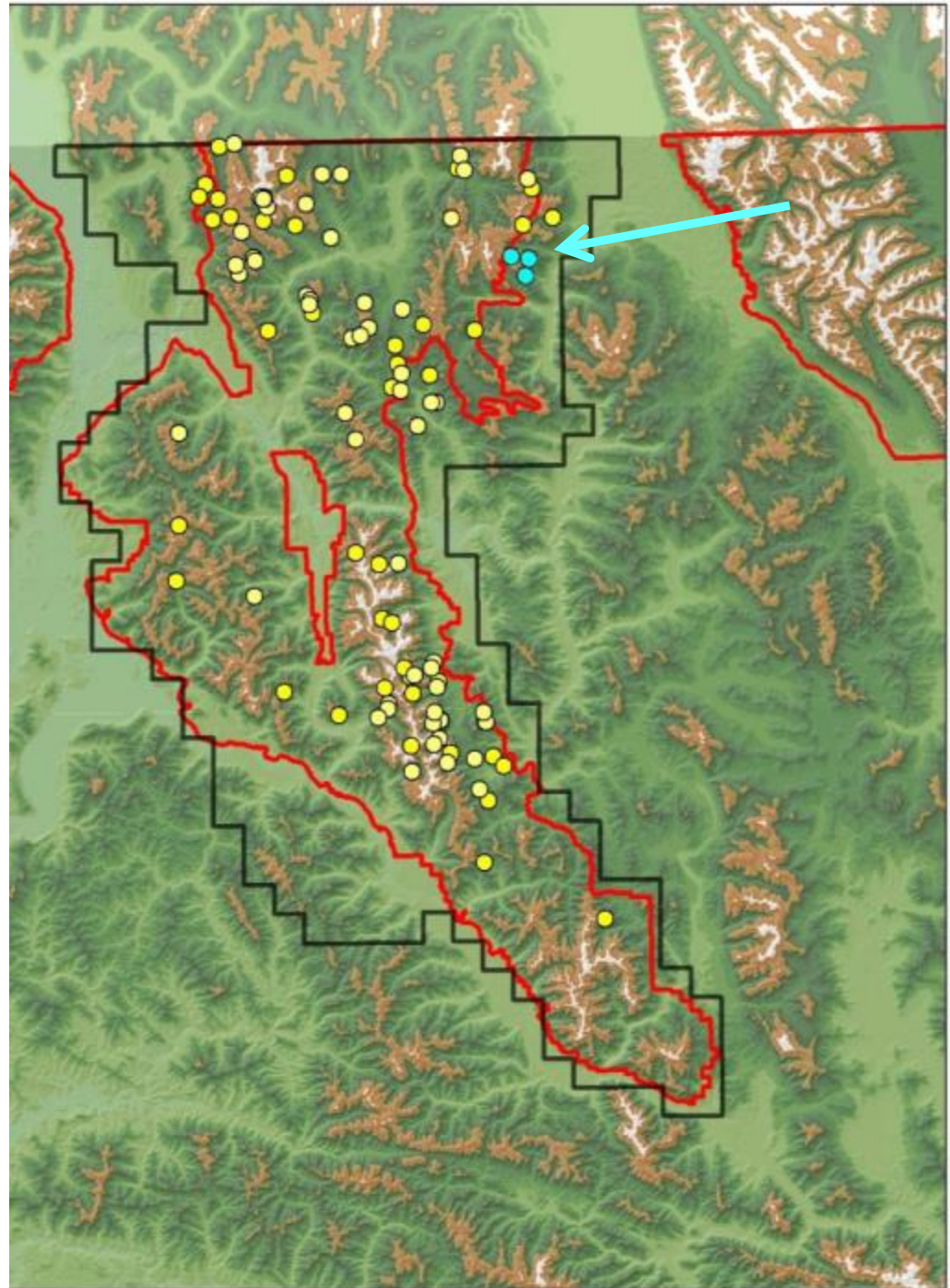
MIGRANT 737M FROM NCDE

Detection history: NCDE

Kendall 2004: Detected both
parents in Whitefish Range:
Chloris and Shorty in Blue Sky trail area

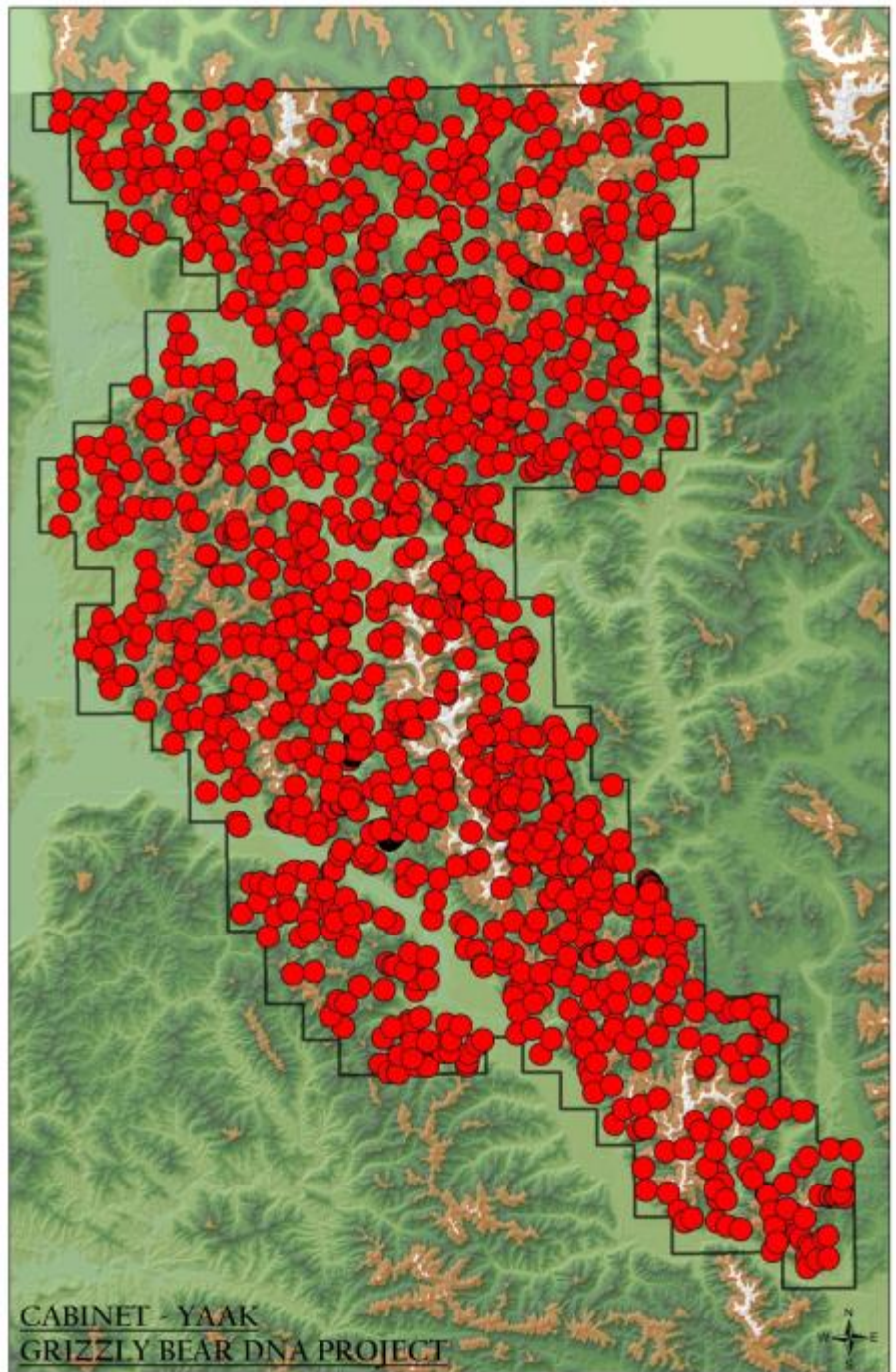
Detection history: Yaak

Kasworm 2010 & 2012: research
live captures



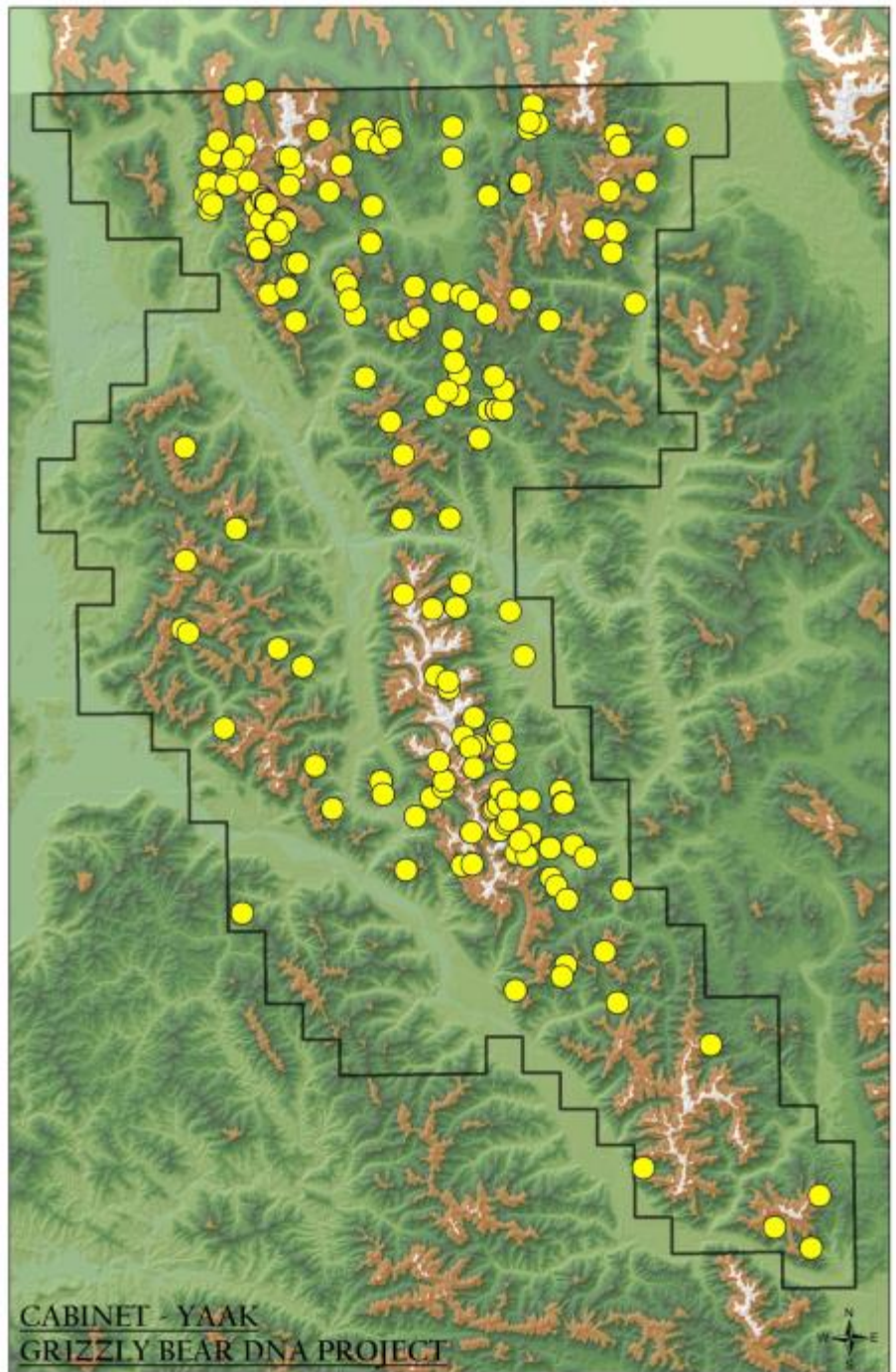
EFFECTIVENESS OF SAMPLING

Black Bear ●



EFFECTIVENESS OF SAMPLING

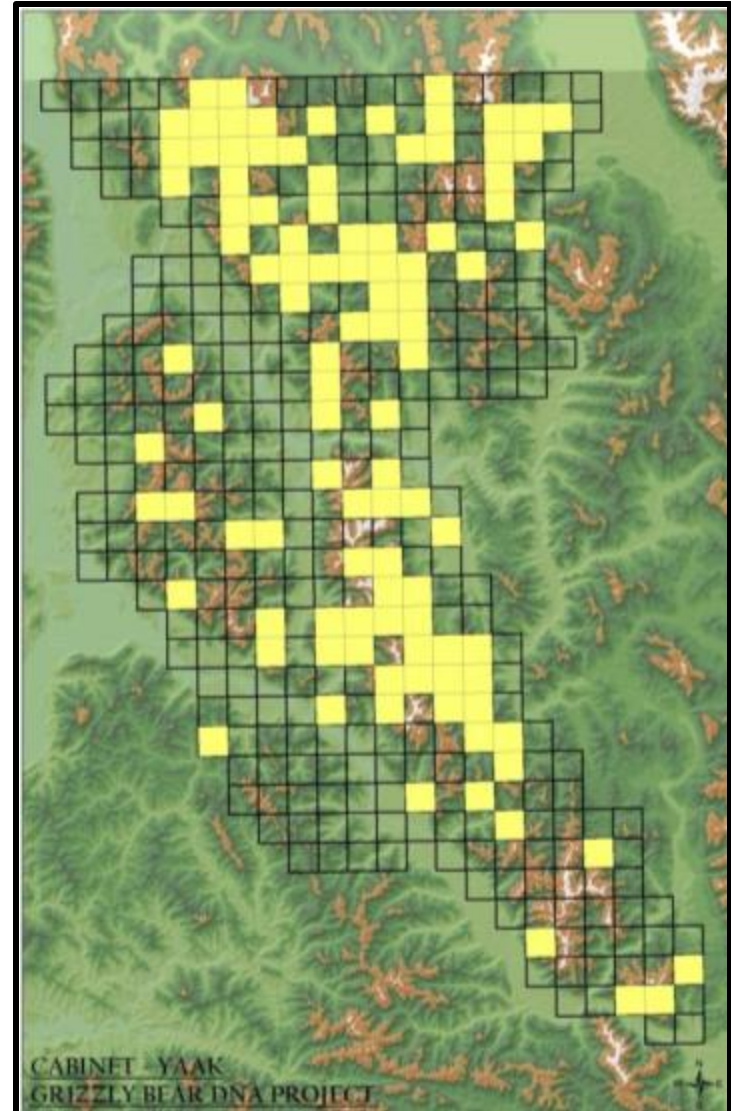
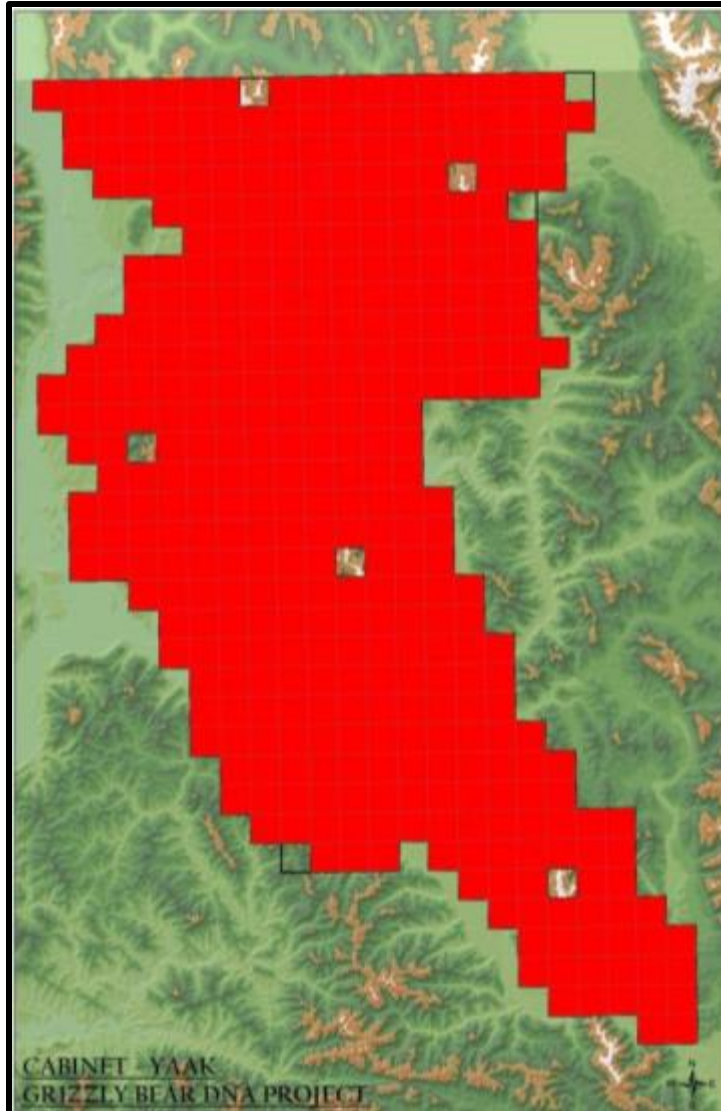
Grizzly Bear 



SPECIES IDENTIFICATION


CELLS WITH **BLACK BEARS**:
98% (387 of 395)

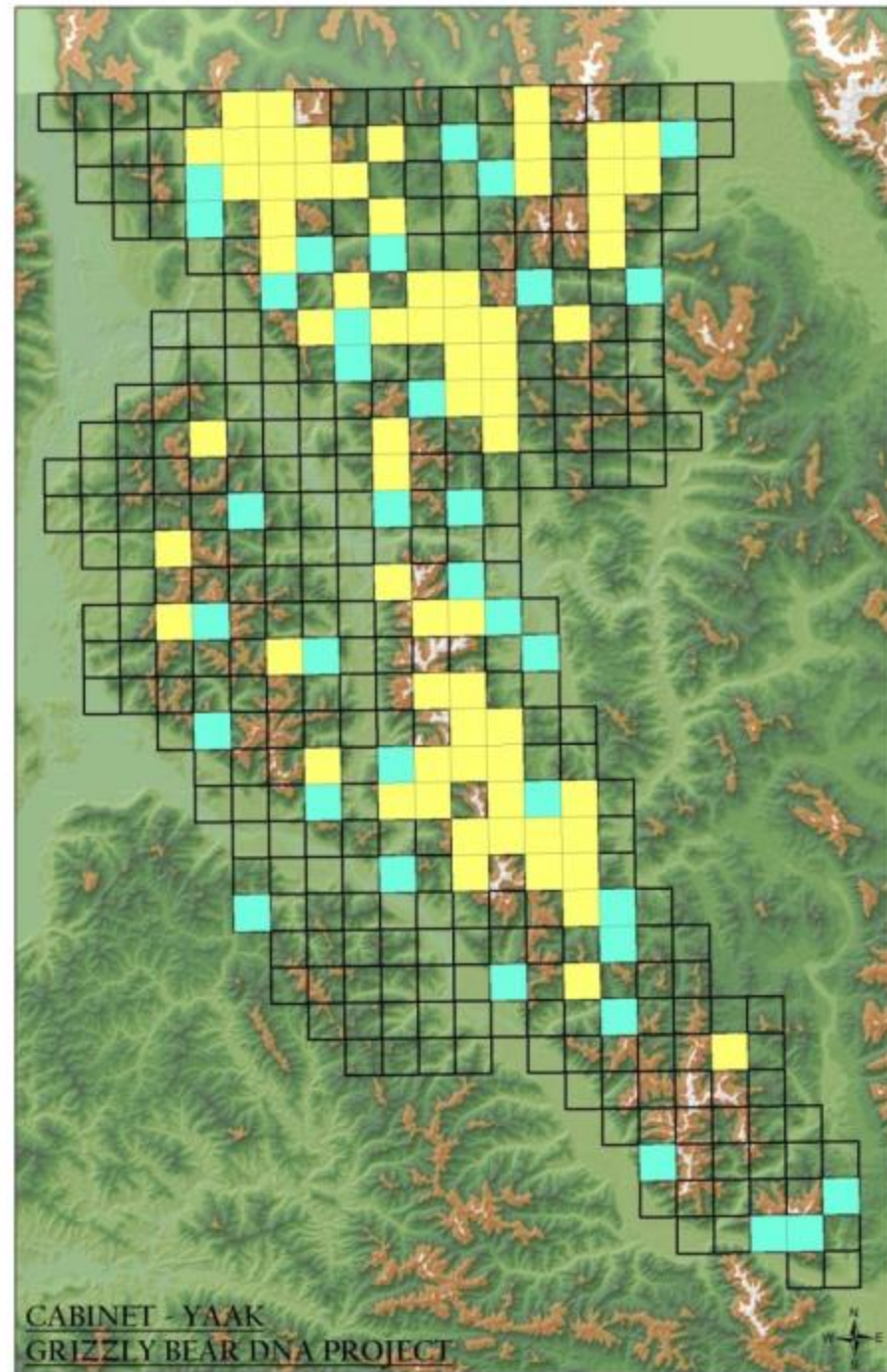
CELLS WITH **GRIZZLIES**:
26% (103 of 395)



GRIZZLY BEARS DETECTED

Species ID only  35 cells

Individual ID  68 cells



2012 BEAR OBSERVATIONS

Grizzly Bears

Lone sightings: 7

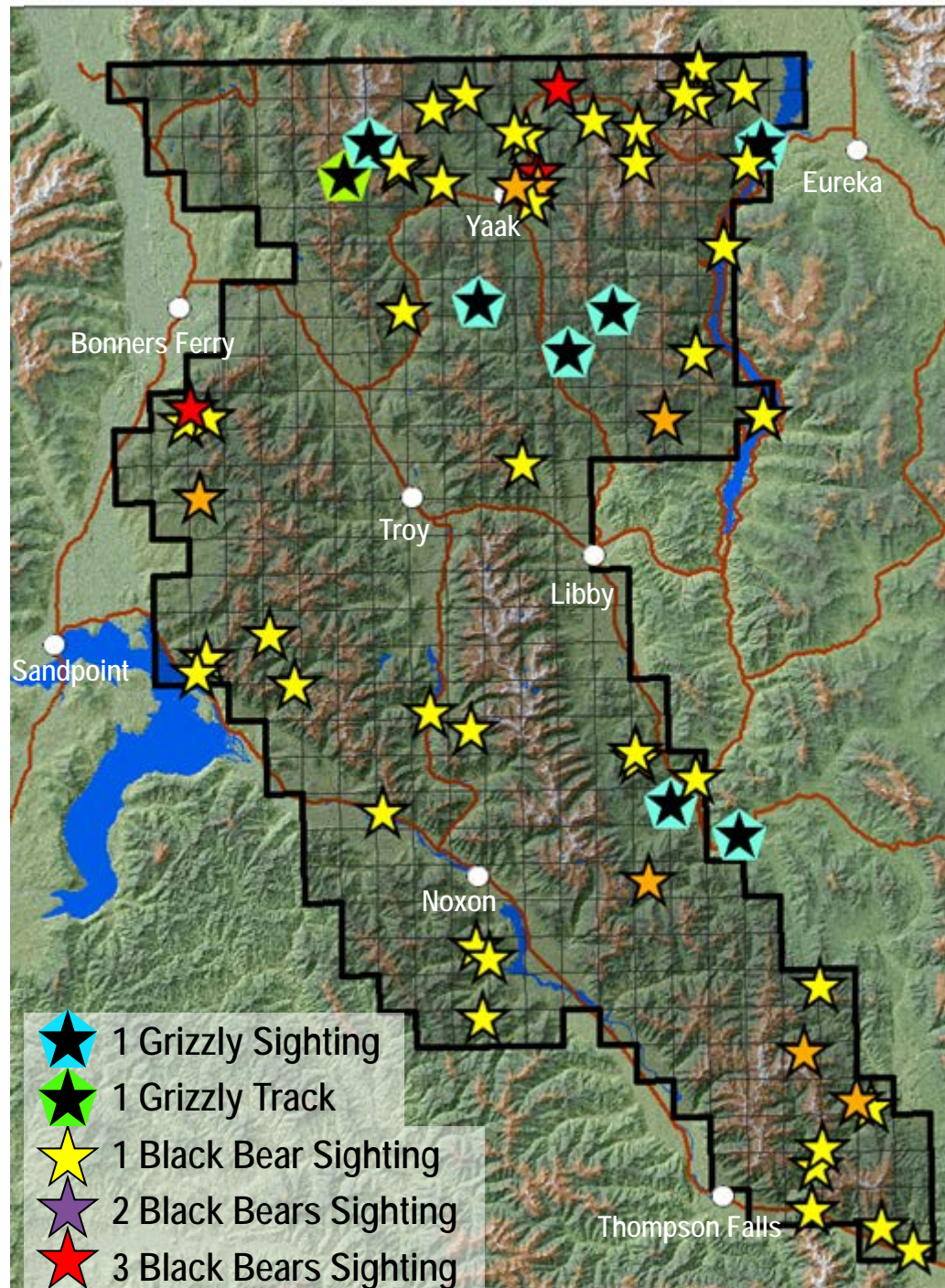
Lone track: 1

Black Bear Sightings: 83

1 bear: 51

2 bears: 7

3 bears: 6



Funding and support provided by



Lincoln County
Rural Advisory
Committee



Plum Creek



Big Sky
Economic
Development
Trust Fund



ID Panhandle
Rural Advisory
Committee



and many more!



ADDITIONAL INFORMATION

Google: grizzly bear dna > Cabinet Yaak Project

