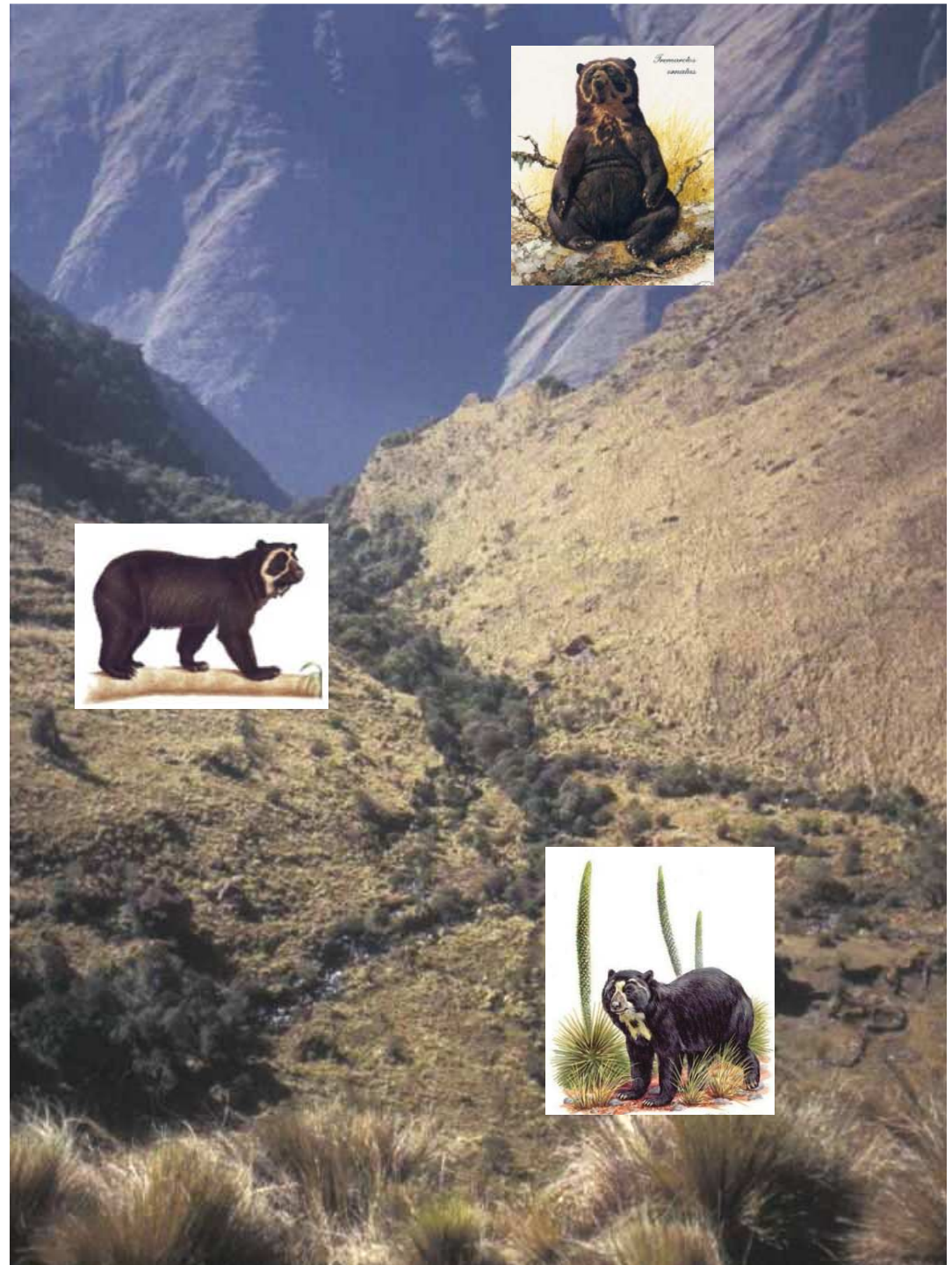


# Andean Bear Density and Abundance Estimates —

How Reliable and  
Useful are They ?

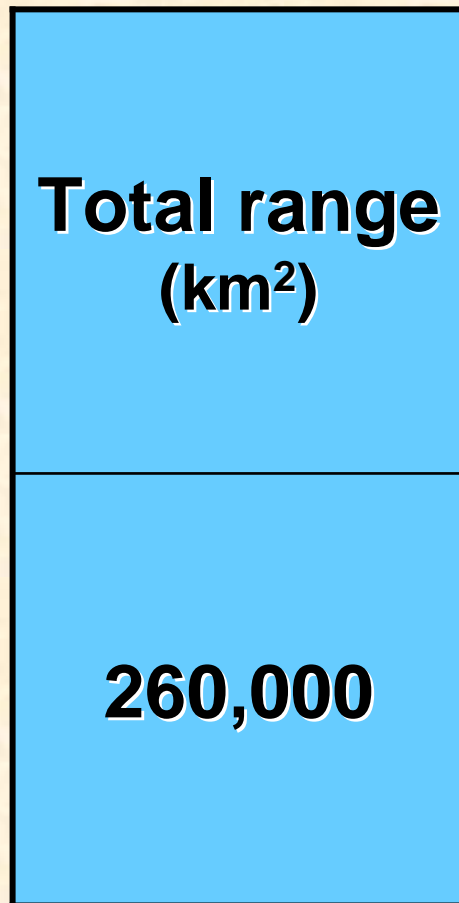
Dave Garshelis

Minnesota Department of  
Natural Resources, USA



# Rangewide estimate of Andean Bears

Peyton et al. 1998



# Rangewide estimate of Andean Bears

Peyton et al. 1998

Total range (km <sup>2</sup> )	Density of American black bears	
	Low	Median
260,000	7/100 km <sup>2</sup>	25/100 km <sup>2</sup>

# Rangewide estimate of Andean Bears

Peyton et al. 1998

Total range (km <sup>2</sup> )	Density of American black bears		Estimated number of Andean bears (excl. cubs)
	Low	Median	
260,000	7/100 km <sup>2</sup>	25/100 km <sup>2</sup>	18,000 – 65,000

# Rangewide estimate of Andean Bears

Peyton et al. 1998

Total range (km <sup>2</sup> )	Density of American black bears		Estimated number of Andean bears (excl. cubs)
	Low	Median	
260,000	7/100 km <sup>2</sup>	25/100 km <sup>2</sup>	18,000 – 65,000 >20,000

# Rangewide estimate of Andean Bears

Peyton et al. 1998

Total range (km <sup>2</sup> )	Density of American black bears		Estimated number of Andean bears (excl. cubs)
	Low	Median	
260,000	7/100 km <sup>2</sup>	25/100 km <sup>2</sup>	18,000 – 65,000 ~20,000





82 genetic samples



## Long-term effective population from genetic heterozygosity:

- No evidence of recent bottleneck
- Mutation rate =

$$2.5 \times 10^{-4} - 7 \times 10^{-5}$$

- Effective population:  $N_e/N =$

$$0.27 - 0.75$$

$$N = 24,000 - 90,000$$

# How can you count bears?



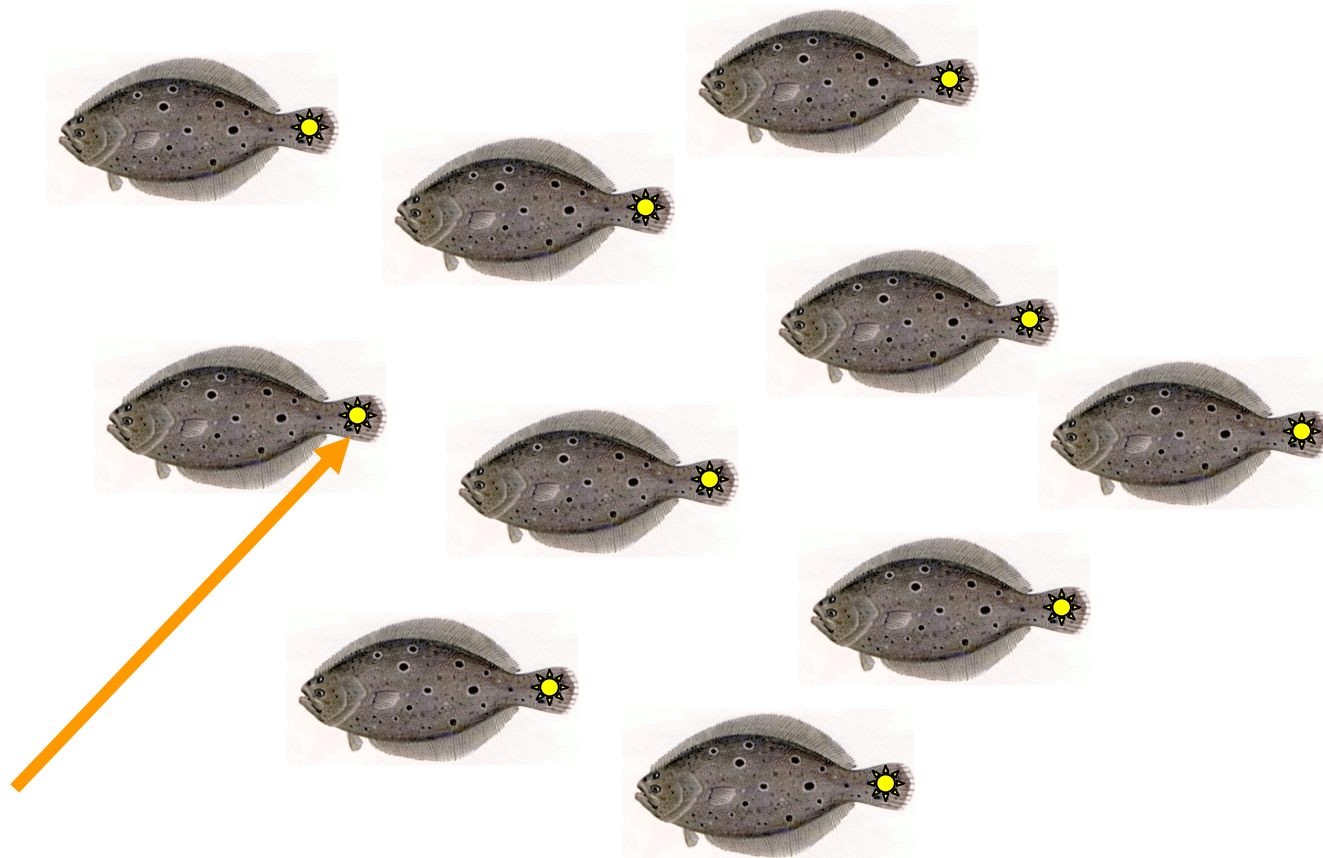






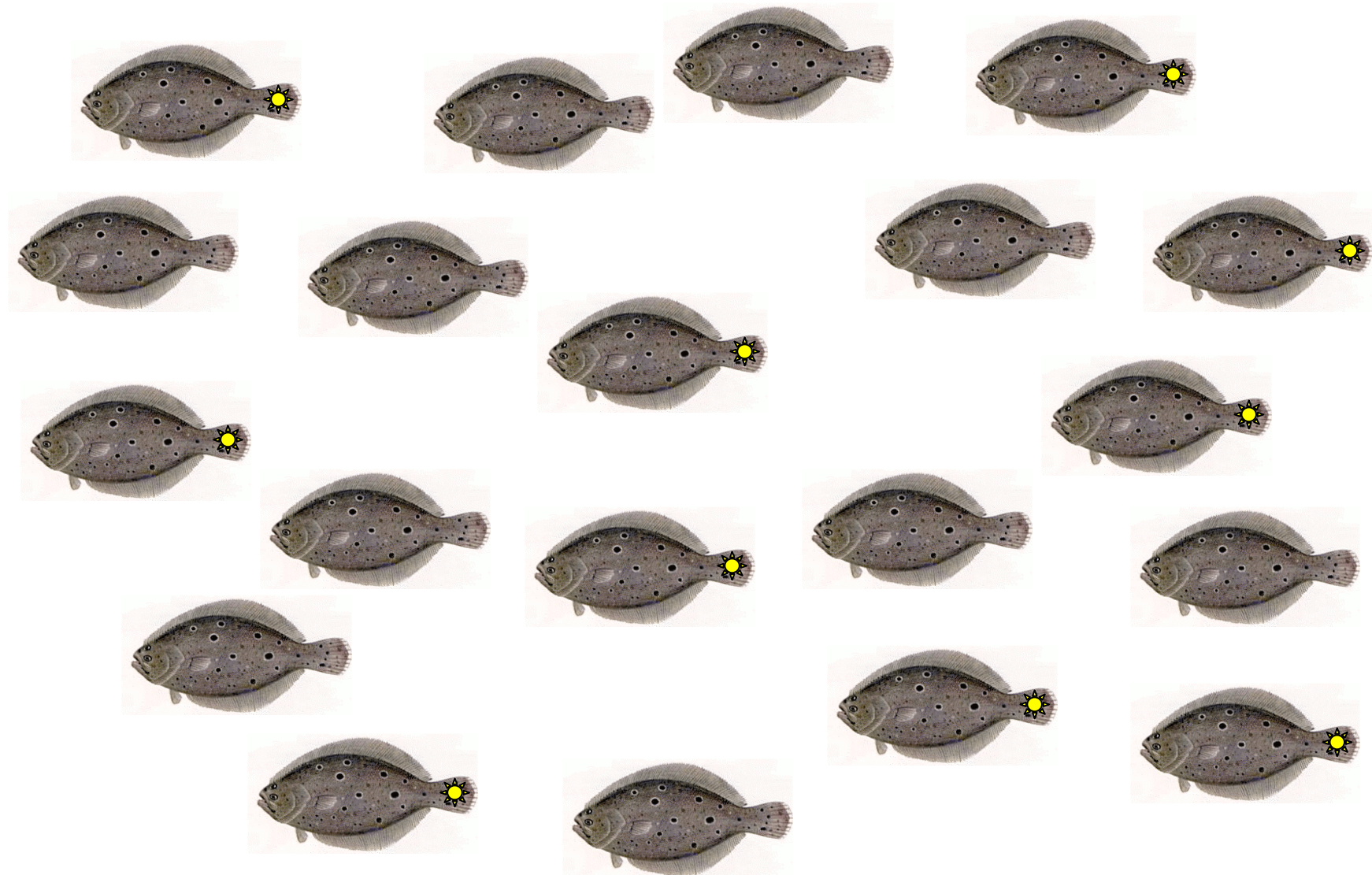


# Mark-recapture





# Mark-recapture





















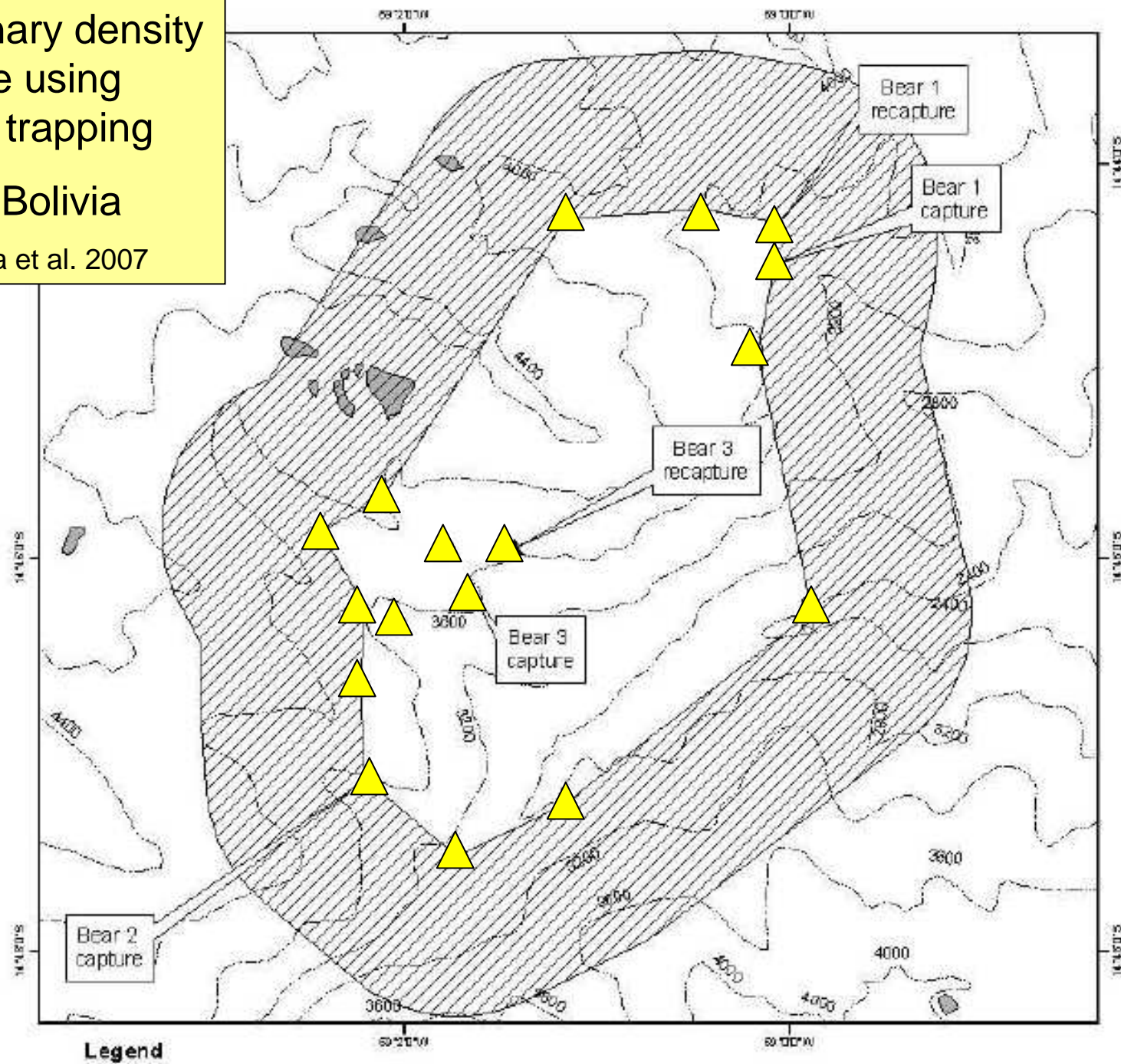




Preliminary density  
estimate using  
camera trapping

Madidi, Bolivia

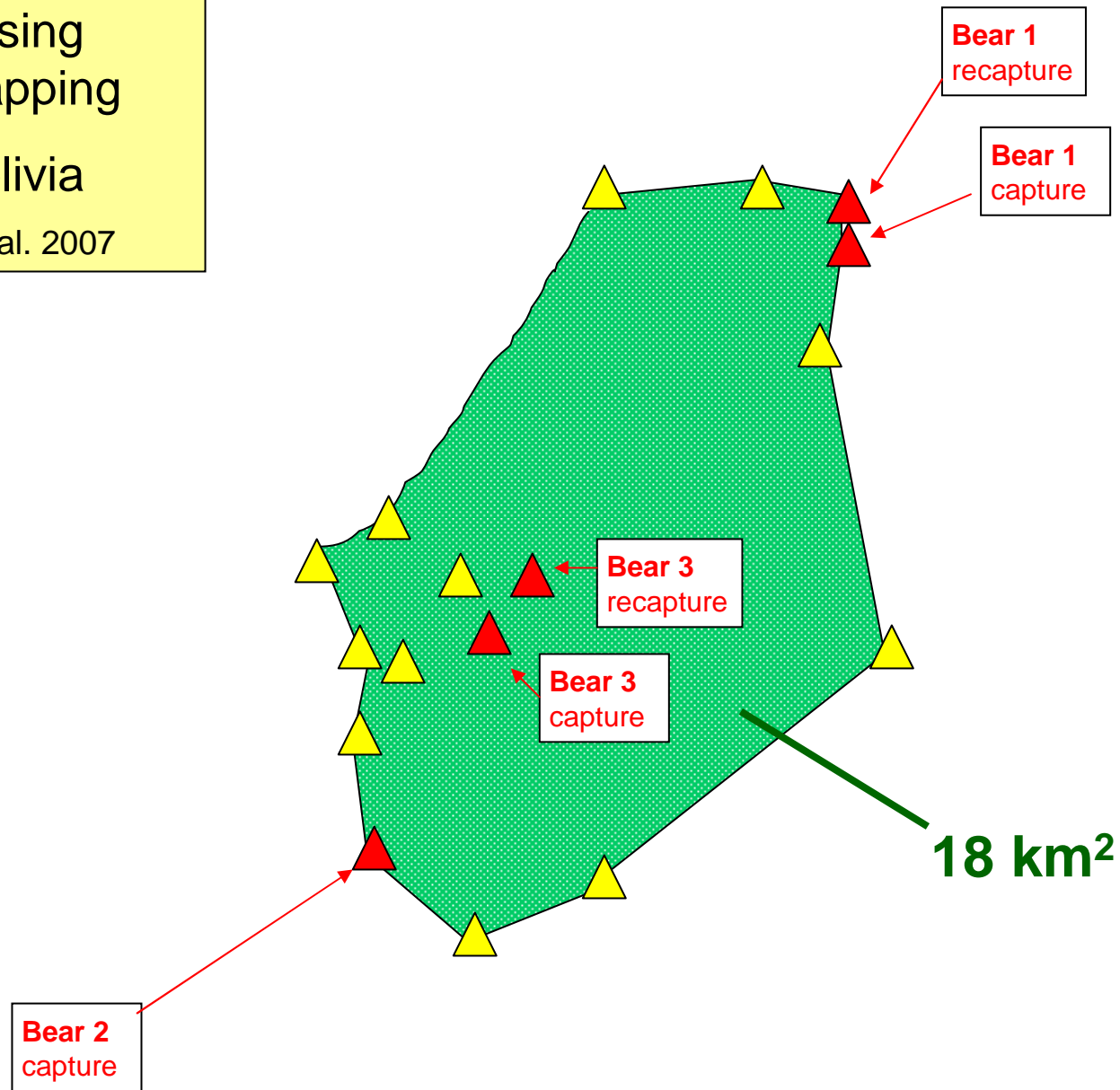
Rios-Uzeda et al. 2007



Preliminary density  
estimate using  
camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007



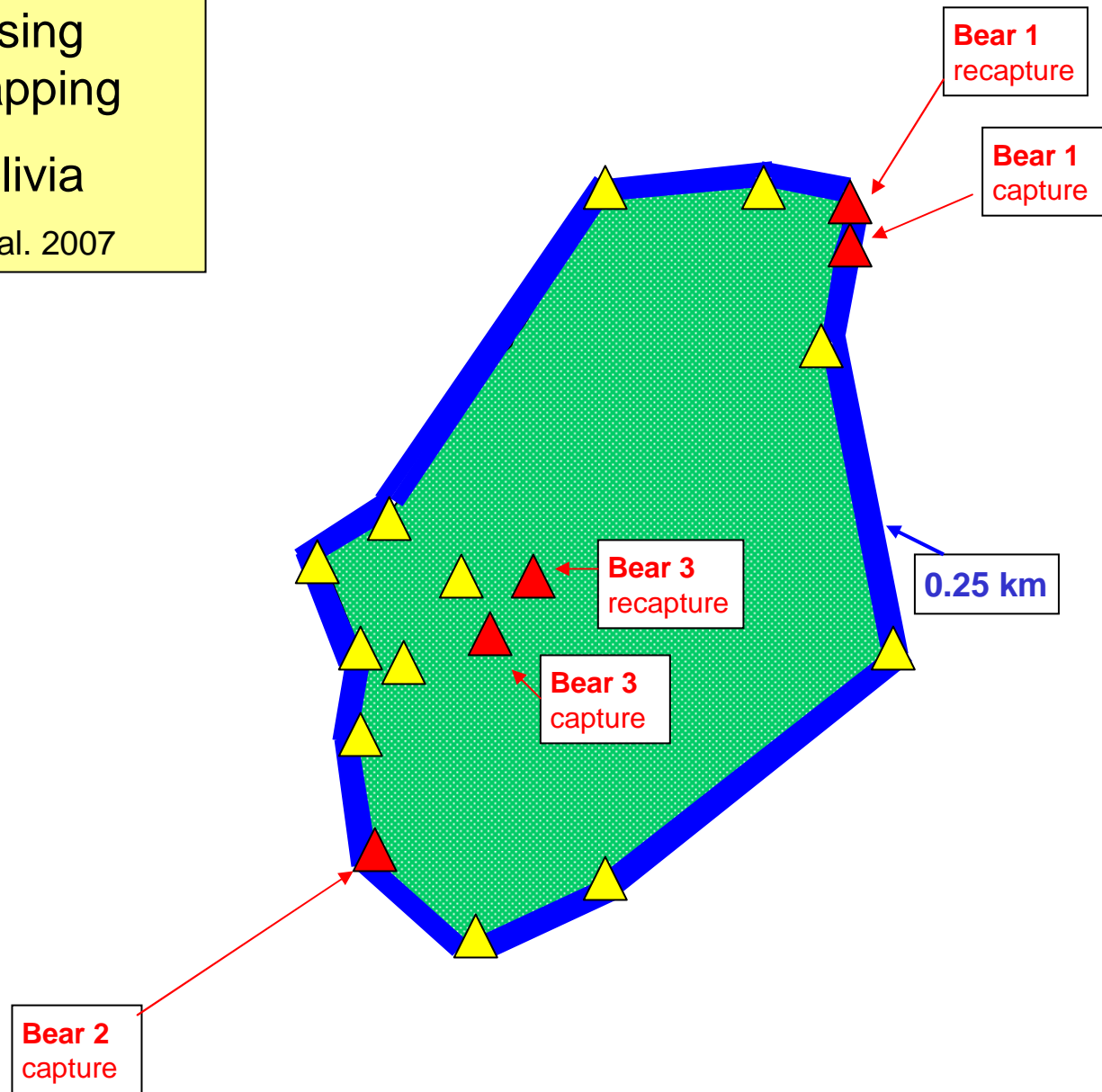
**N = 3**



Preliminary density  
estimate using  
camera trapping

Madidi, Bolivia

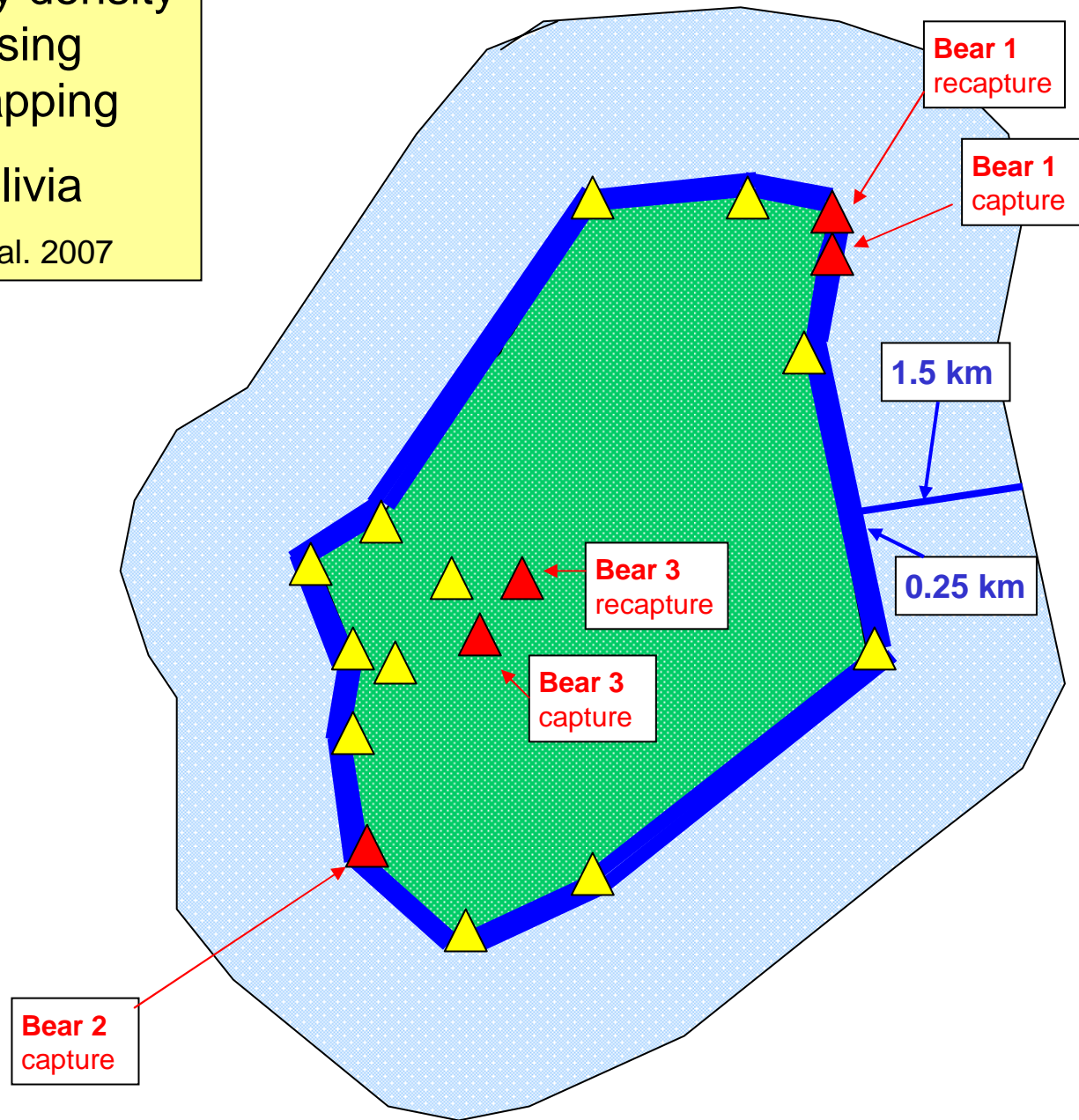
Rios-Uzeda et al. 2007



Preliminary density  
estimate using  
camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007



# Madidi density estimates

Rios-Uzeda et al. 2007

<b>Buffer width</b>	<b>Estimated density bears/100 km<sup>2</sup></b>
<b>0.25 km</b>	<b>8.0 - 19.2</b>
<b>1.5 km</b>	<b>3.5 - 8.5</b>

# Madidi density estimates

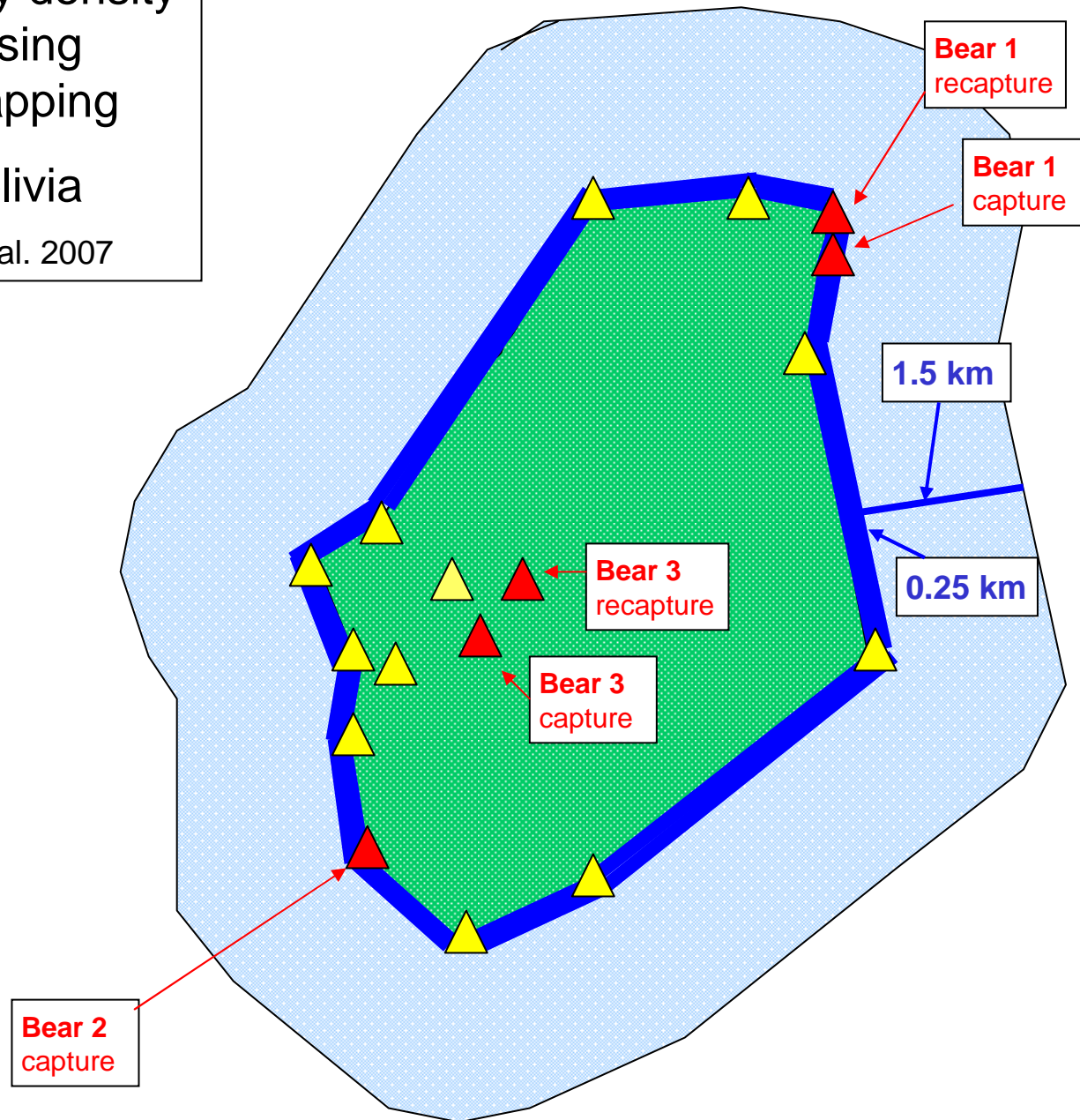
Rios-Uzeda et al. 2007

Buffer width	Estimated density bears/100 km <sup>2</sup>
0.25 km	8.0 - 19.2
1.5 km	3.5 - 8.5 4.4 - 6
2.1 km	2.6 - 6.2

Preliminary density  
estimate using  
camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007



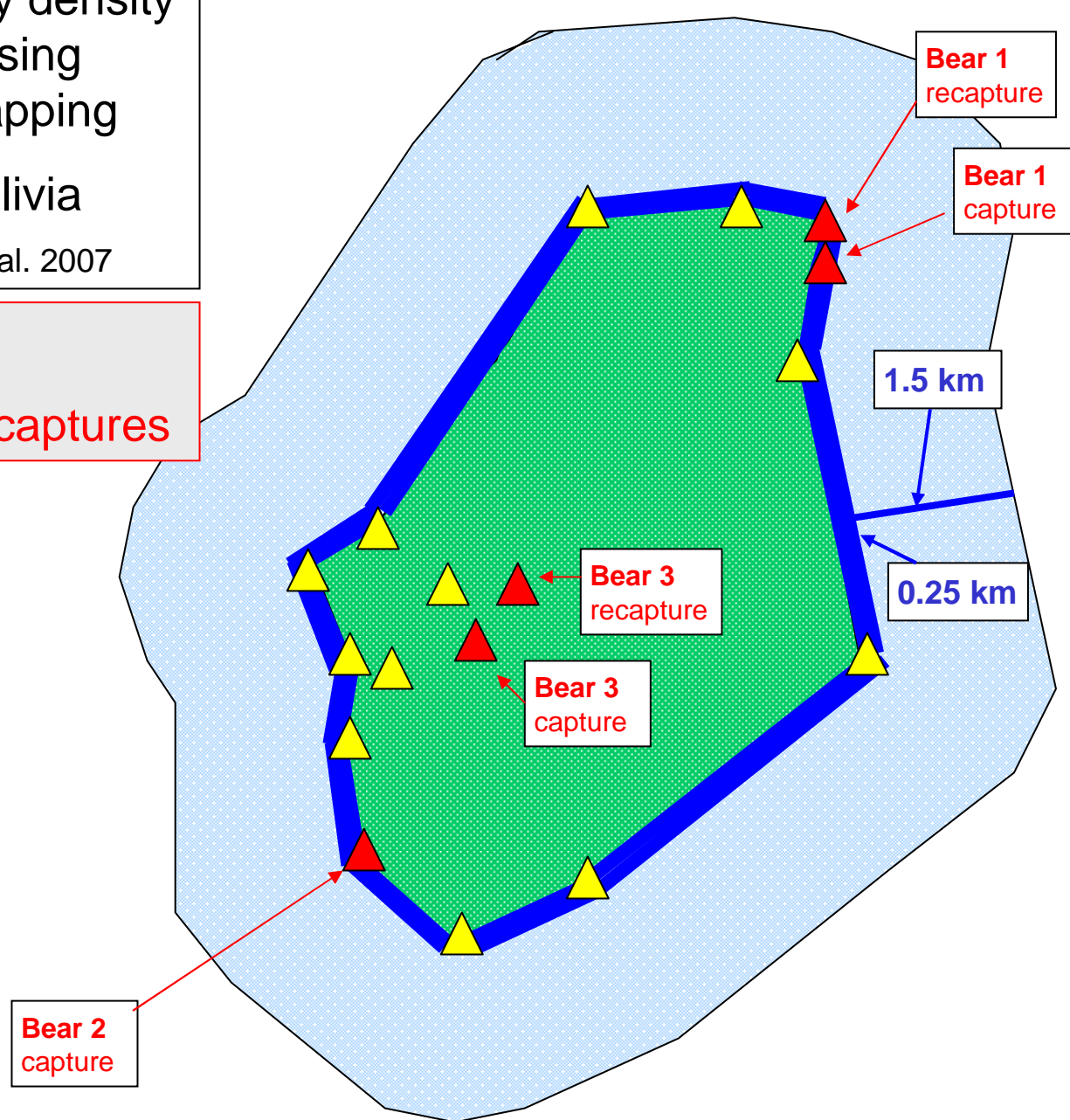
# Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

## Problems

- Too few captures





# Preliminary density estimate using camera trapping

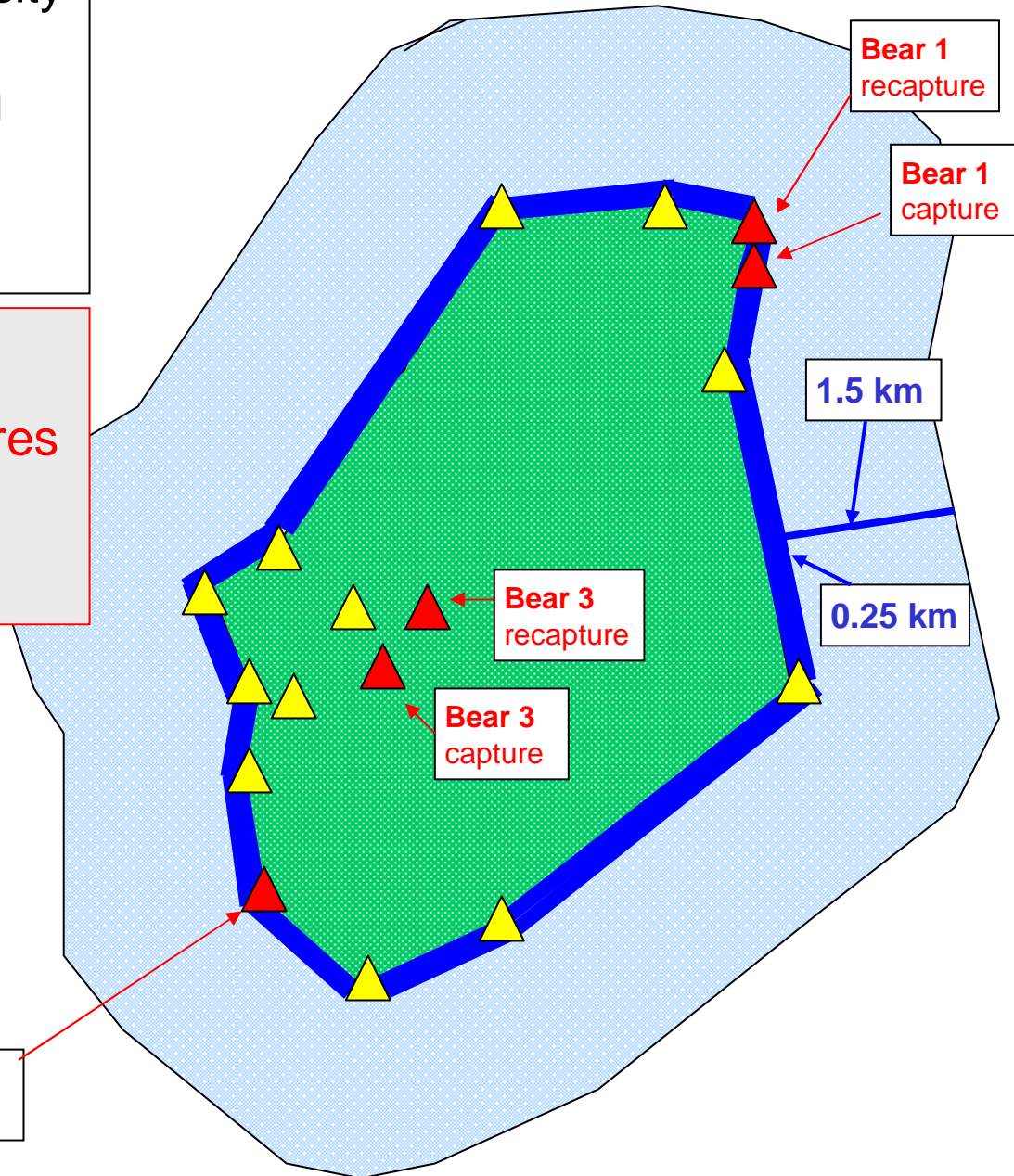
Madidi, Bolivia

Rios-Uzeda et al. 2007

## Problems

- Too few captures
- Too short time (1 month)

**Bear 2**  
capture



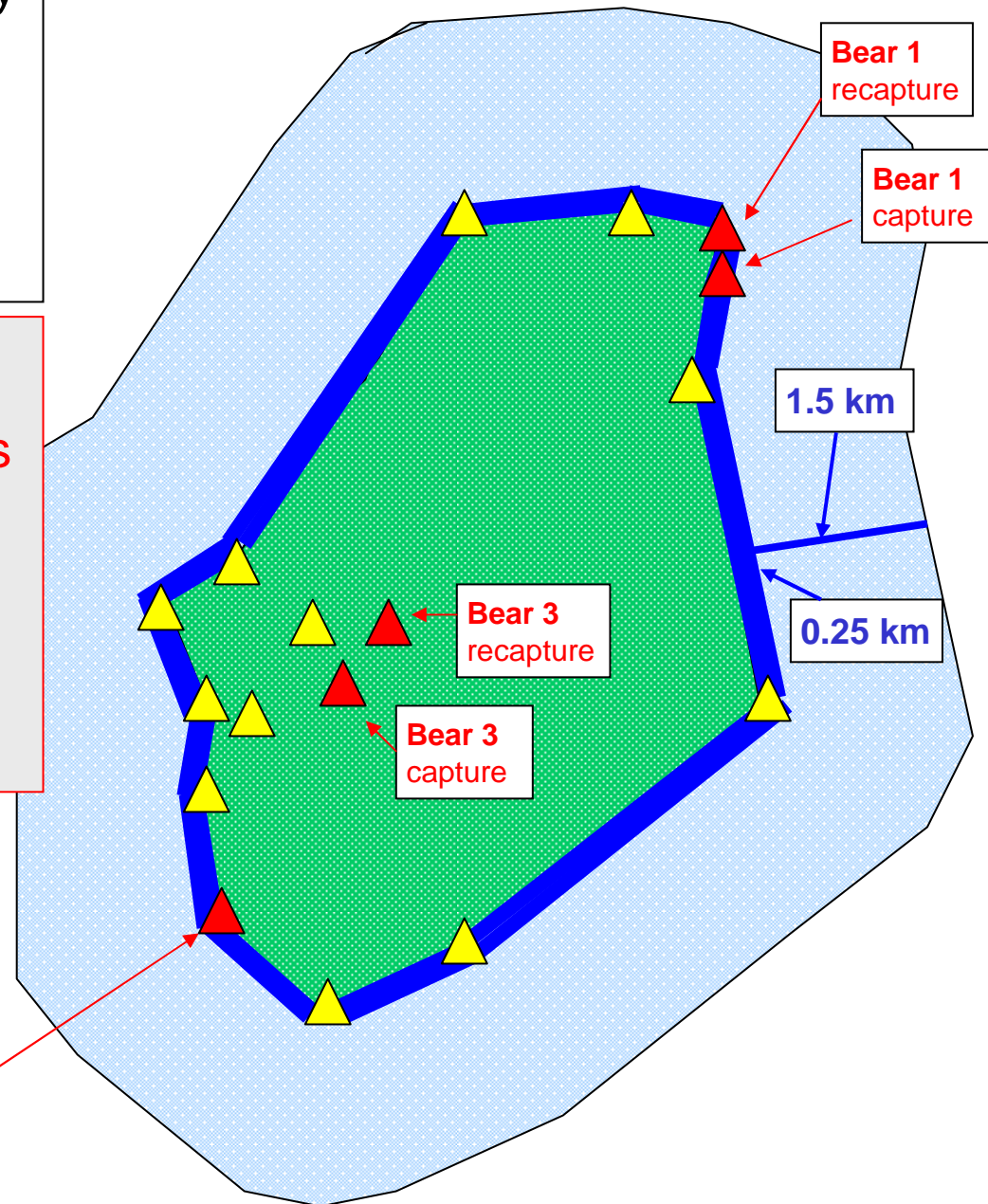
# Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

## Problems

- Too few captures
- Too short time (1 month)
- Large spaces untrapped



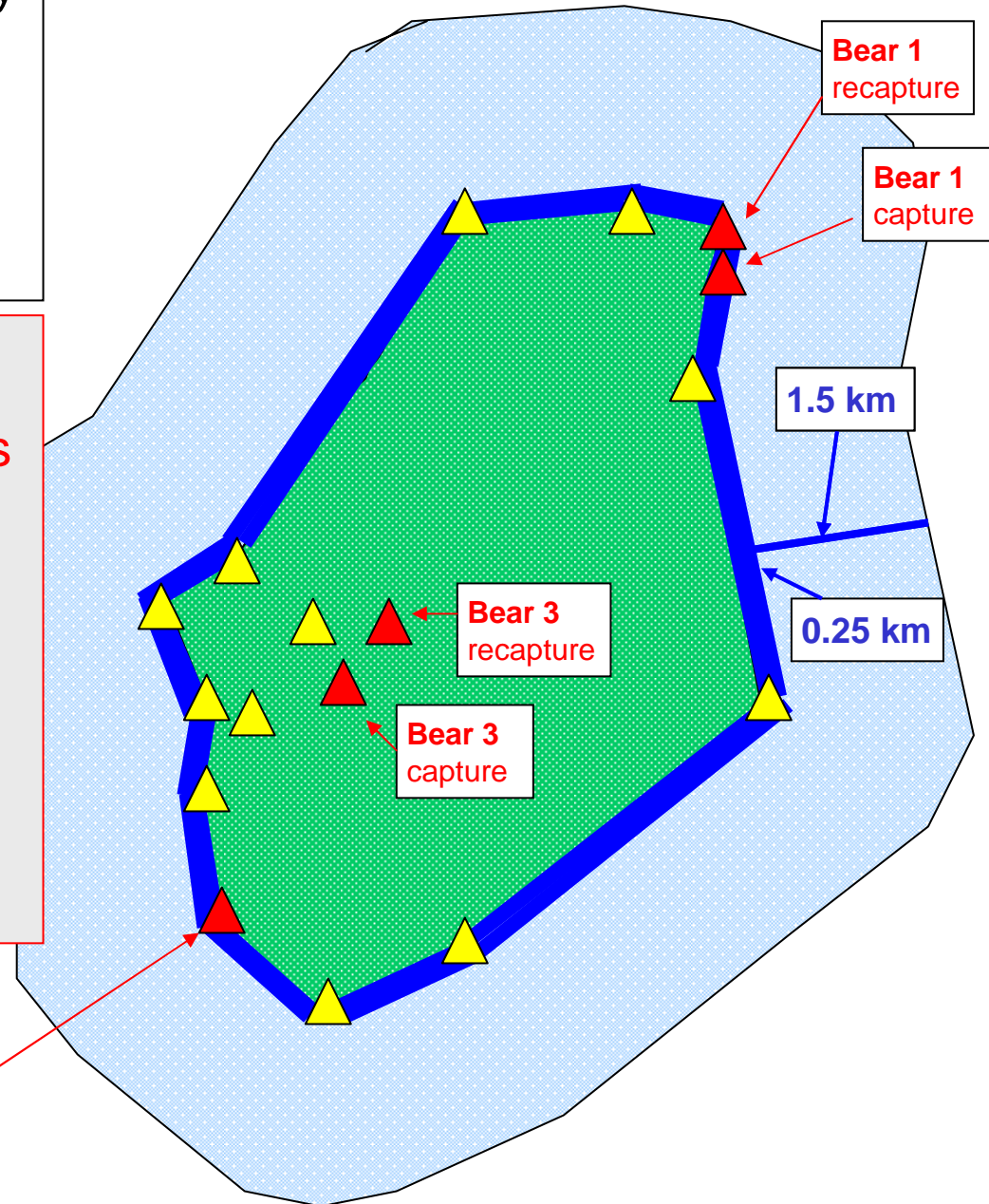
# Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

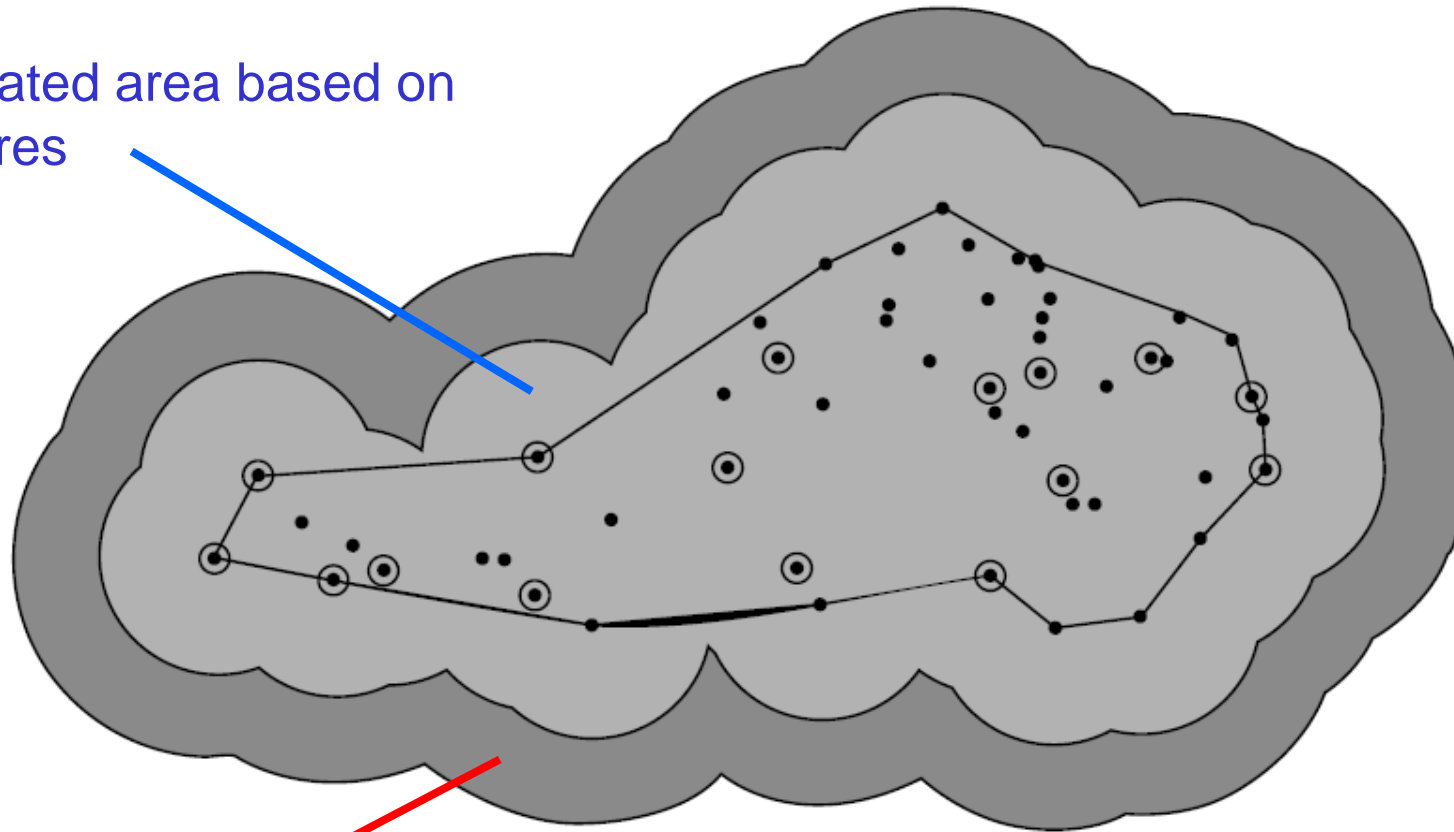
## Problems

- Too few captures
- Too short time (1 month)
- Large spaces untrapped
- Buffer strip very uncertain



**Estimating density of jaguars in Brazil. Soisalo & Cavalcanti 2006**

Estimated area based on  
captures



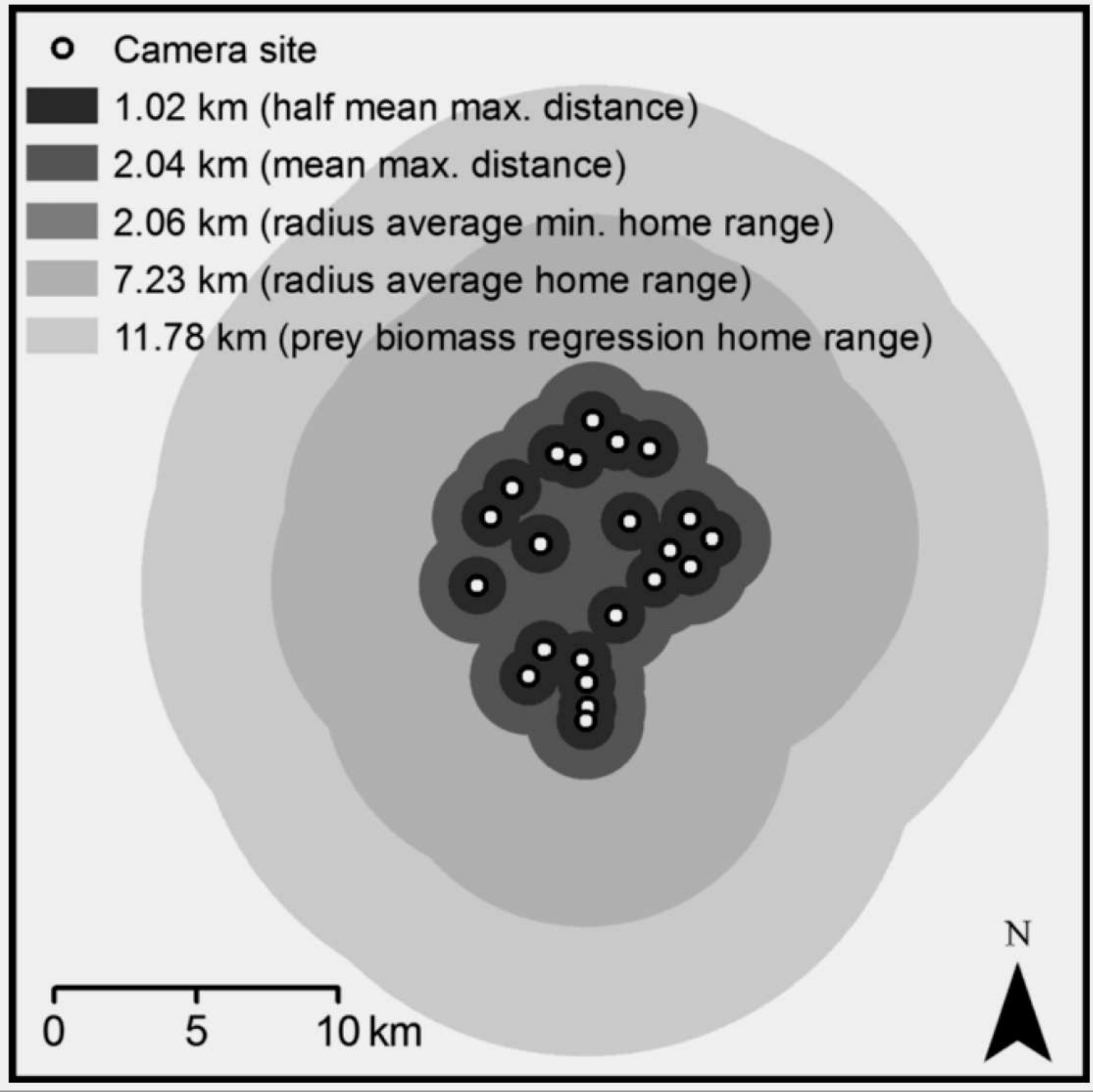
Estimated area based on  
GPS locations

-----  
10 km

## 5 different buffers

Assessing  
estimators of  
snow leopard  
abundance.

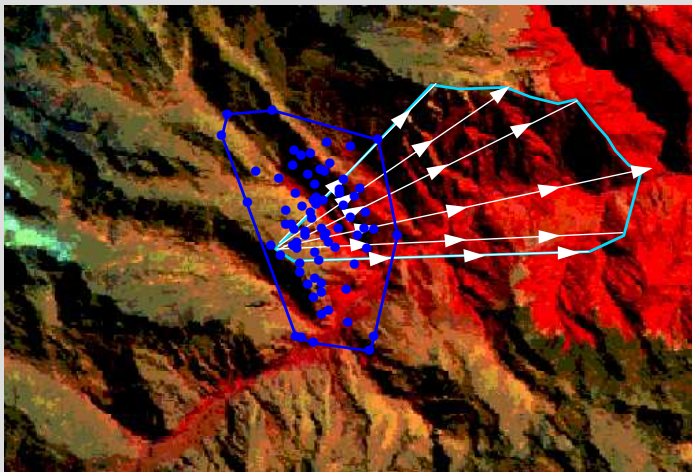
McCarthy et al.  
2008



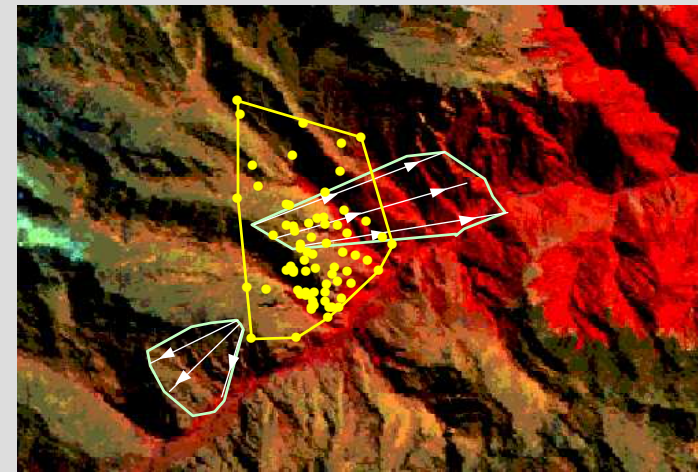
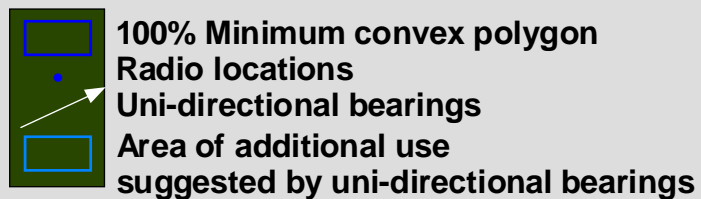


## Home range data from Madidi, Bolivia (Paisley 2001)

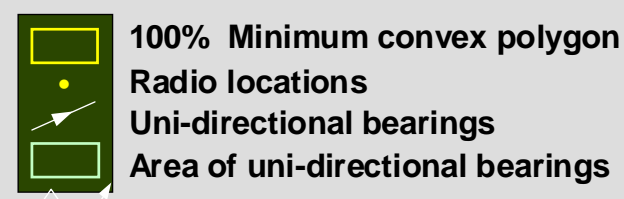
Individual	Days tracked	% days triangulated location obtained
<b>Bear 1</b>	<b>117</b>	<b>64%</b>
<b>Bear 2</b>	<b>101</b>	<b>70%</b>



**Bear 1**

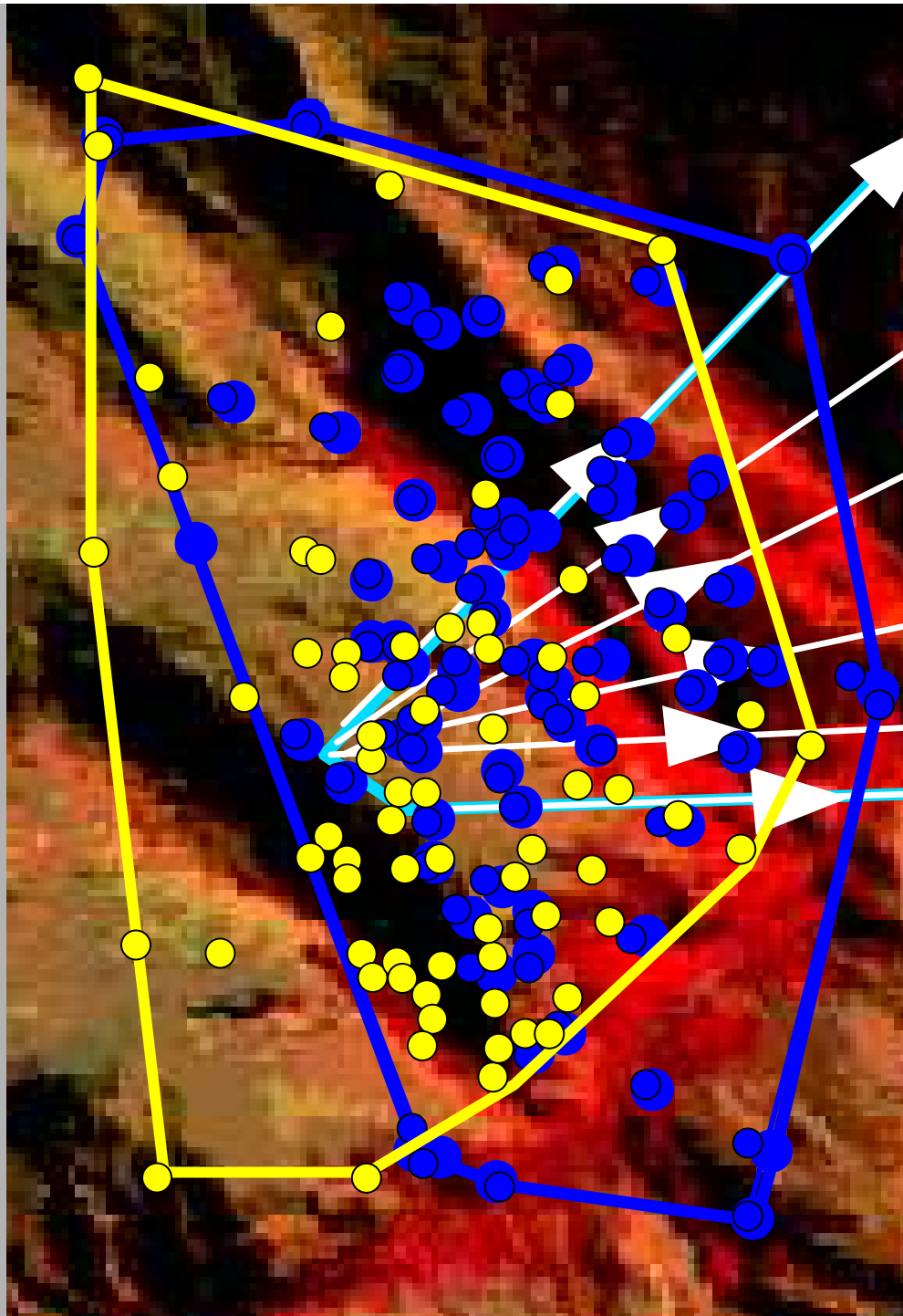


**Bear 2**

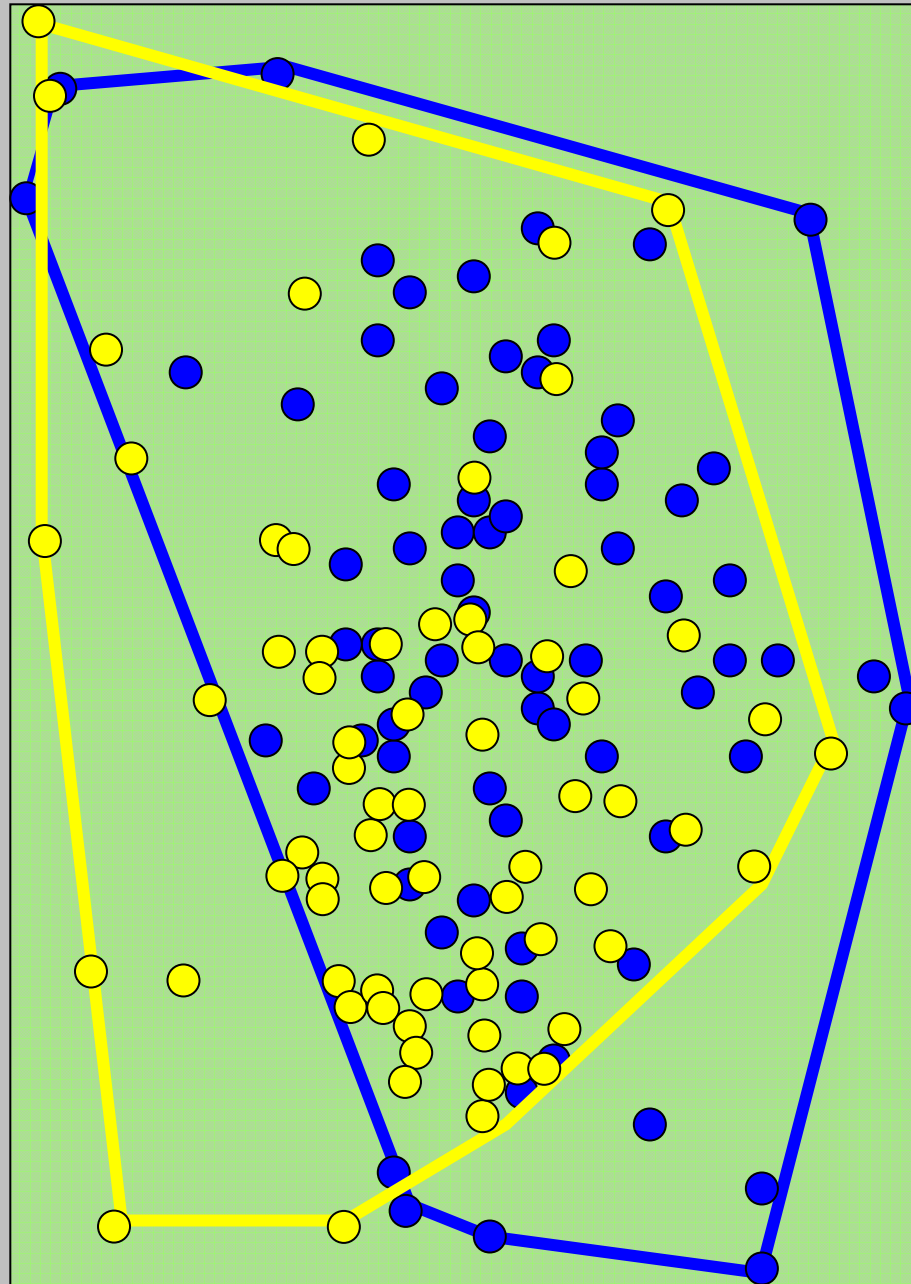




Paisley 2001

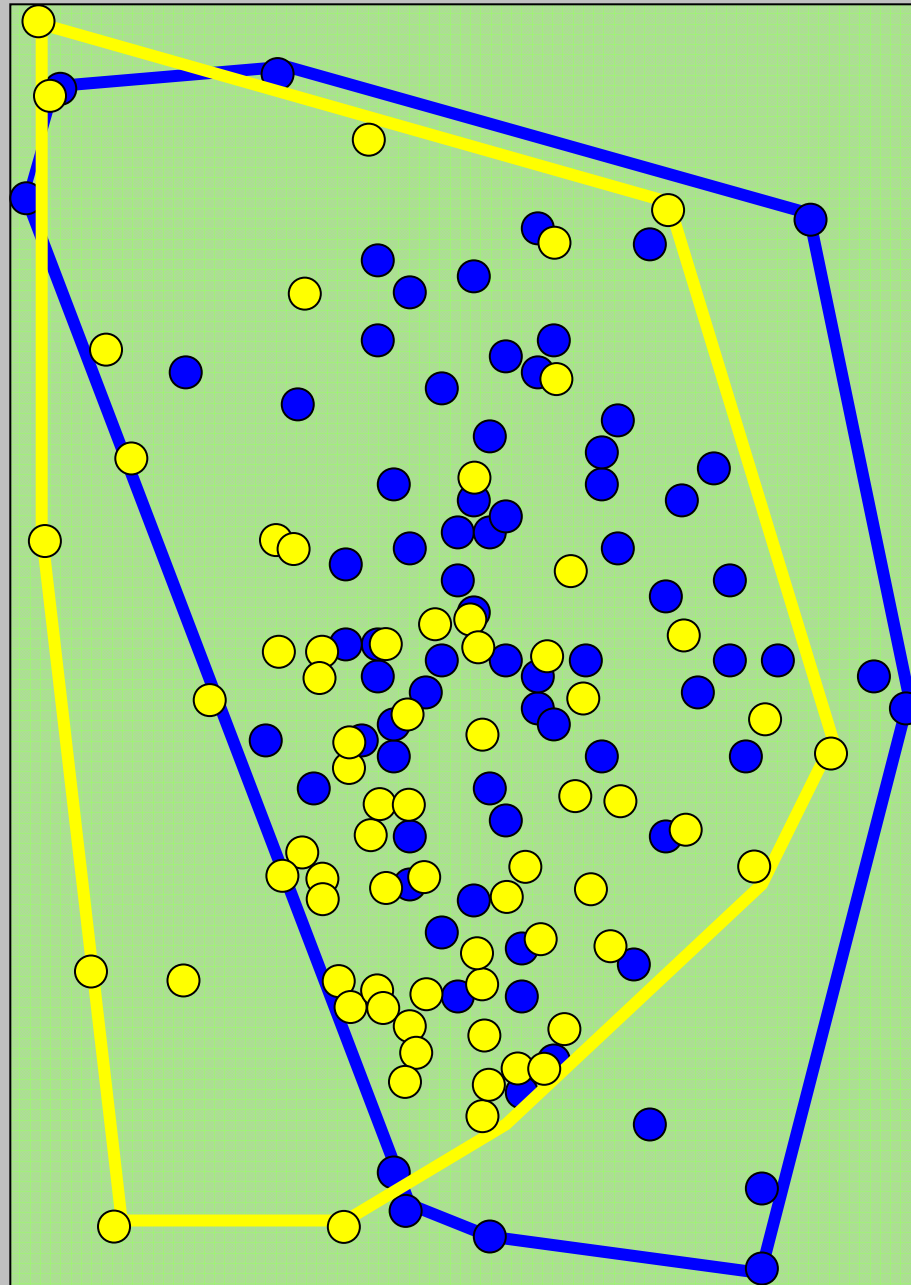


Paisley 2001



Total area:  
**12 km<sup>2</sup>**

Paisley 2001



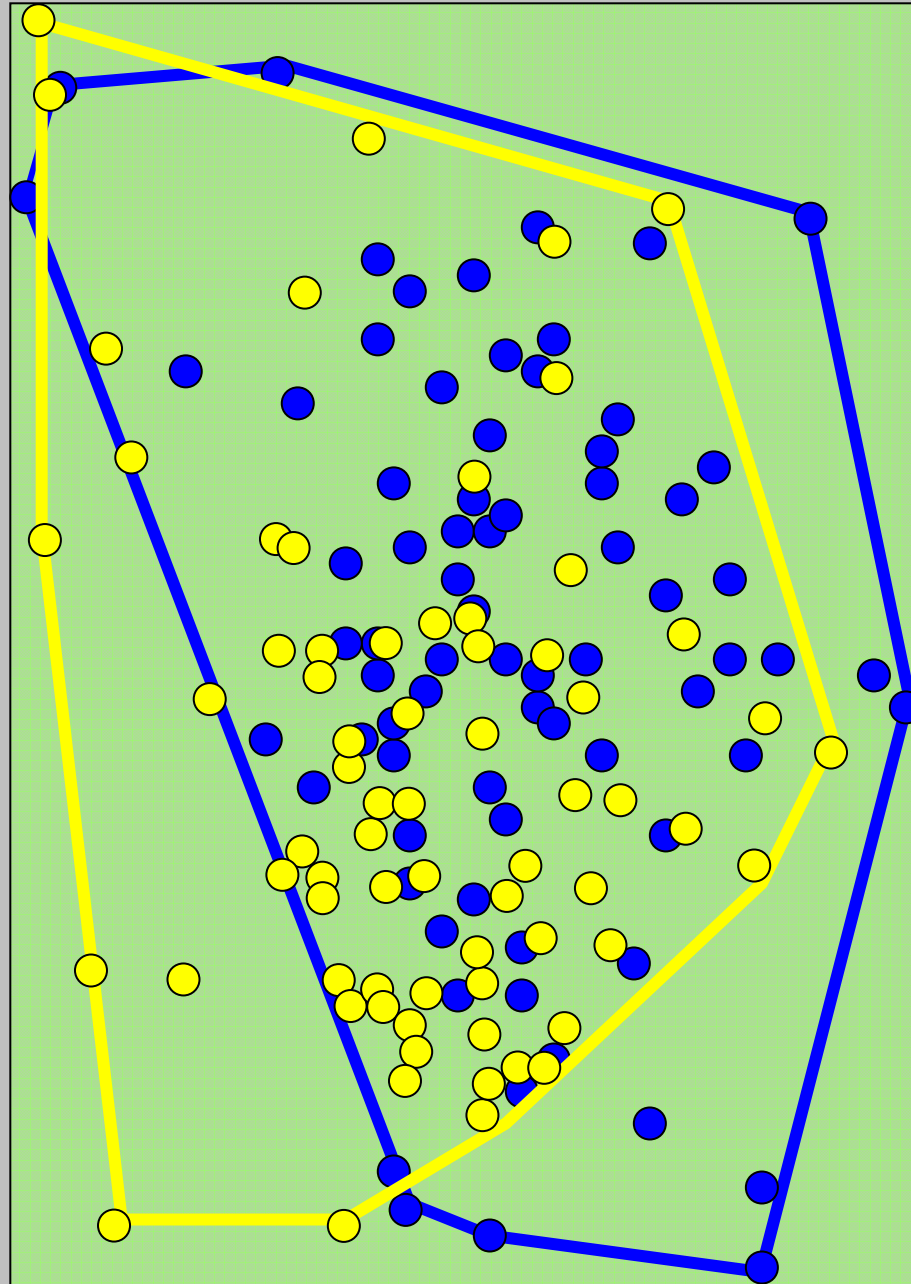
Total area:

**12 km<sup>2</sup>**

Mean time in area:

**67%**

Paisley 2001



Total area:

**12 km<sup>2</sup>**

Mean time in area:

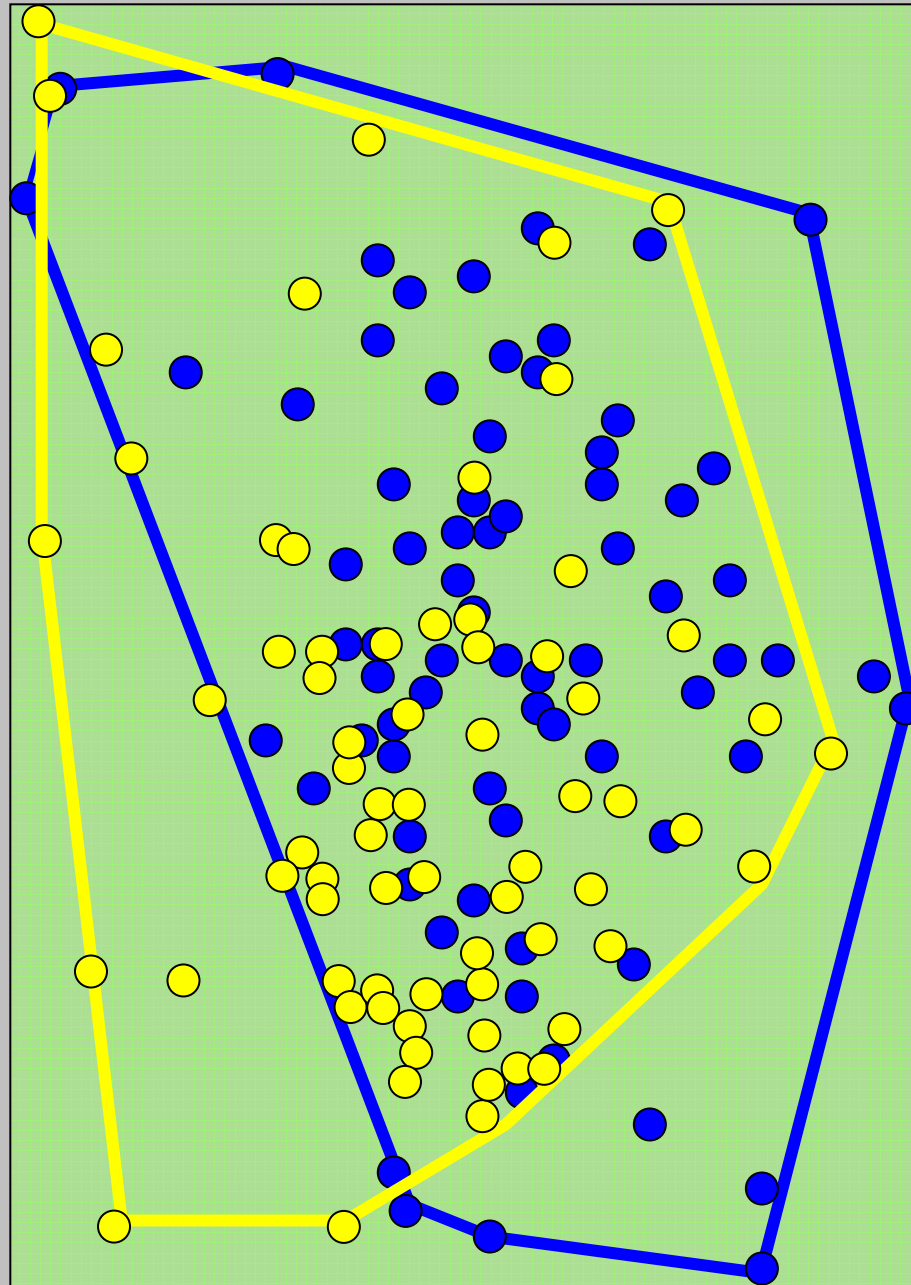
**67%**

Bear equivalents:

**1.3**



Paisley 2001



Total area:

**12 km<sup>2</sup>**

Mean time in area:

**67%**

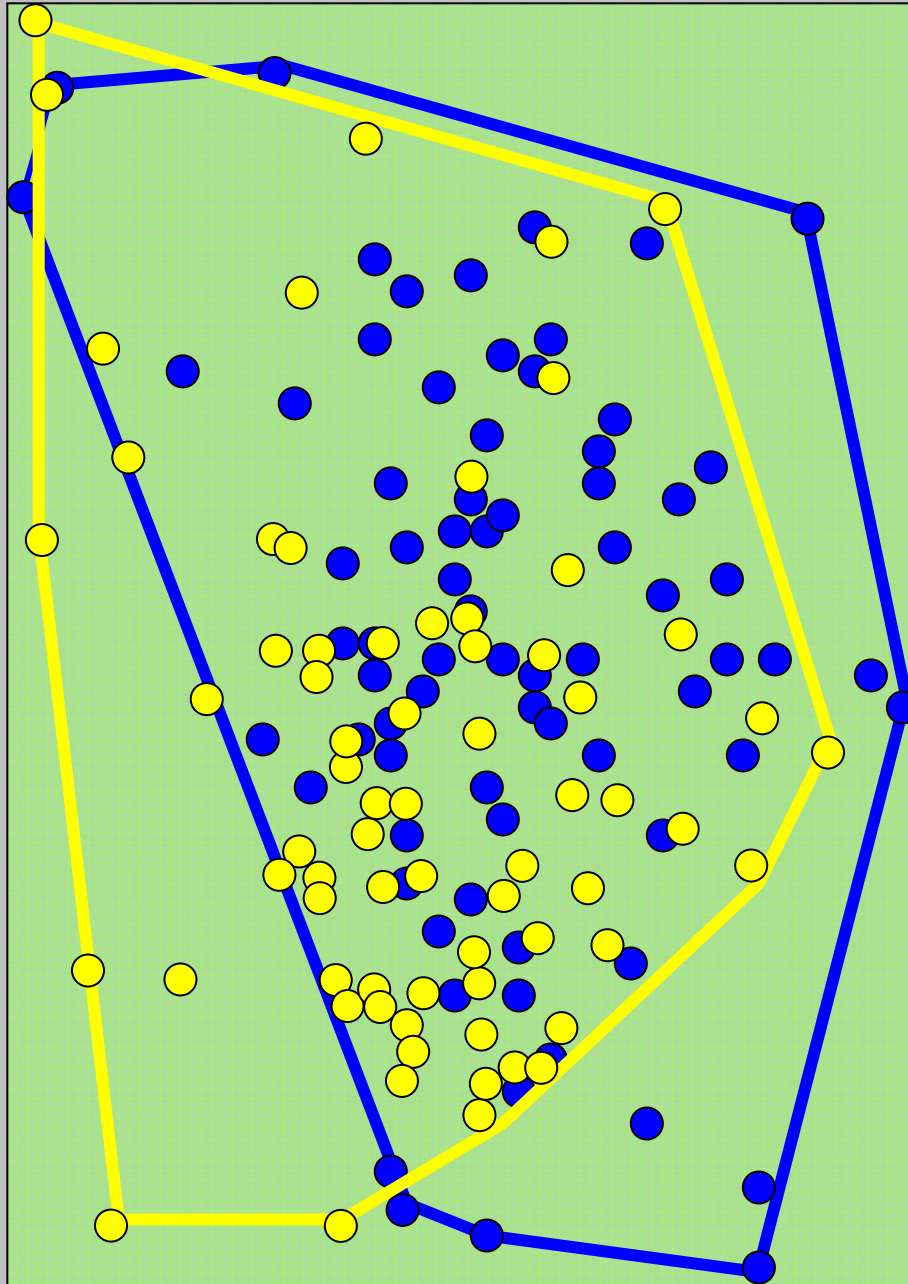
Bear equivalents:

**1.3**

Min. density:

**10.8** bears/100 km<sup>2</sup>

Paisley 2001



Total area:

**12 km<sup>2</sup>**

Mean time in area:

**67%**

Bear equivalents:

**1.3**

Min. density:

**10.8** bears/100 km<sup>2</sup>

Other bears seen:

**~12** bears/100 km<sup>2</sup>

# Madidi density estimates

Rios-Uzeda et al. 2007

Buffer width	Estimated density bears/100 km <sup>2</sup>
0.25 km	<b>~12</b> 8.0 - 19.2
1.5 km	3.5 - 8.5 <b>4.4 - 6</b>
2.1 km	<b>4.4 - 6</b> 2.6 - 6.2

## Rough mark-recapture “rules of thumb”

### **Preliminary survey:**

**95% CI =  $\pm 50\%$  of population**

### **Management & Conservation:**

**95% CI =  $\pm 25\%$  of population**



## Rough mark-recapture “rules of thumb”

### Preliminary survey:

95% CI =  $\pm 50\%$  of population

Recapture sample  $\geq 16$

### Management & Conservation:

95% CI =  $\pm 25\%$  of population

Recapture sample  $\geq 64$

# Rough mark-recapture “rules of thumb”

## Preliminary survey:

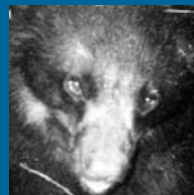
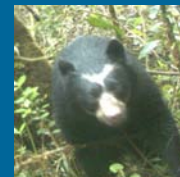
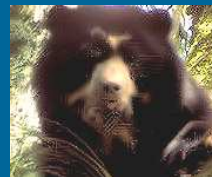
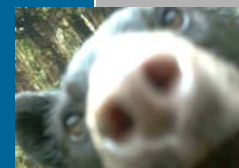
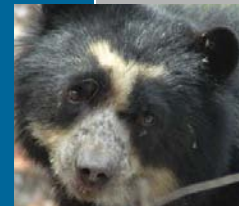
95% CI =  $\pm 50\%$  of population

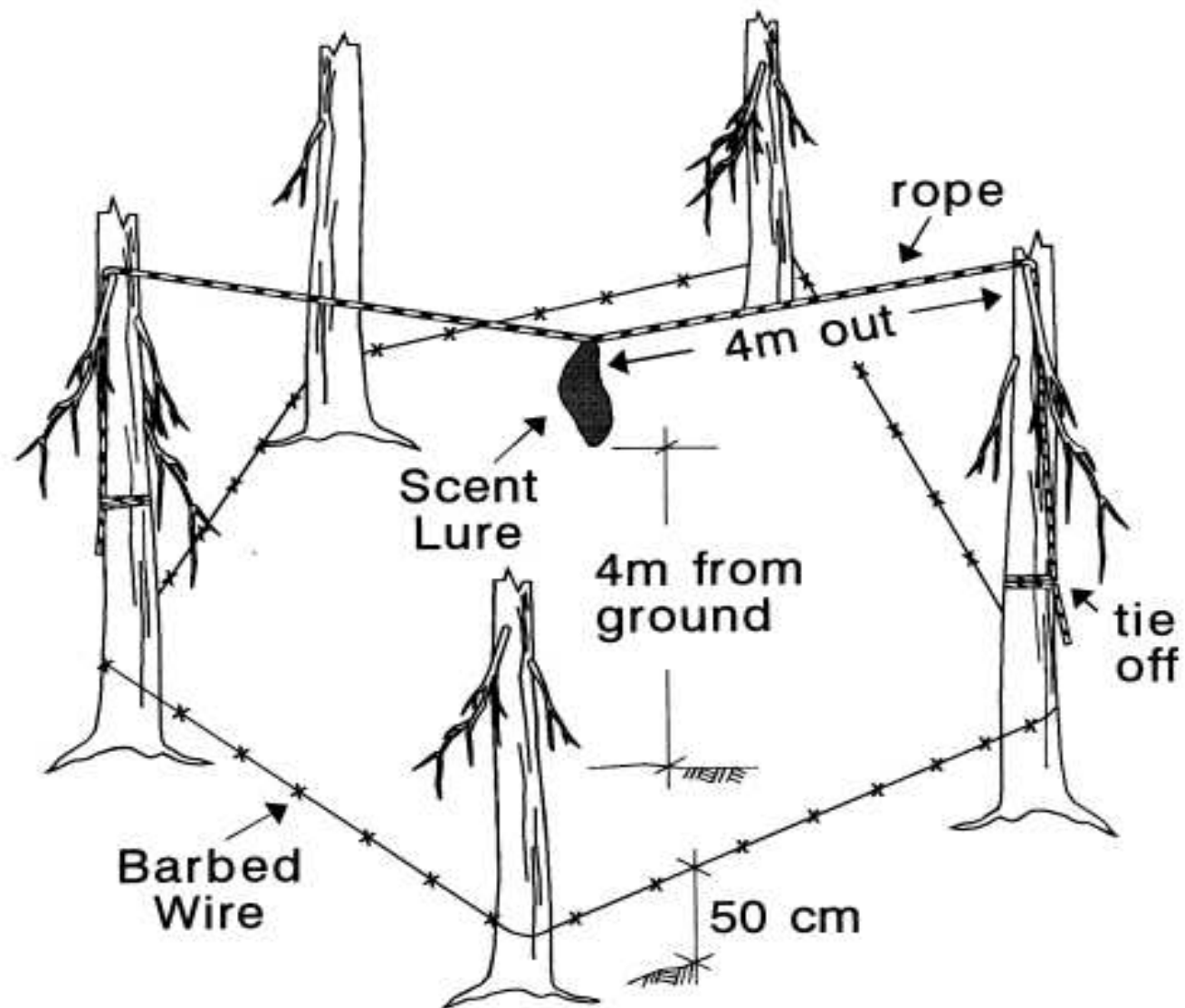
Recapture sample  $\geq 16$

## Management:

95% CI =  $\pm 25\%$  of population

Recapture sample  $\geq 4$





# DNA Hair-trap

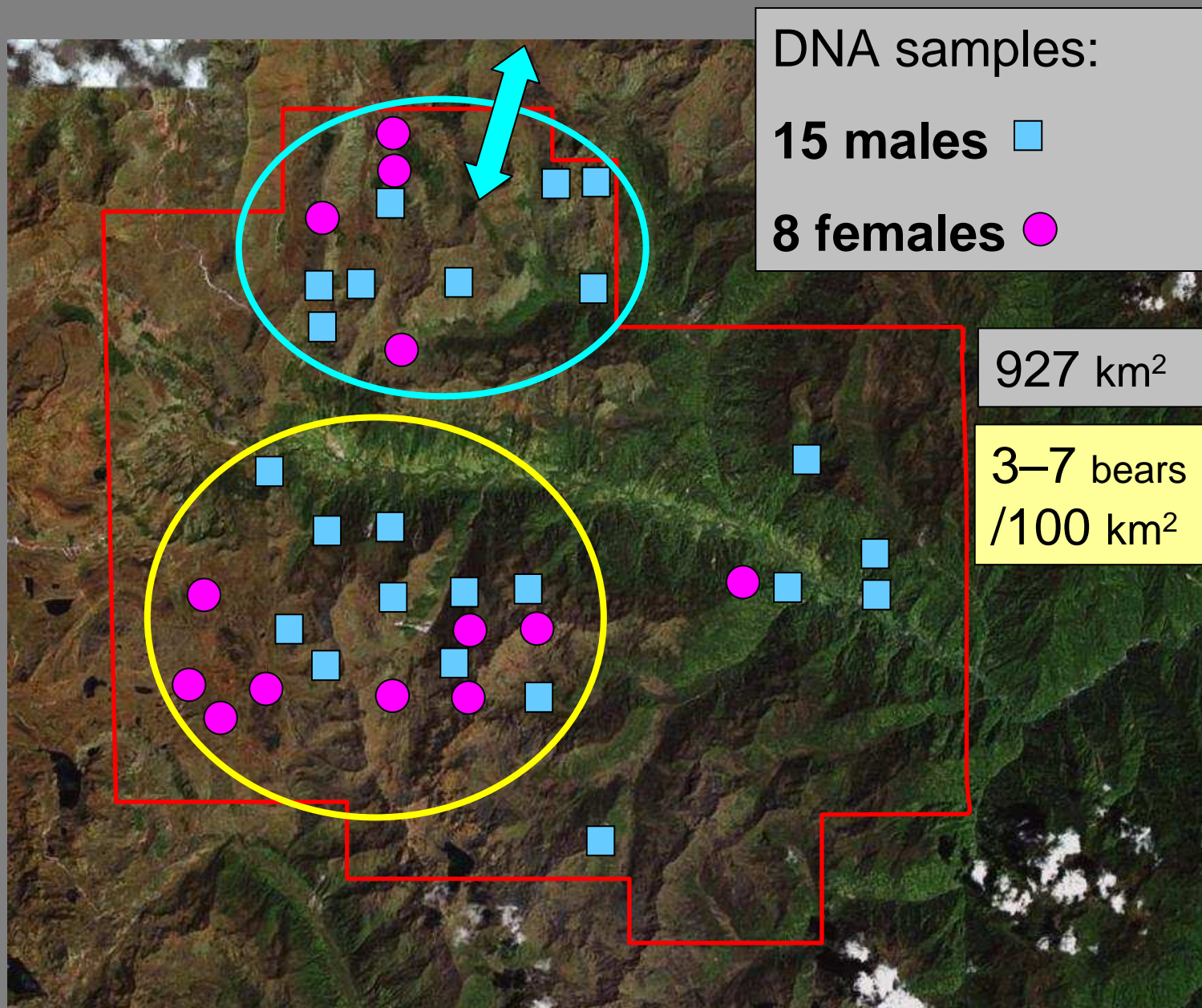
B. McLellan





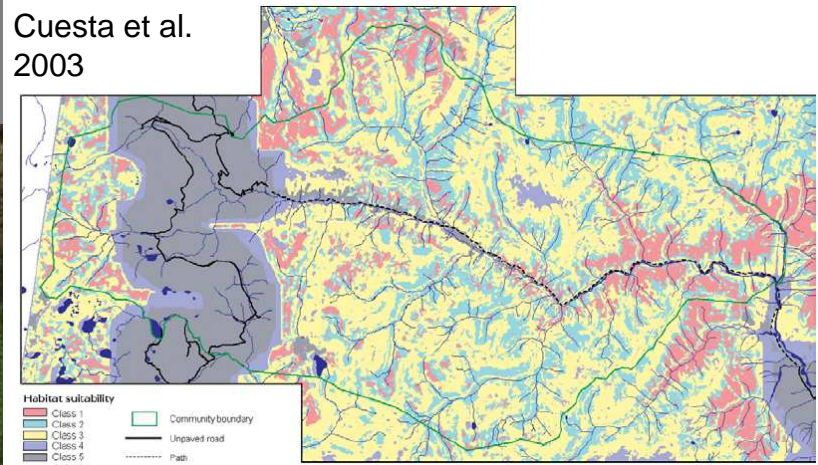
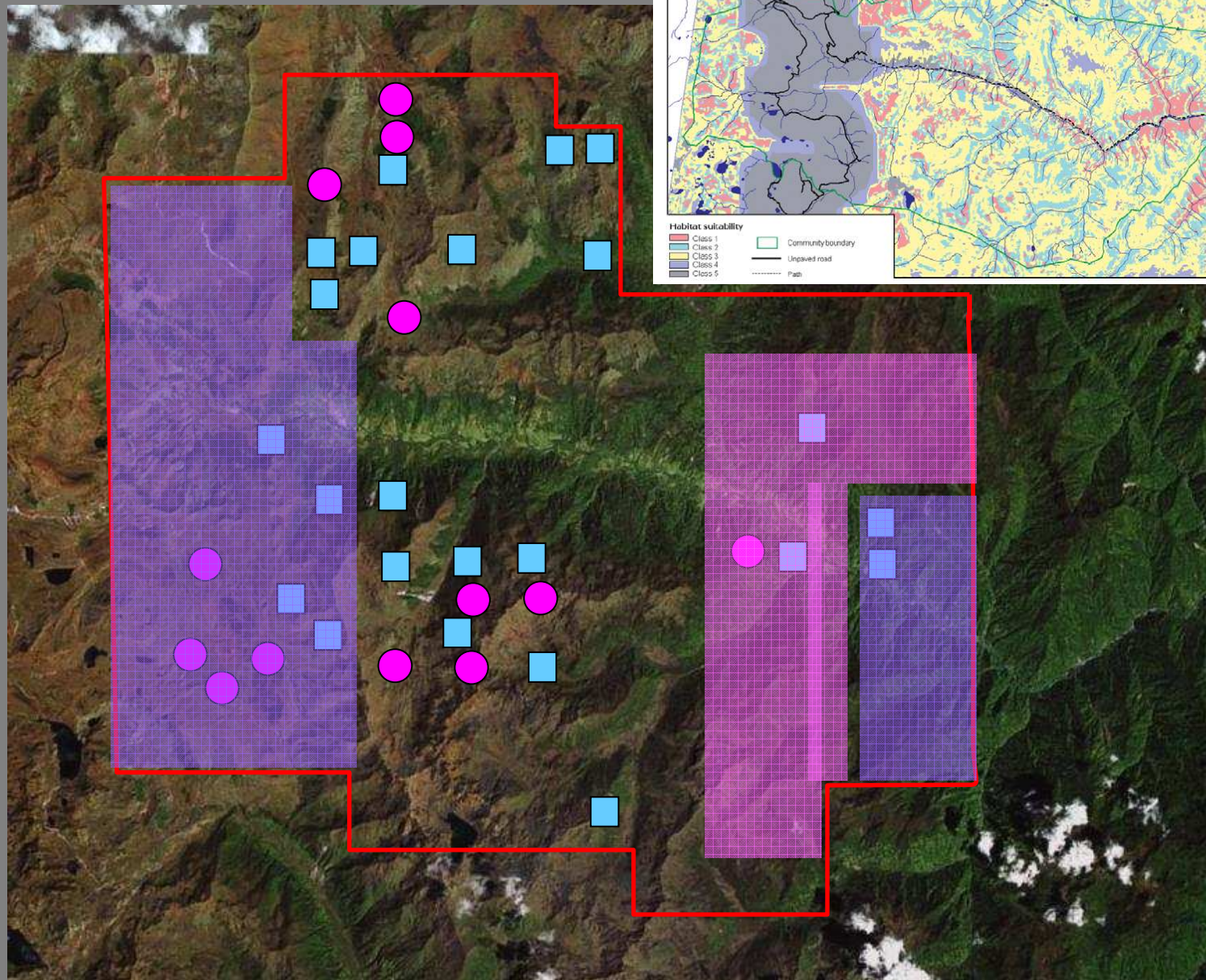


Viteri *et al.*: Cayambe-Coca Ecological Reserve, Ecuador





Cuesta et al.  
2003





Isn't all this taken  
care of by  
Confidence Intervals  
(CIs)?



CIs only account for  
sampling variation.



CIs only account for  
sampling variation.

CIs do not account for  
error due to study design.





CIs only account for  
sampling variation.

CIs do not account for  
error due to study design.

CIs around biased  
estimates may not include  
true population number.



CI's only account for  
sampling variation.

CI's do not account for  
error due to study design.

CI's around biased  
estimates may not include  
true population number.



When is a  
population  
estimate  
necessary?

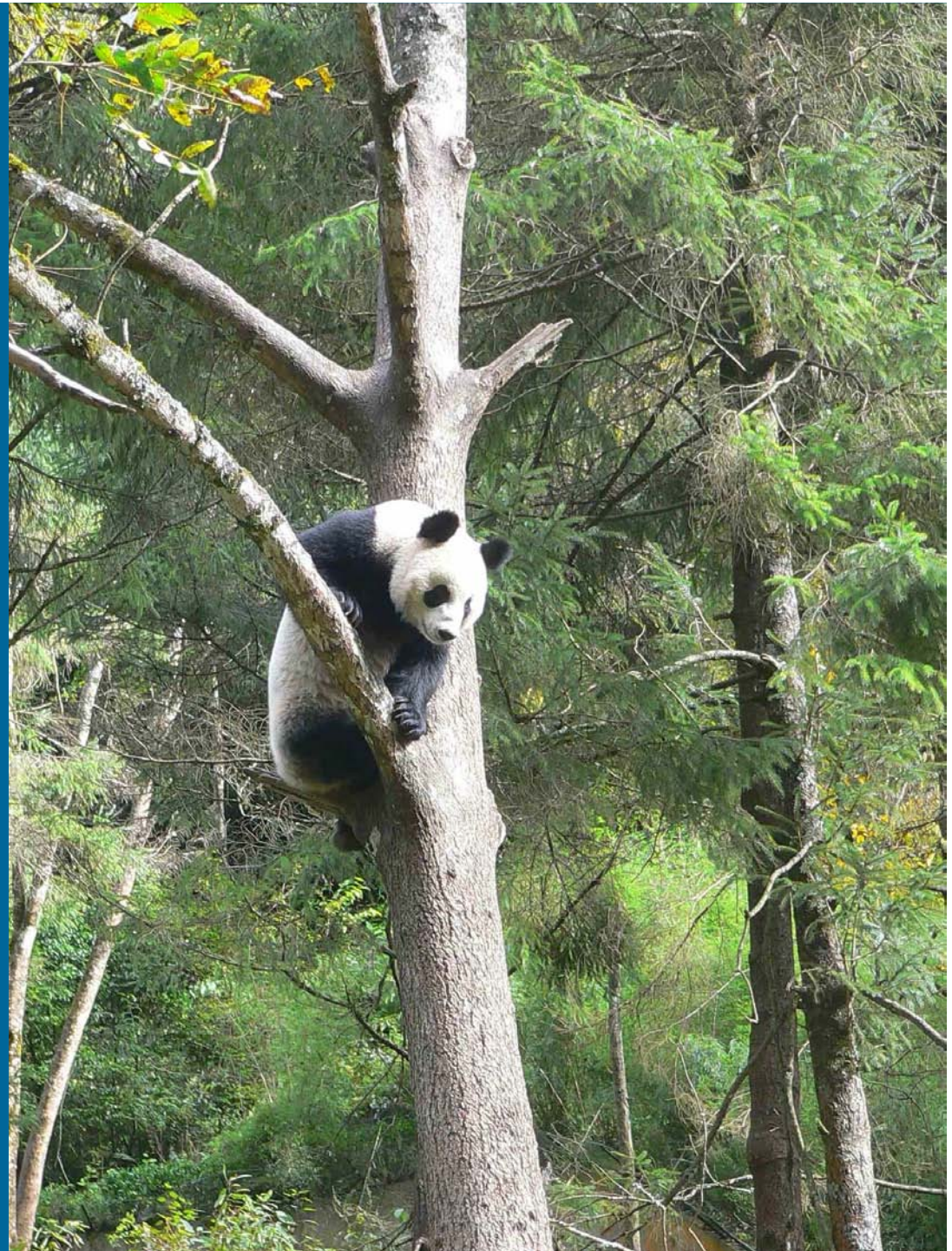
- **Harvested  
populations**



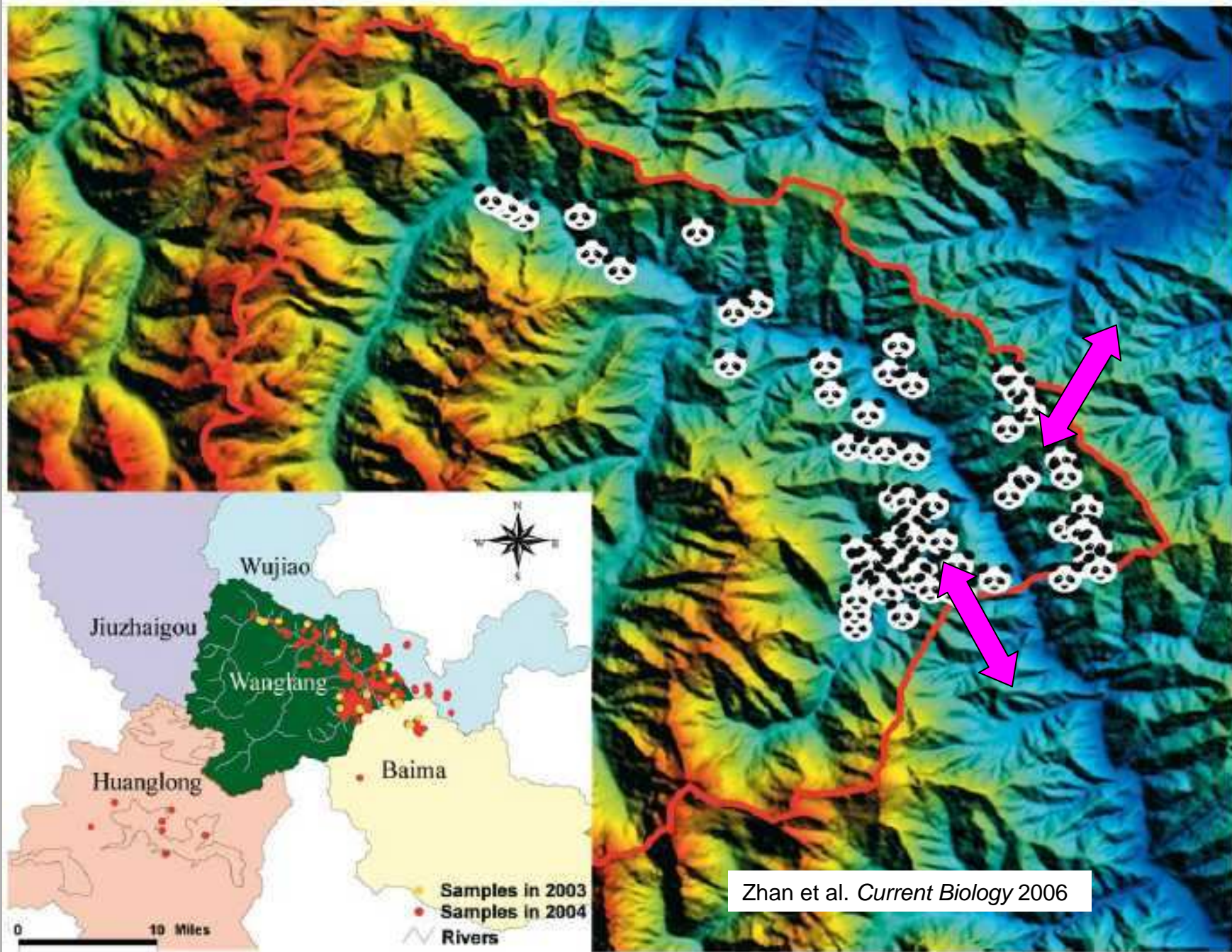


# When is a population estimate necessary?

- To monitor endangered species









# When is a population estimate necessary?

- To improve conservation of all species?



# Andean Bear Density and Abundance Estimates —

How Reliable and  
Useful are They ?

You be the  
judge

