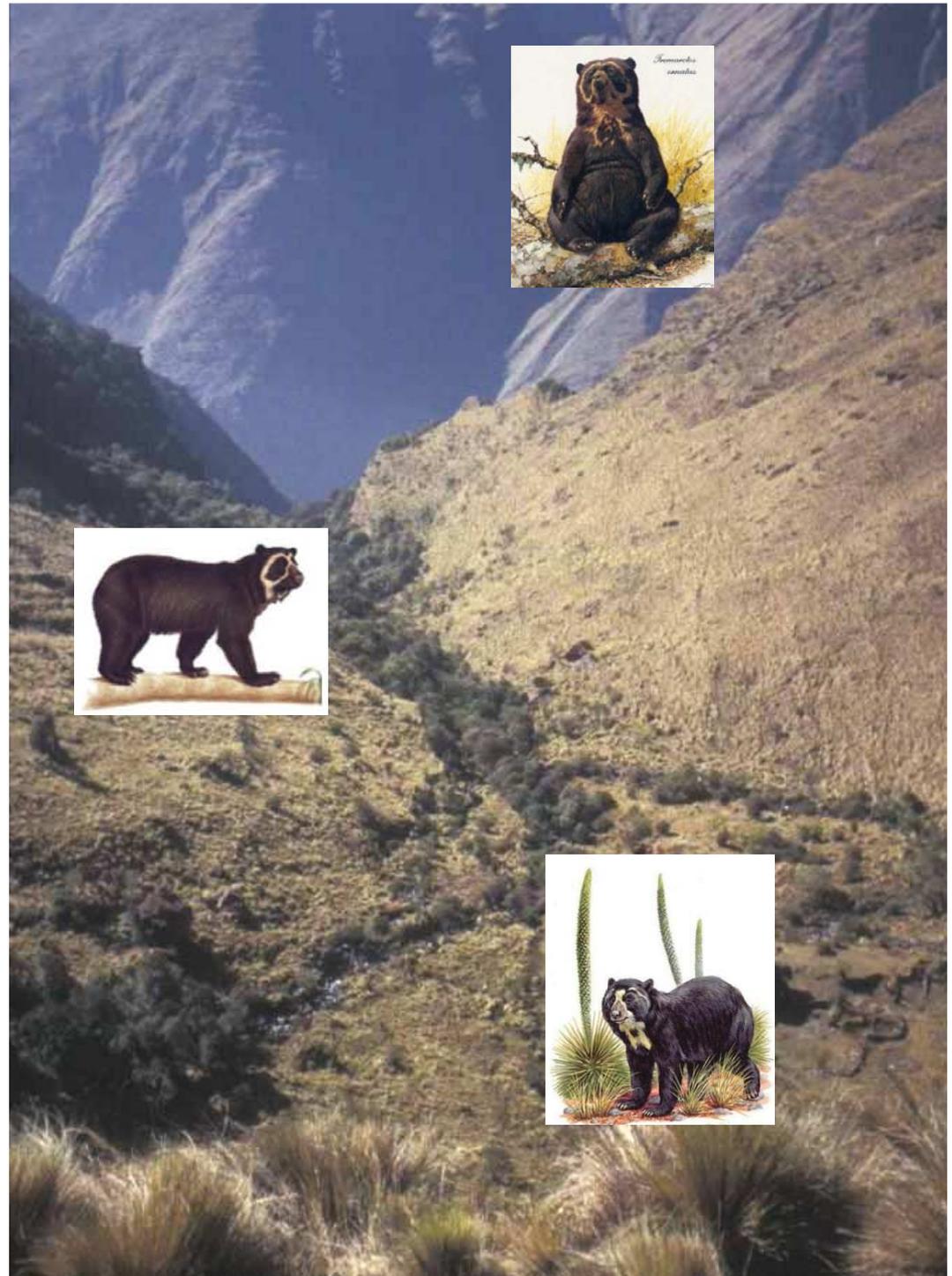


Andean Bear Density and Abundance Estimates —

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 (km²)	Density of American black bears	
	Low	Median
260,000	7/100 km²	25/100 km²

Rangewide estimate of Andean Bears

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Total range (km ²)	Density of American black bears		Estimated number of Andean bears (excl. cubs)
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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: $N_e/N =$

$$0.27 - 0.75$$

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

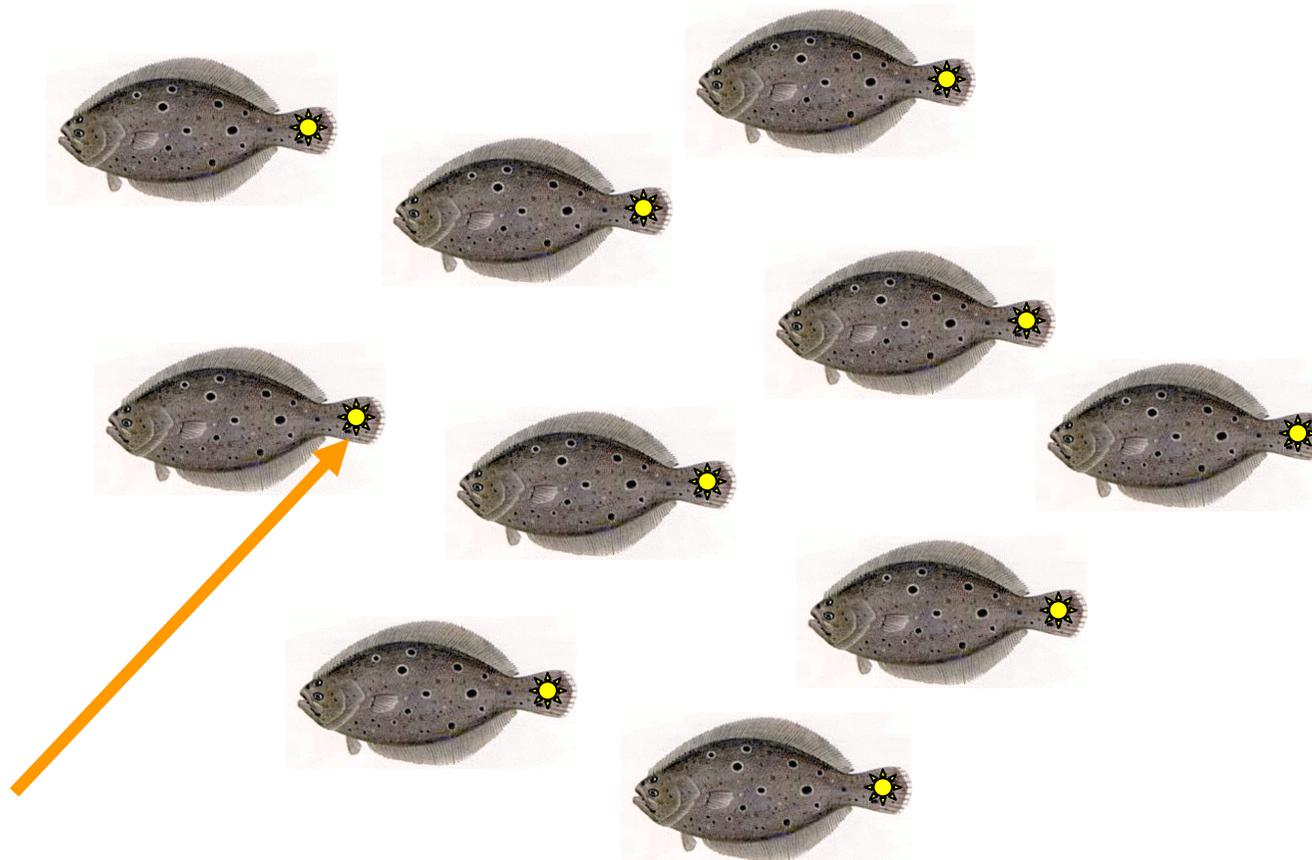
How can you count bears?



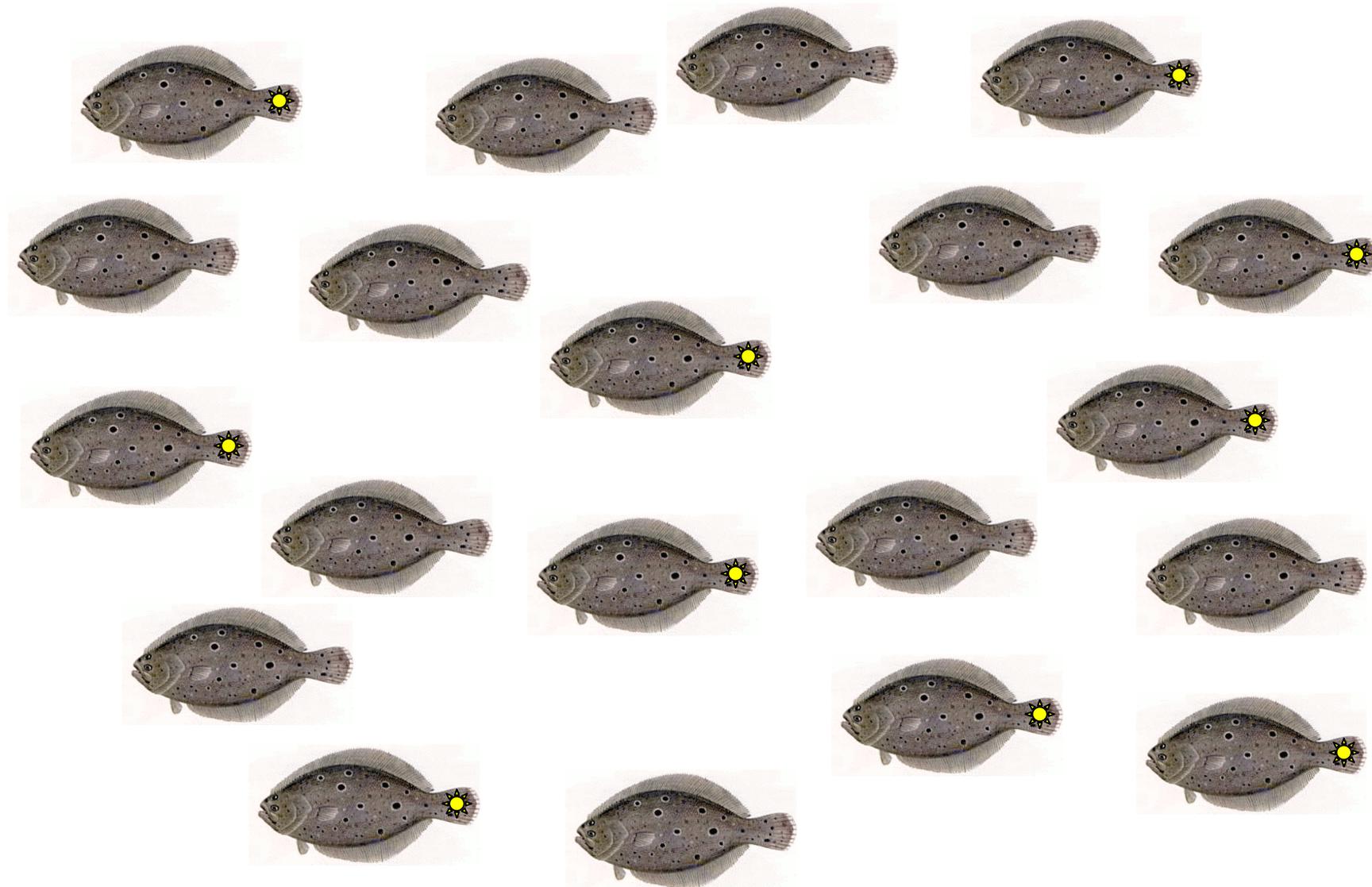




Mark-recapture



Mark-recapture











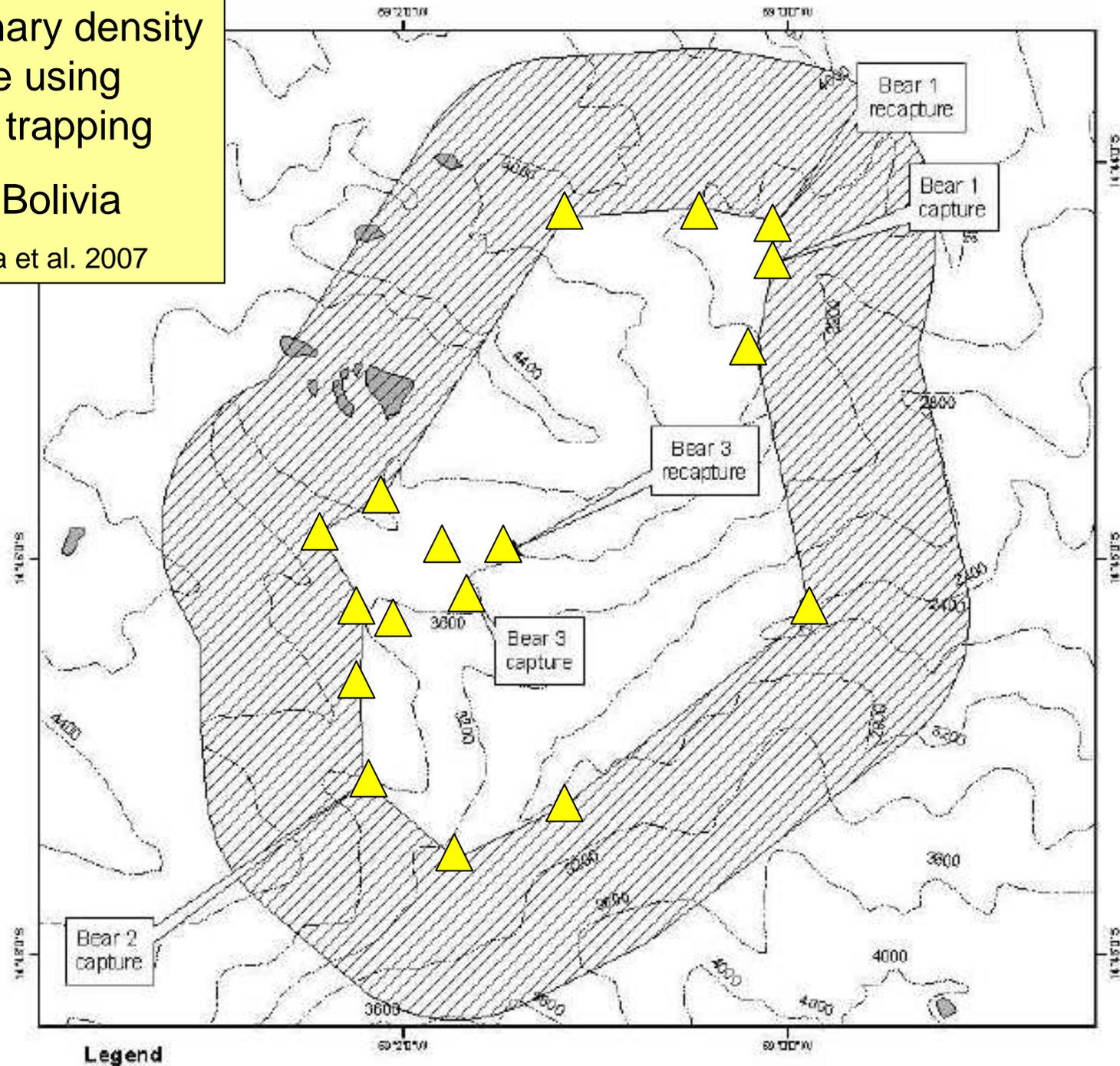




Preliminary density
estimate using
camera trapping

Madidi, Bolivia

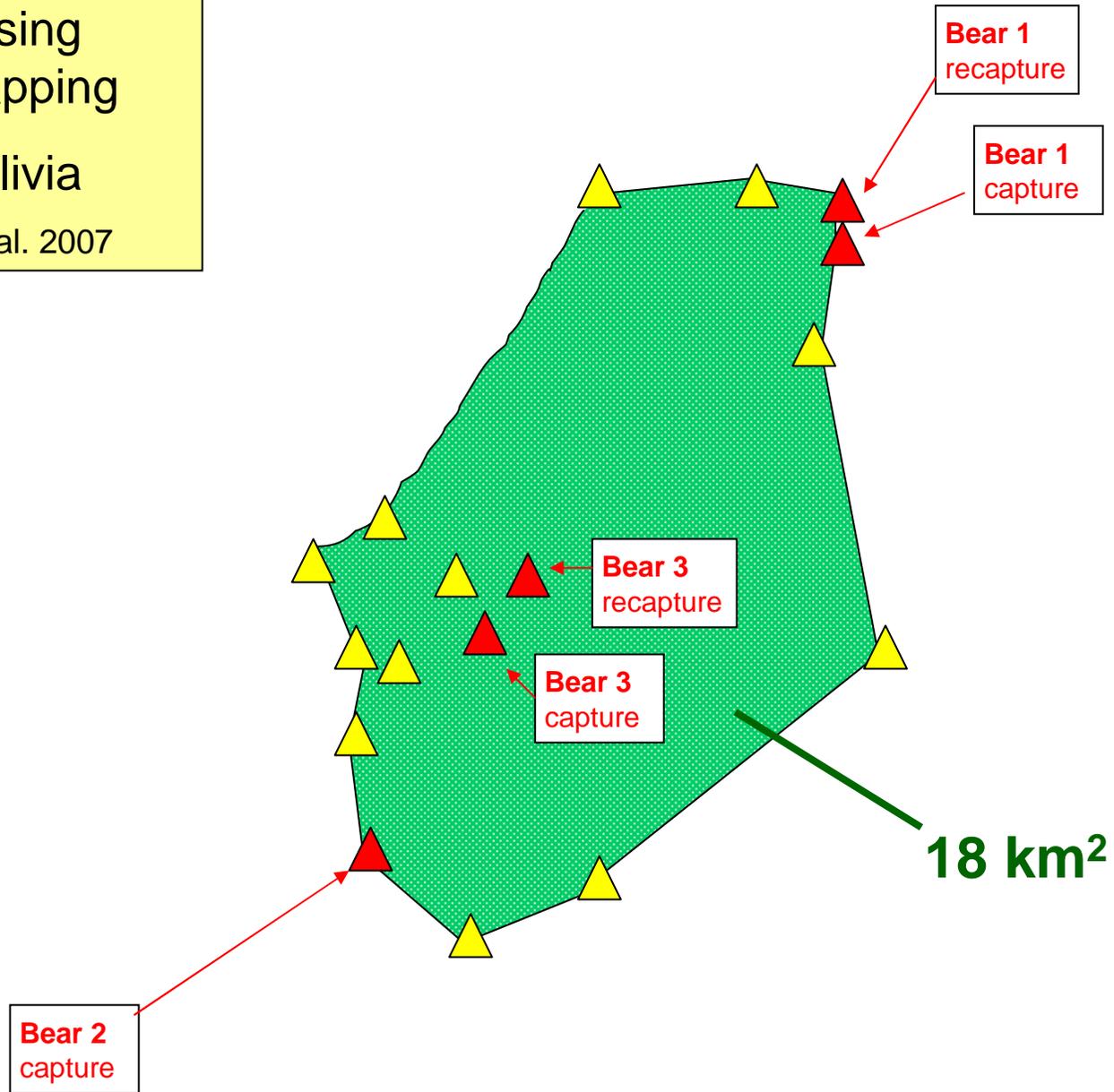
Rios-Uzeda et al. 2007



Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

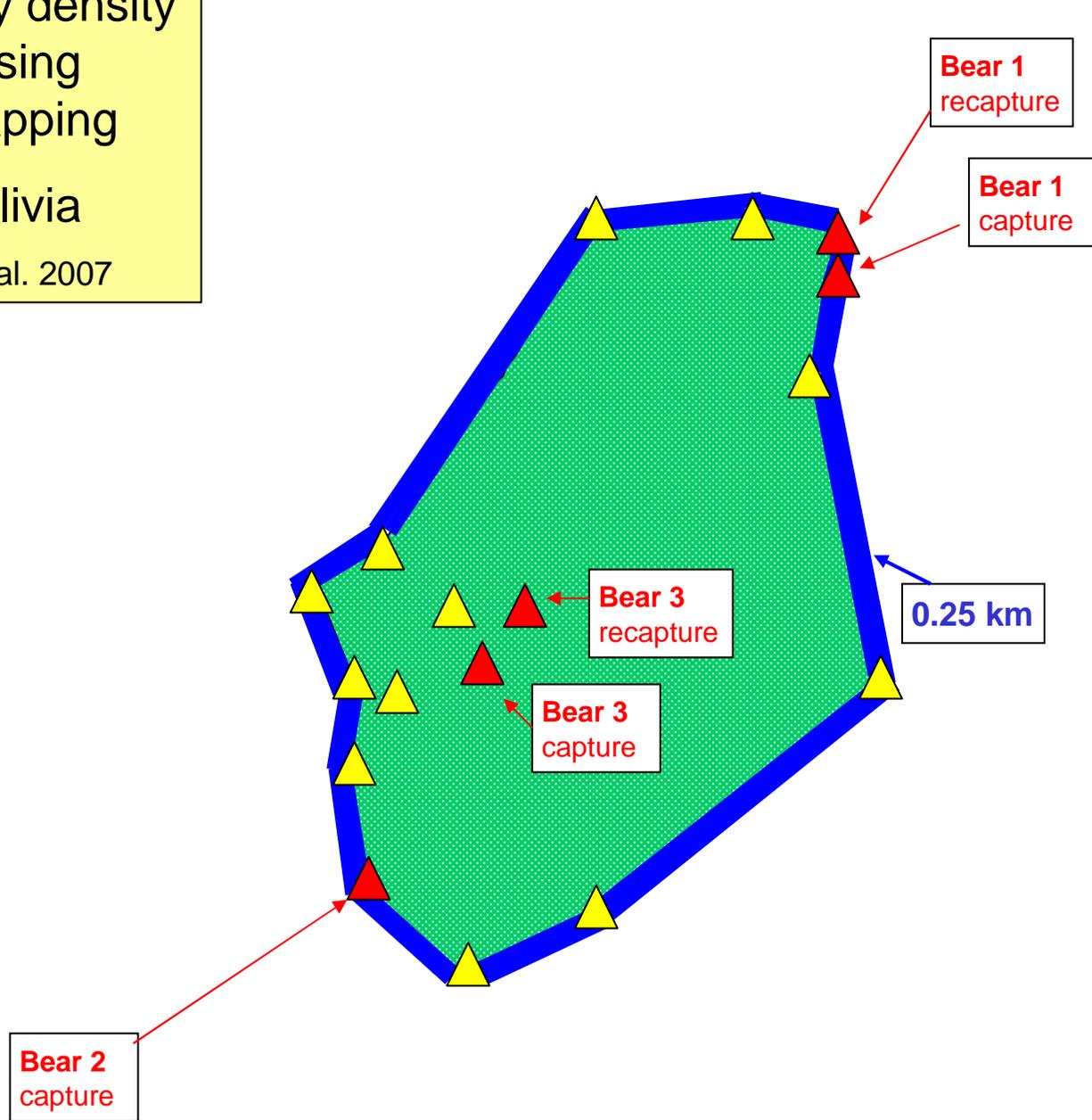


N = 3

Preliminary density estimate using camera trapping

Madidi, Bolivia

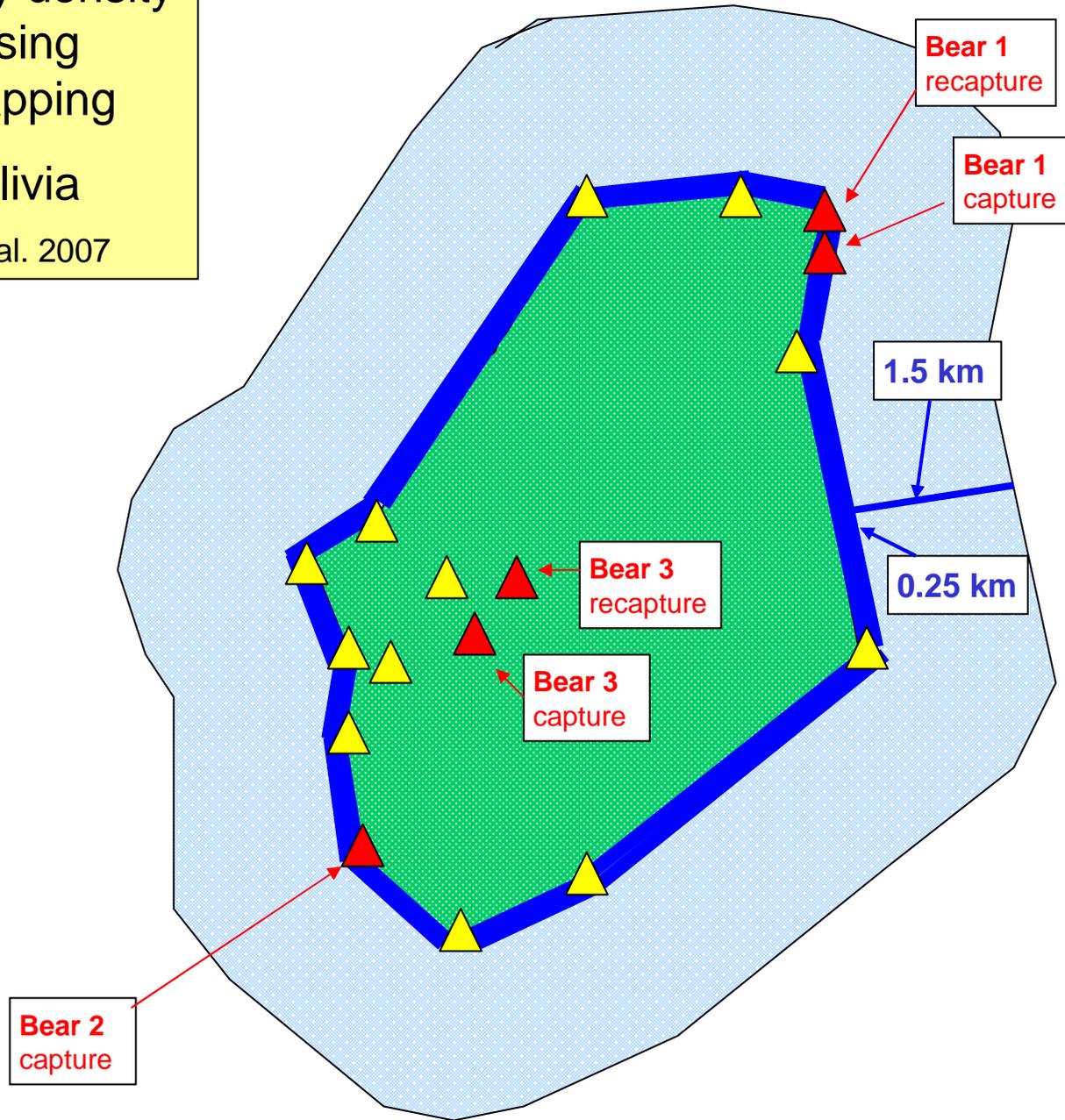
Rios-Uzeda et al. 2007



Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007



Madidi density estimates

Rios-Uzeda et al. 2007

Buffer width	Estimated density bears/100 km²
0.25 km	8.0 - 19.2
1.5 km	3.5 - 8.5

Madidi density estimates

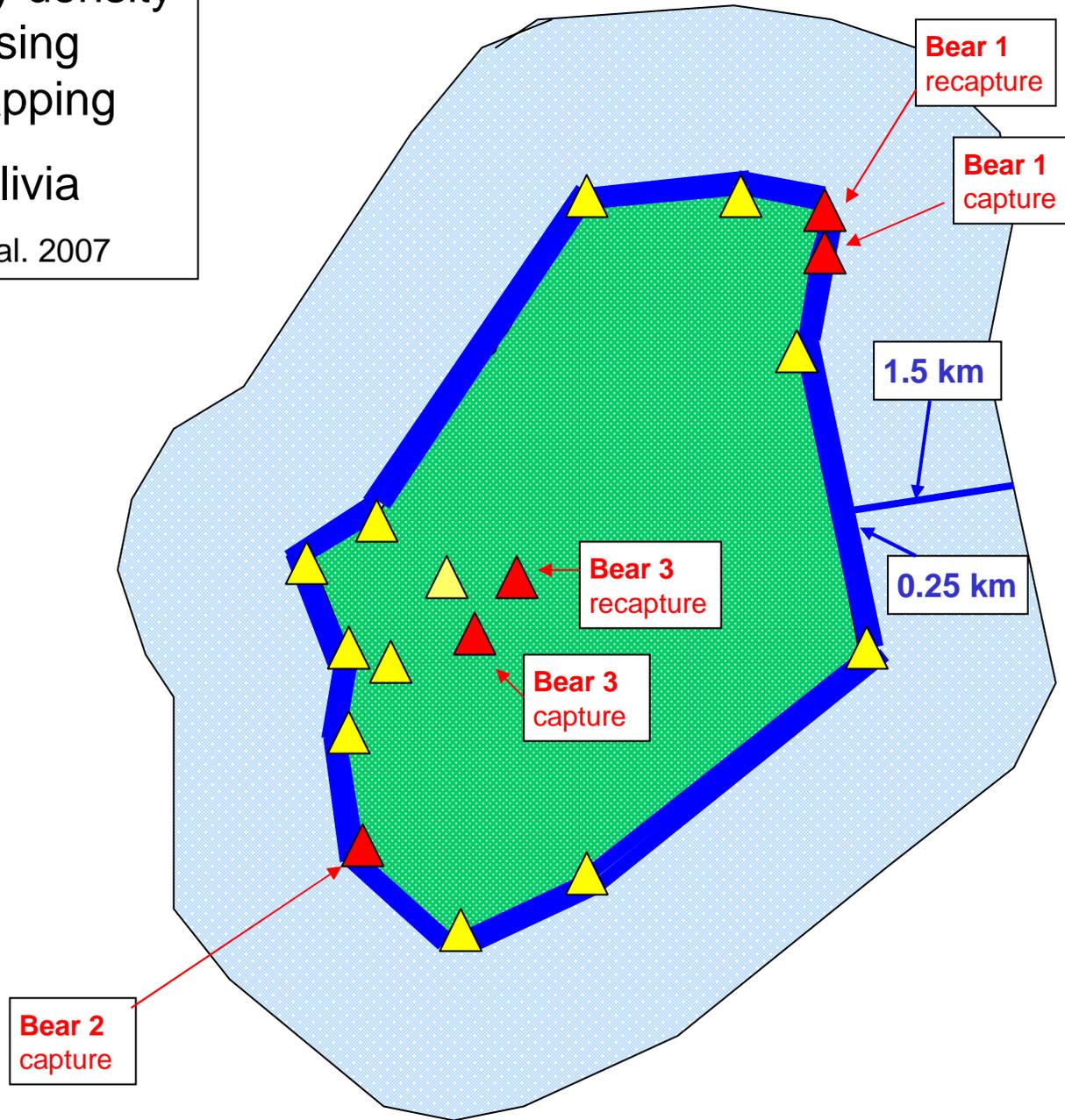
Rios-Uzeda et al. 2007

Buffer width	Estimated density bears/100 km ²
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



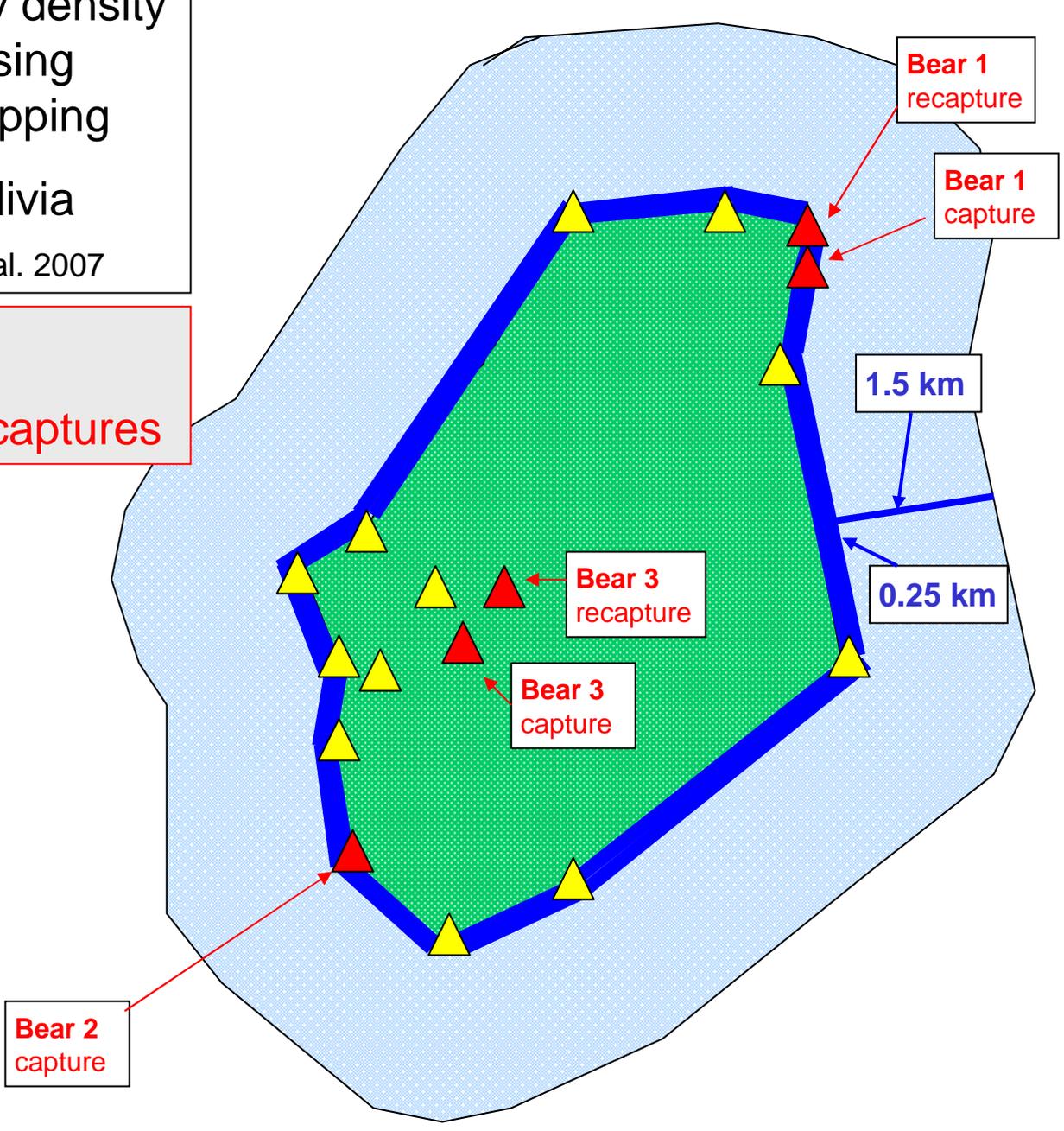
Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

Problems

- Too few captures



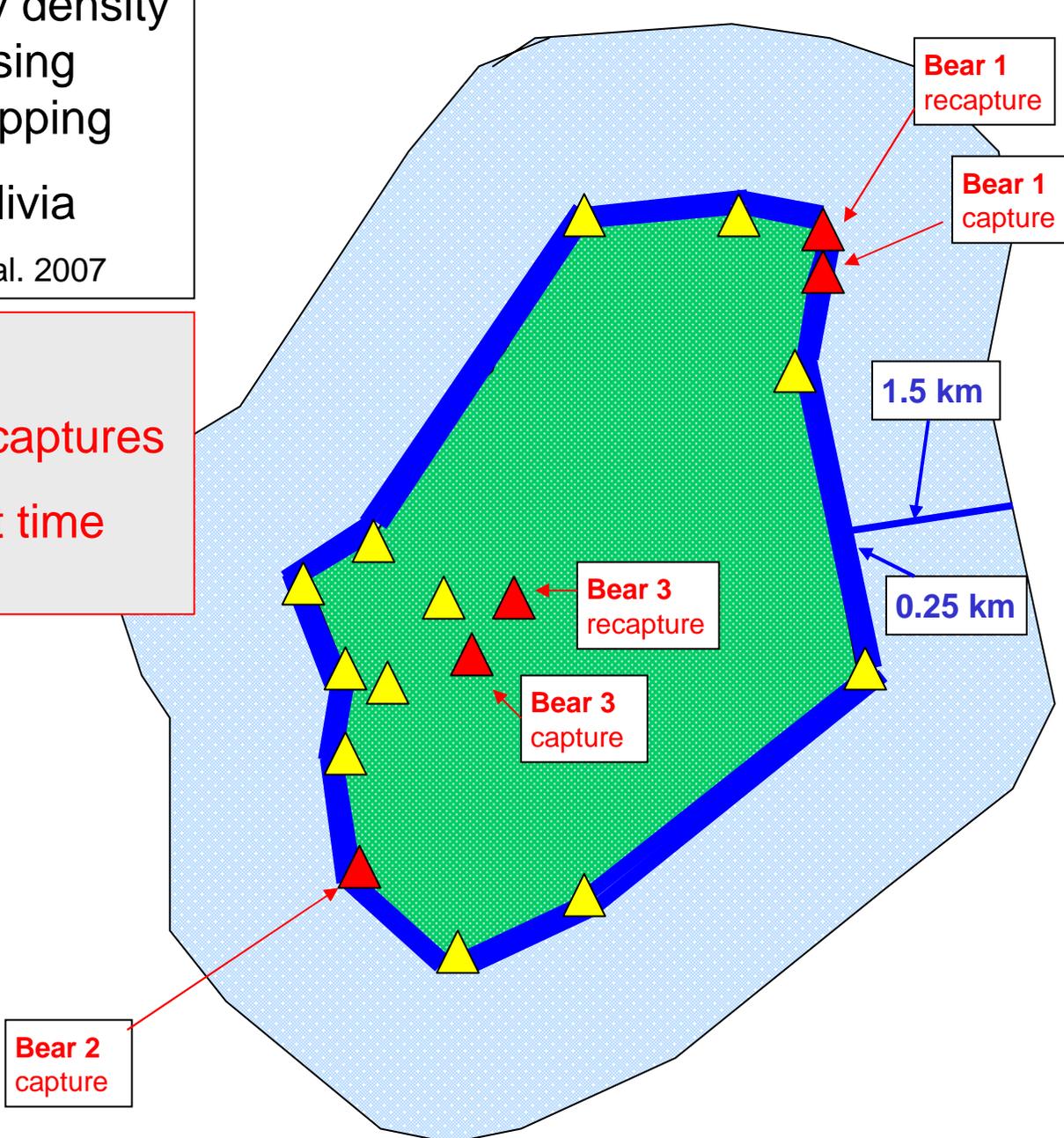
Preliminary density estimate using camera trapping

Madidi, Bolivia

Rios-Uzeda et al. 2007

Problems

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



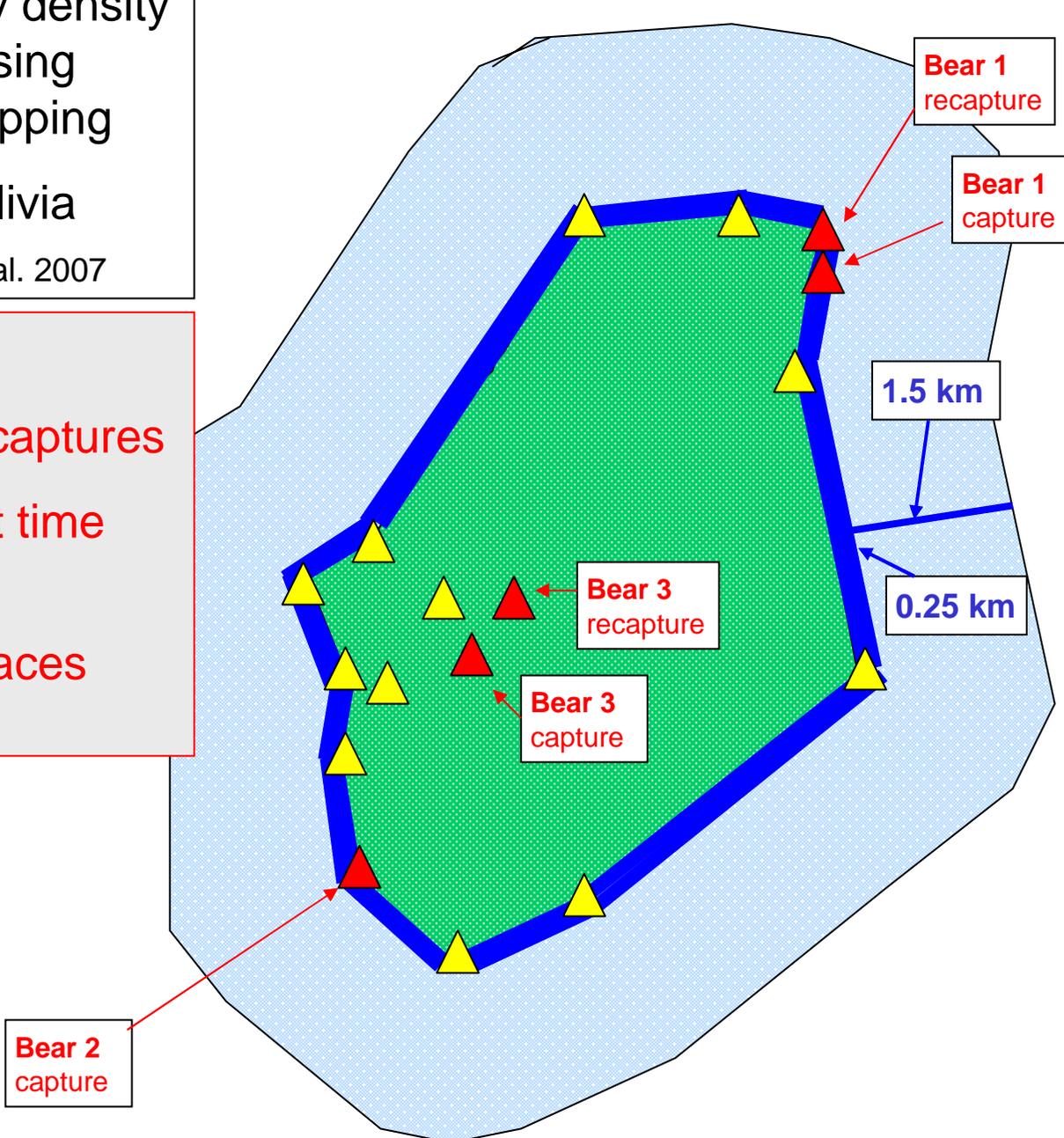
Preliminary density estimate using camera trapping

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

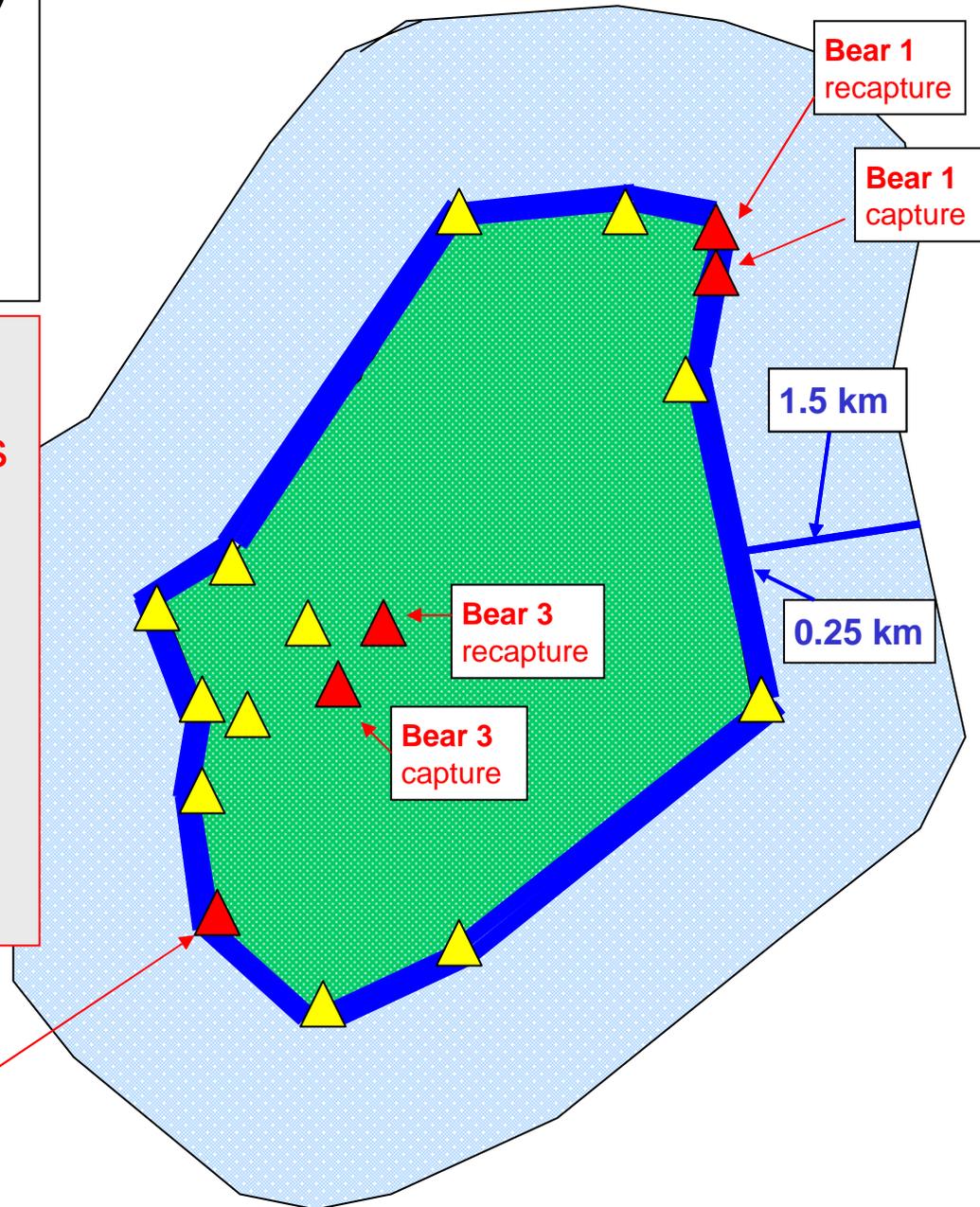
Madidi, Bolivia

Rios-Uzeda et al. 2007

Problems

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

Bear 2 capture



Bear 1 recapture

Bear 1 capture

1.5 km

0.25 km

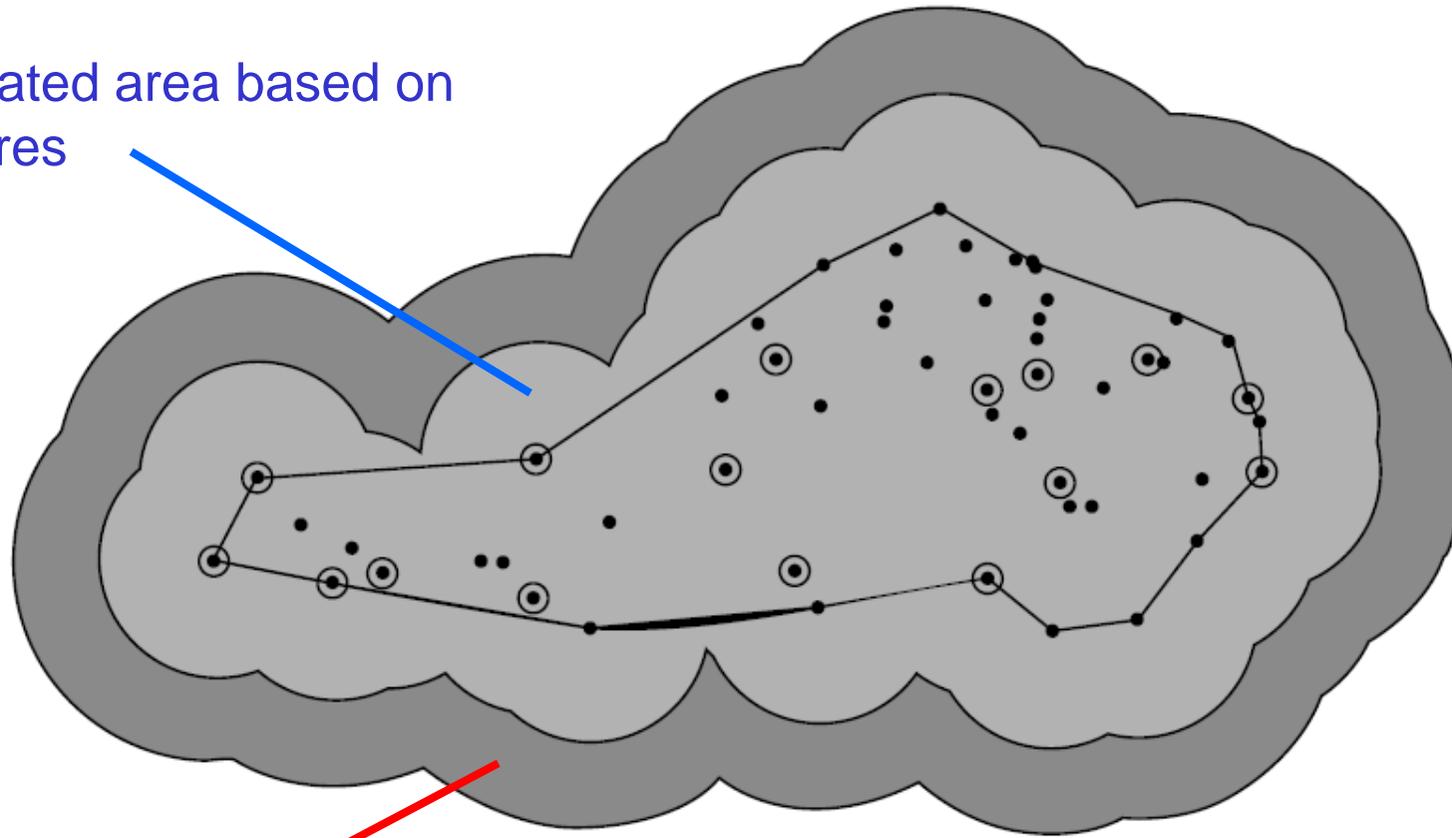
Bear 3 recapture

Bear 3 capture



Estimating density of jaguars in Brazil. Soisalo & Cavalcanti 2006

Estimated area based on captures



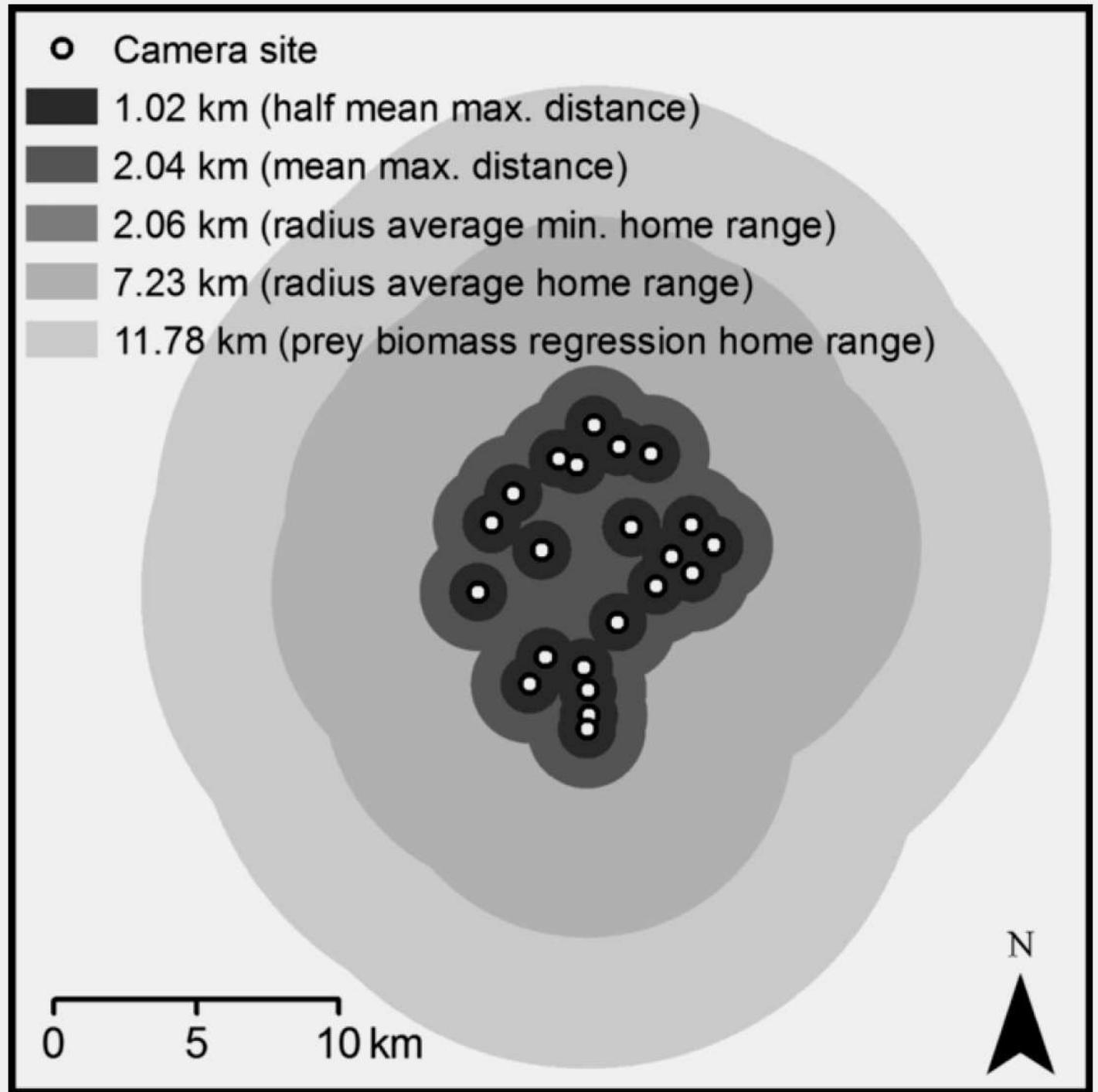
Estimated area based on GPS locations

10 km

5 different buffers

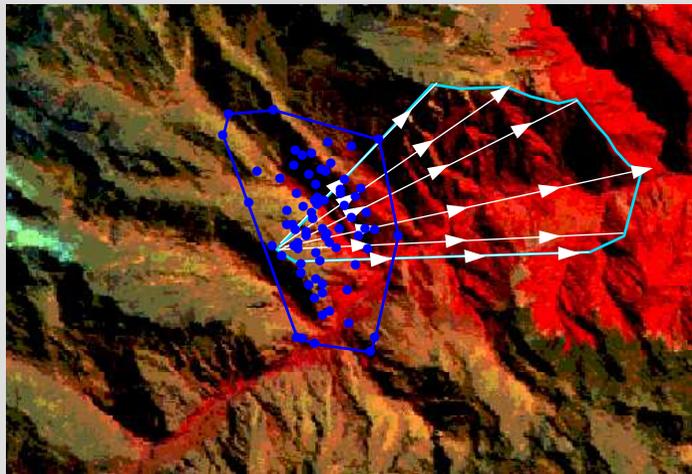
Assessing estimators of snow leopard abundance.

McCarthy et al. 2008

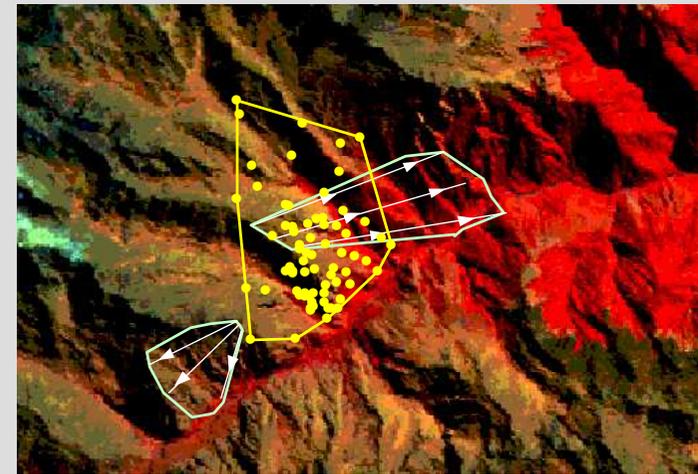
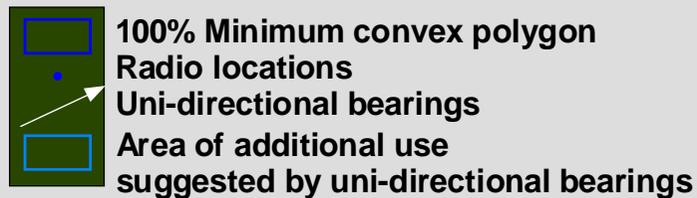


Home range data from Madidi, Bolivia (Paisley 2001)

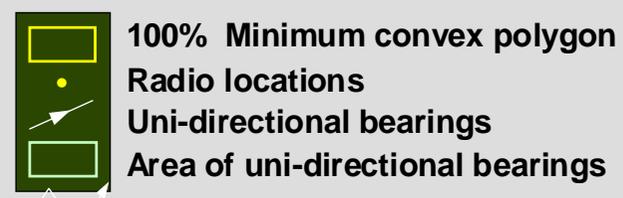
Individual	Days tracked	% days triangulated location obtained
Bear 1	117	64%
Bear 2	101	70%



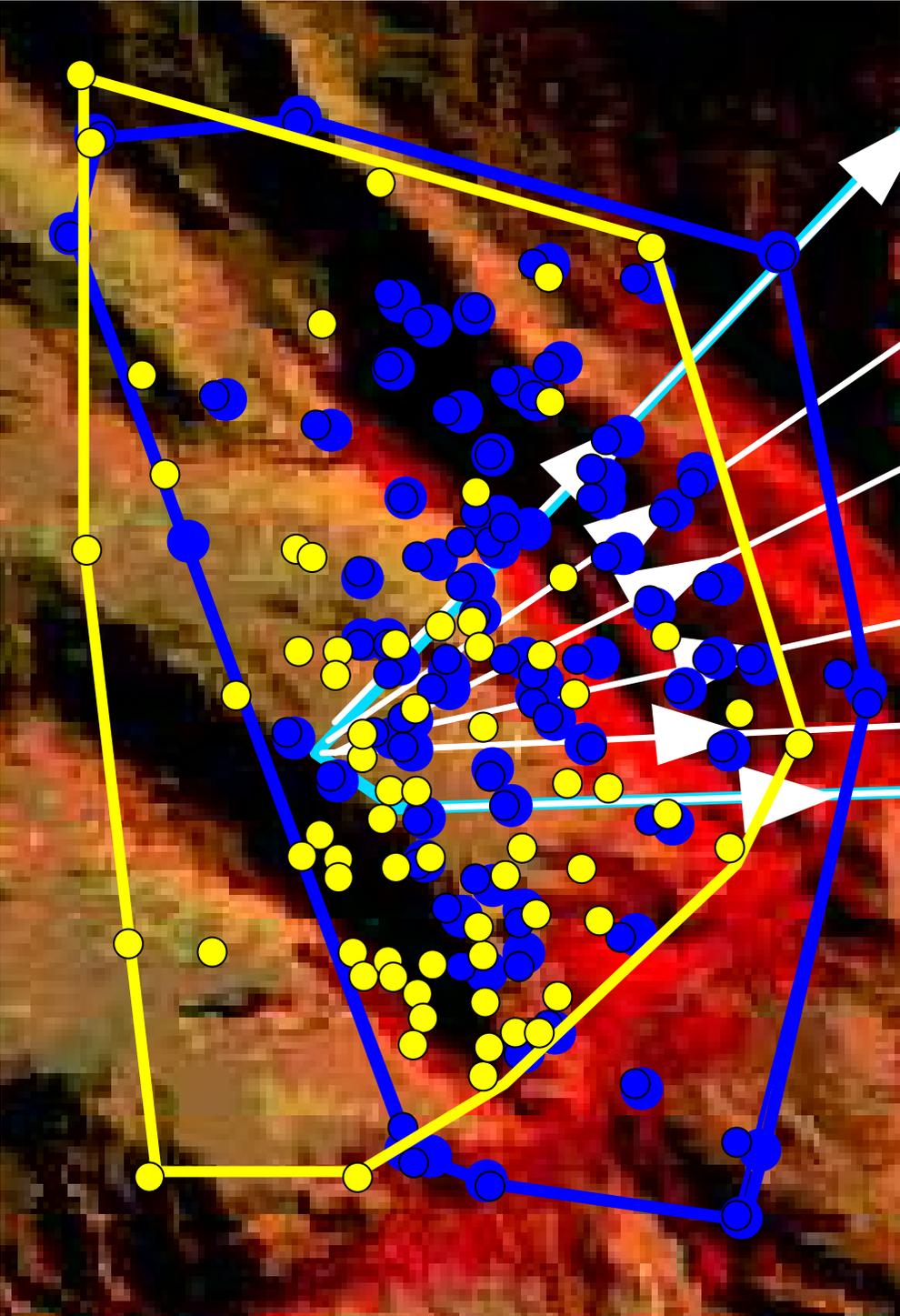
Bear 1



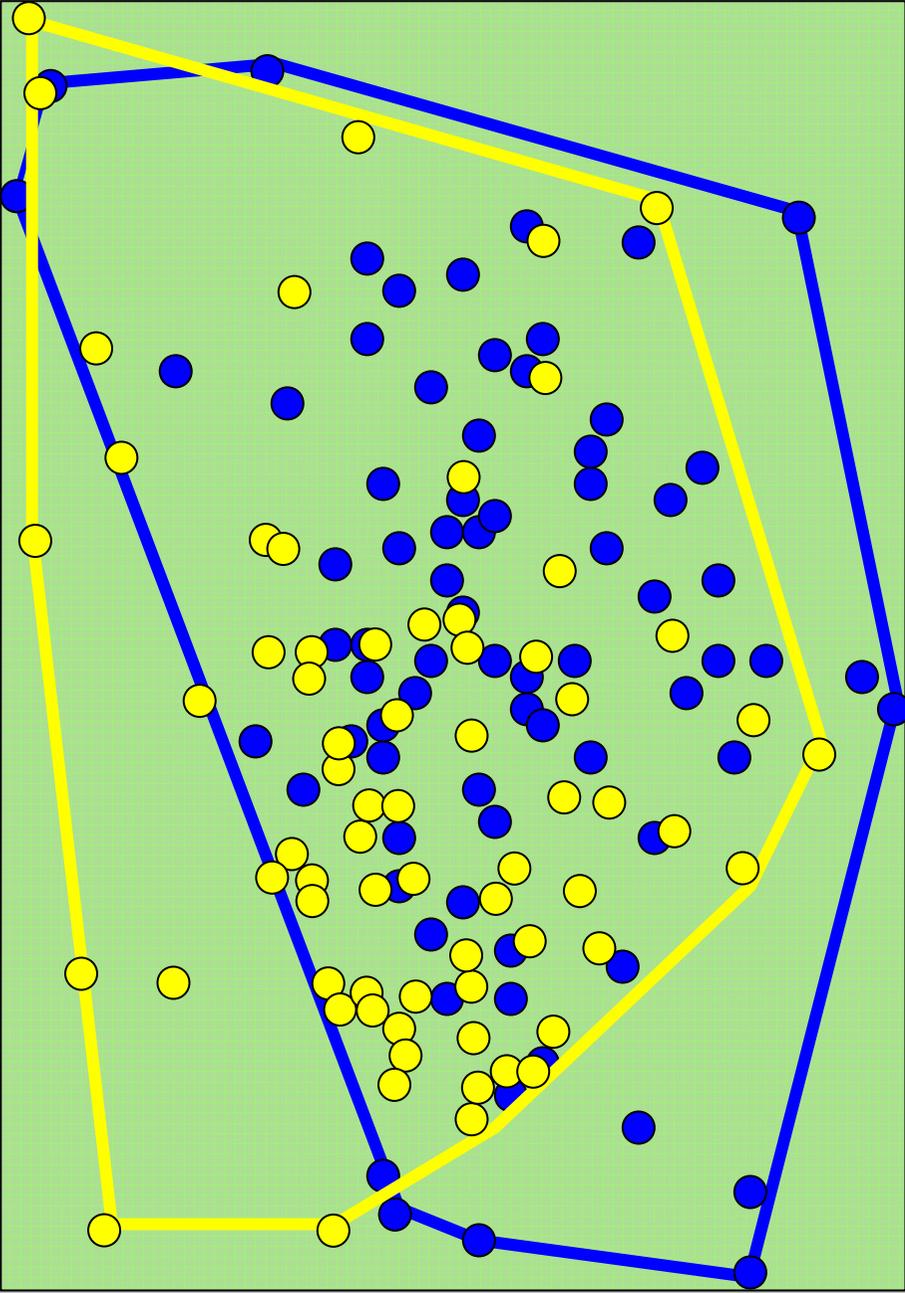
Bear 2



Paisley 2001

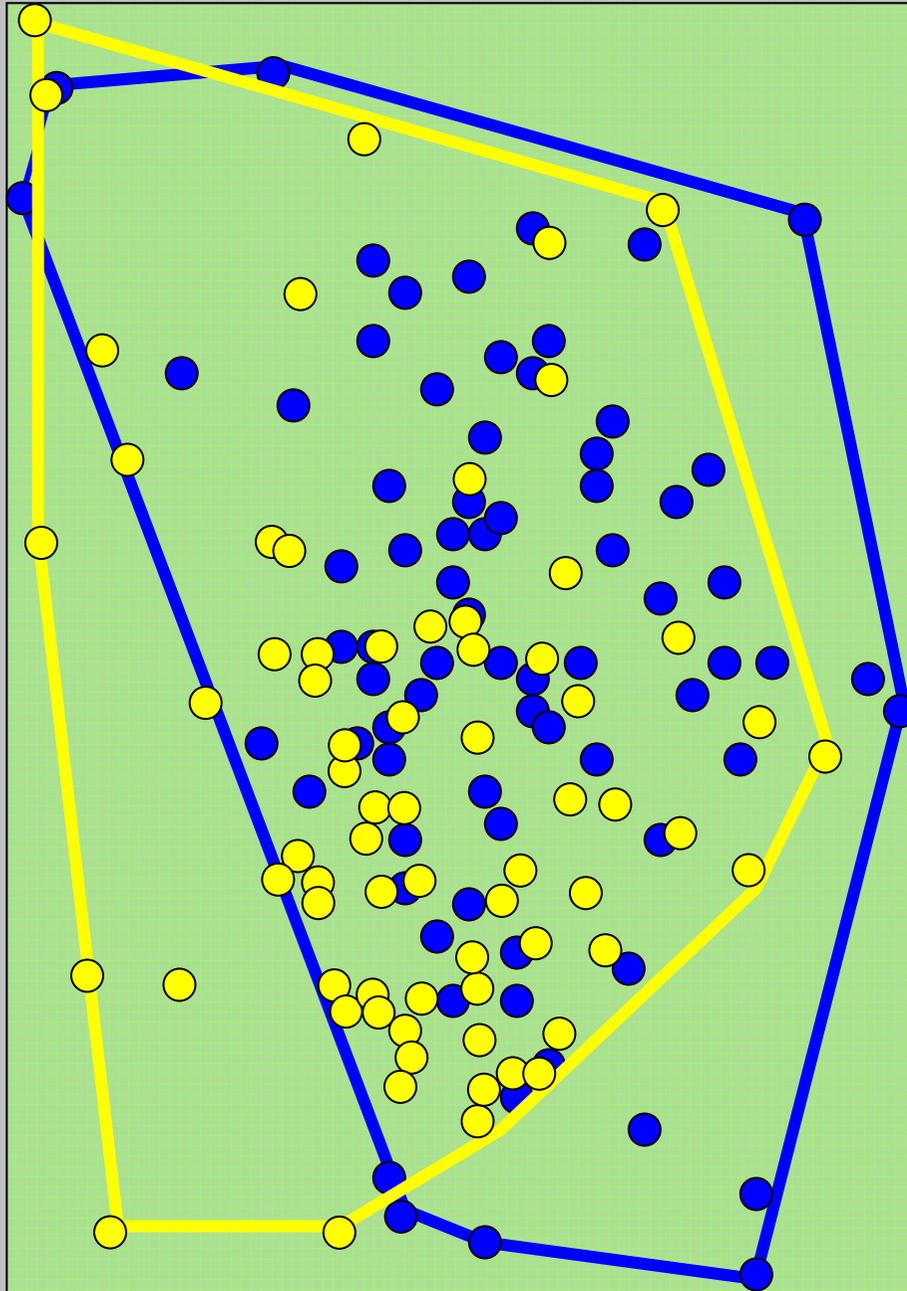


Paisley 2001



Total area:
12 km²

Paisley 2001



Total area:

12 km²

Mean time in area:

67%

Bear equivalents:

1.3

Madidi density estimates

Rios-Uzeda et al. 2007

Buffer width	Estimated density bears/100 km ²
0.25 km	~12 8.0 - 19.2
1.5 km	3.5 - 8.5 4.4 - 6
2.1 km	4.4 - 6 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 ≥ 16

Management & Conservation:

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

Recapture sample ≥ 64

Rough mark-recapture “rules of thumb”

Preliminary survey:

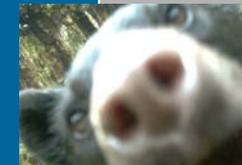
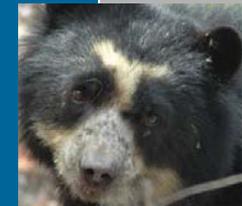
95% CI = $\pm 50\%$ of population

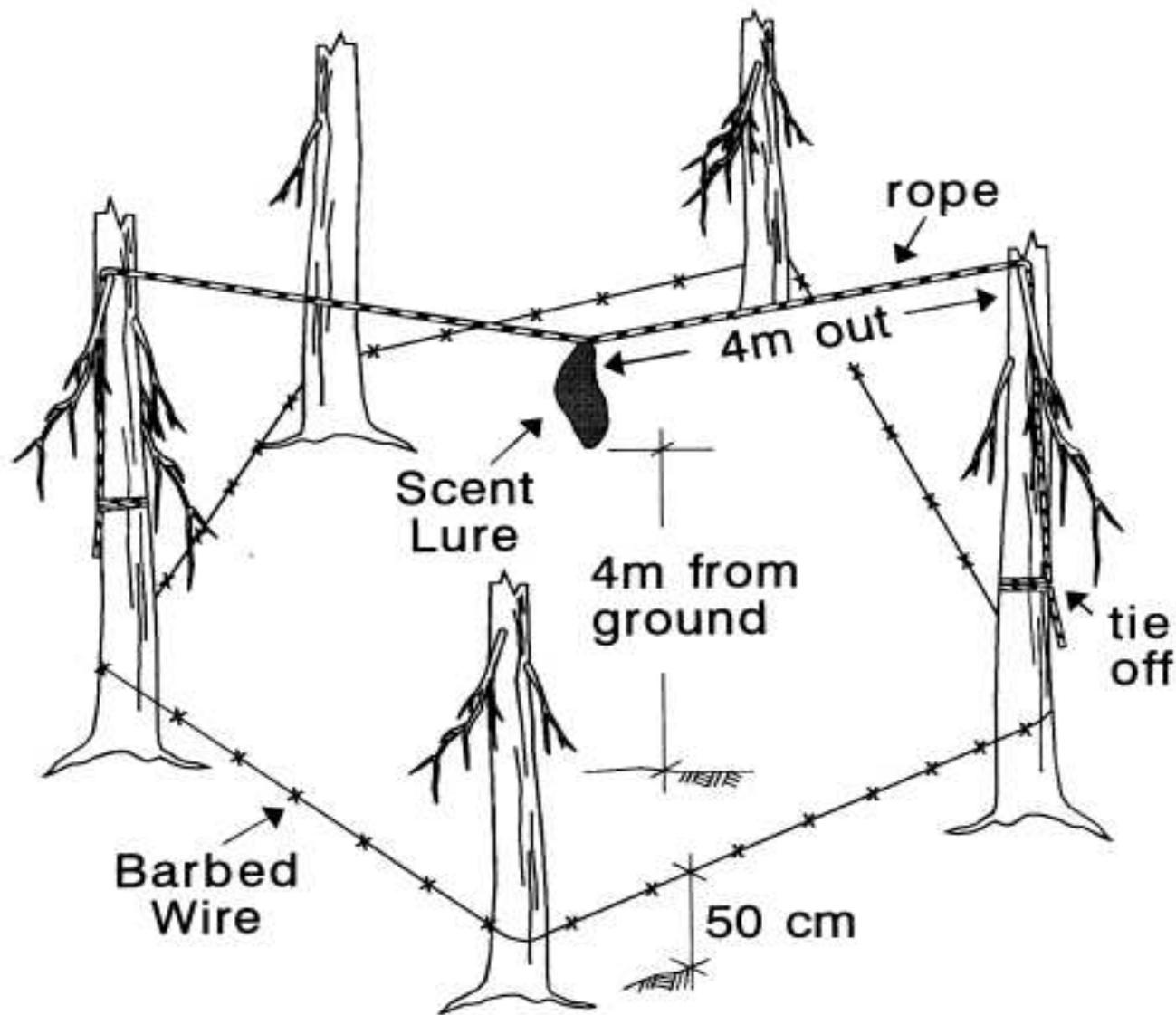
Recapture sample ≥ 16

Management:

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

Recapture



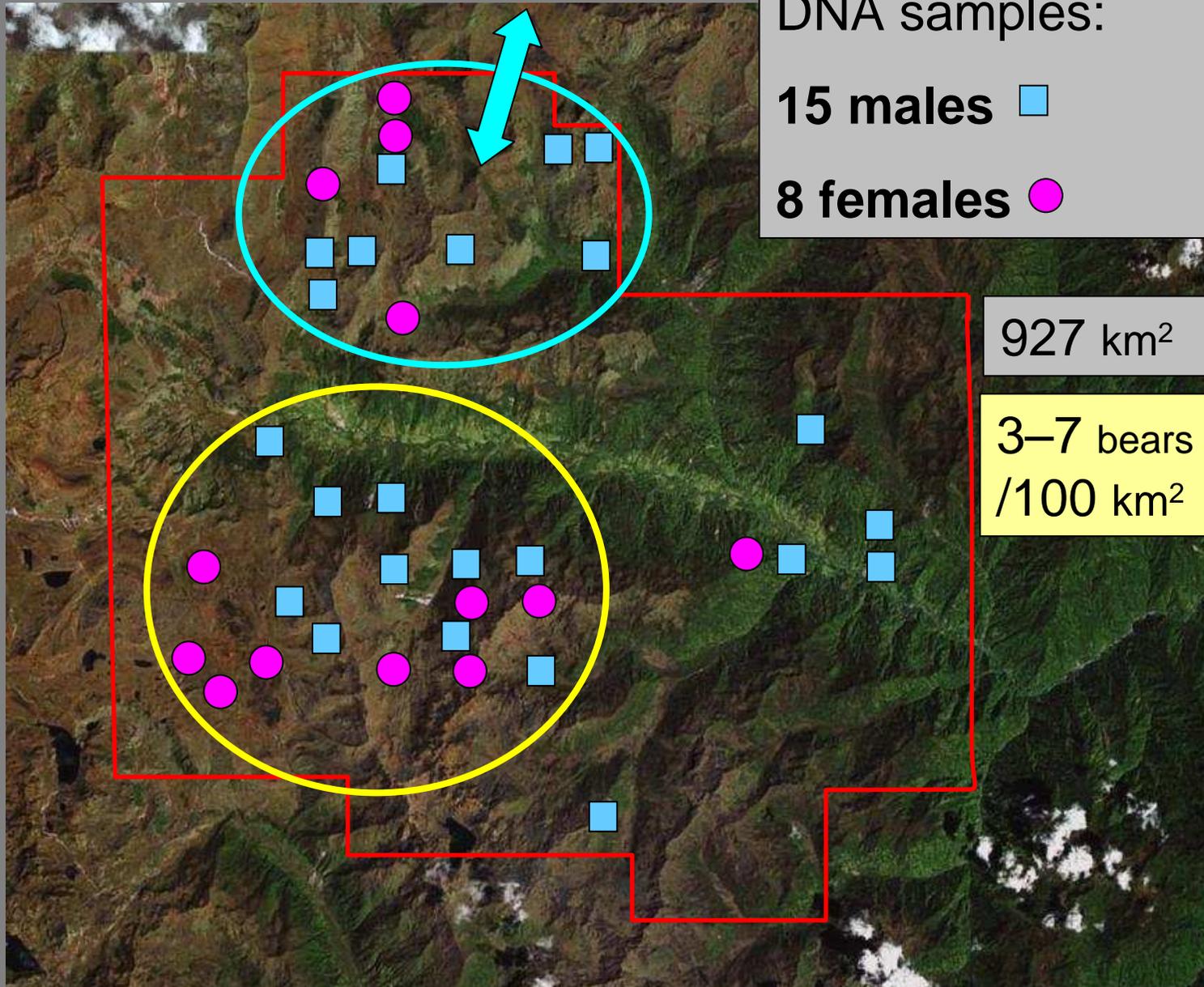


DNA Hair-trap

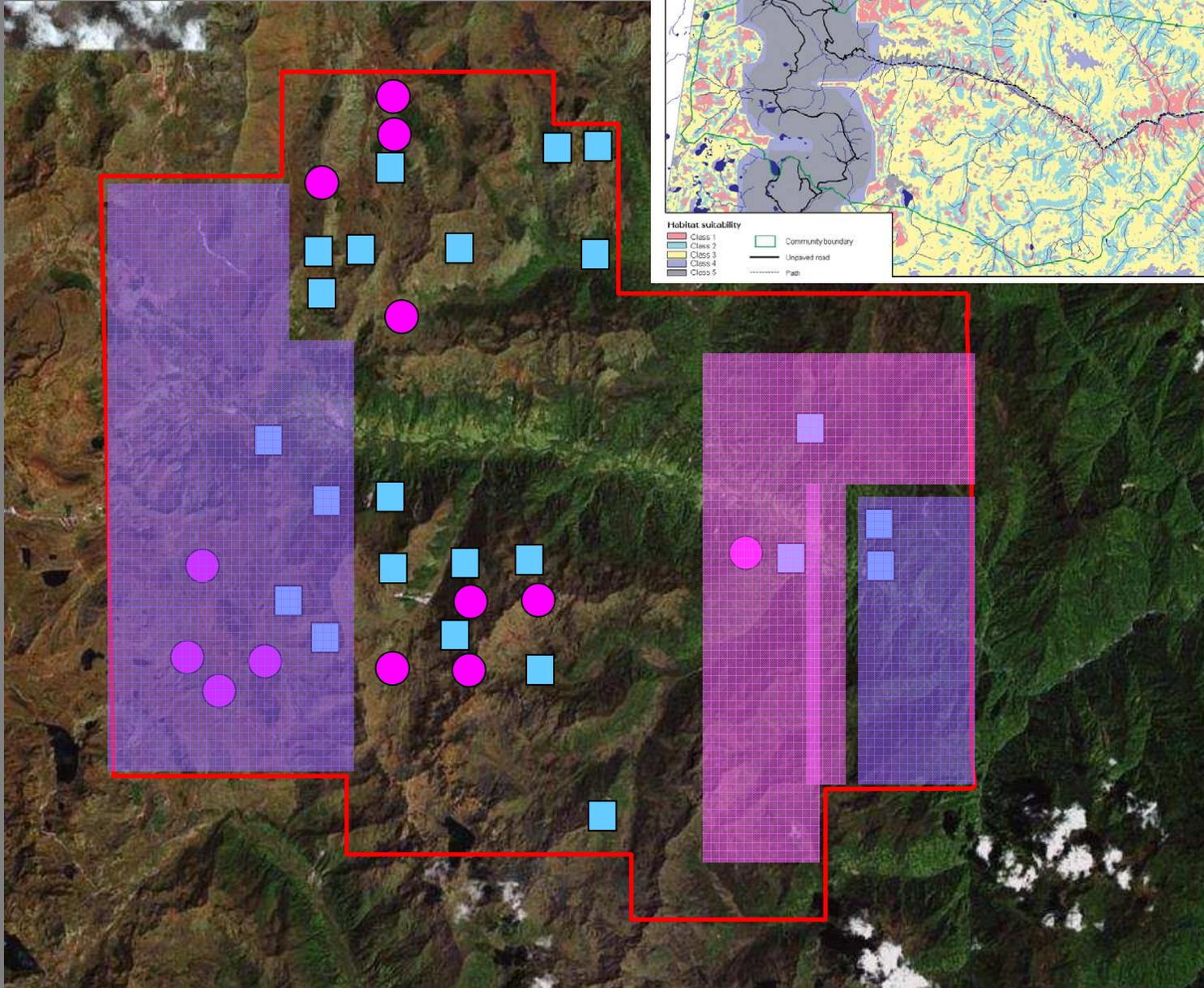
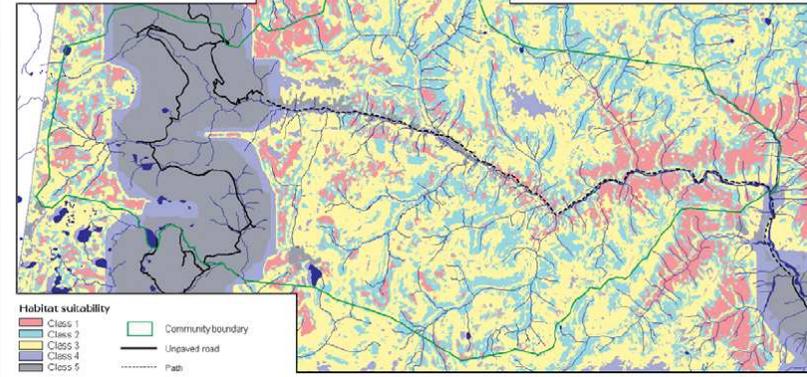
B. McLellan



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



Cuesta et al.
2003



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



CI's only account for
sampling variation.



CIs only account for
sampling variation.

CIs do not account for
error due to study design.



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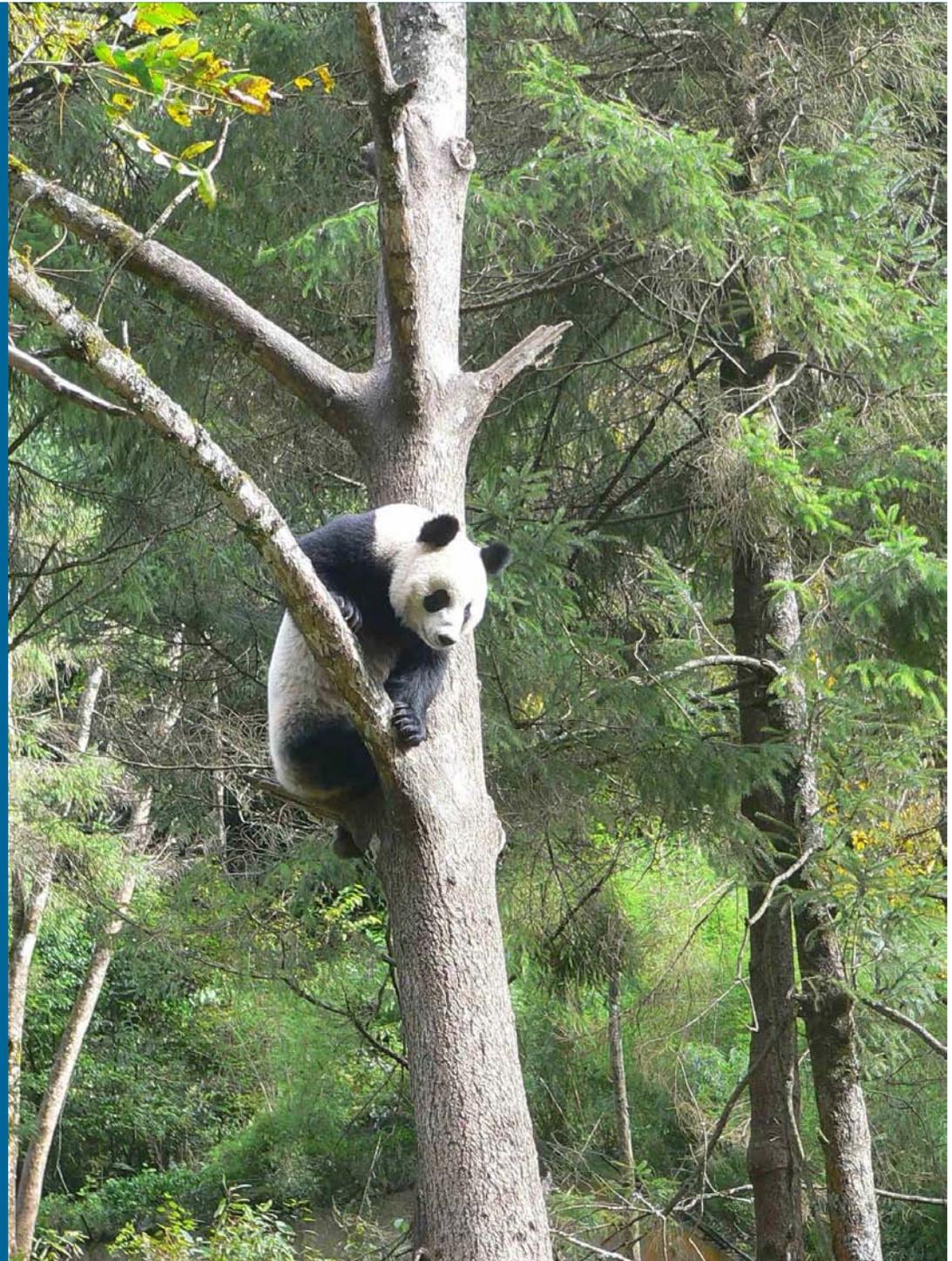
When is a population estimate necessary?

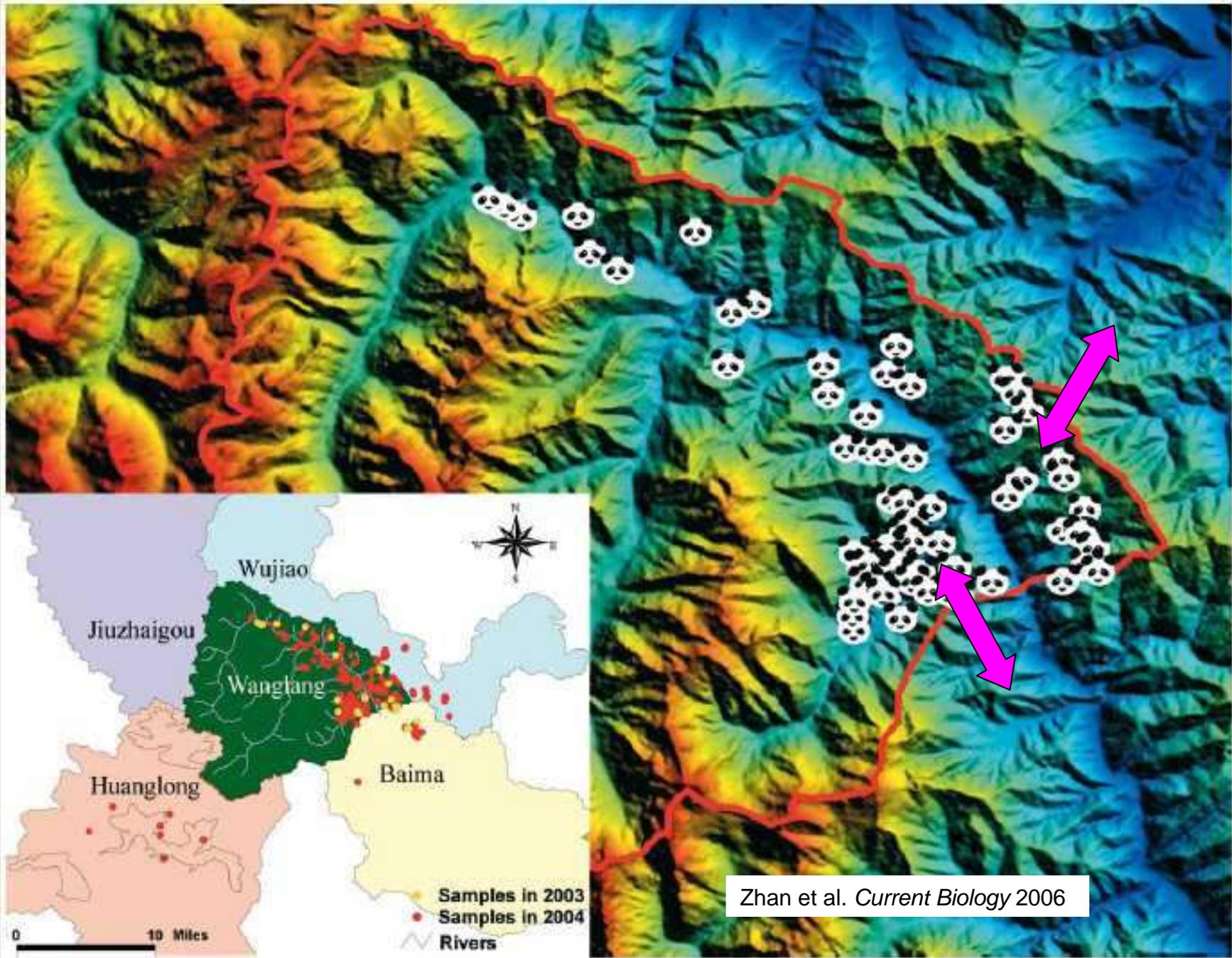
- **Harvested populations**



When is a population estimate necessary?

- To monitor endangered species





Zhan et al. *Current Biology* 2006

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

