LESSONS LEARNED FROM MONITORING FERAL CATS

Annalie Dorph[1*], Elly Gooch[1], Rebecca Stone[1], Georgia Smith[2], Heath Milne[2], Olivia Kimber[1,2], Jessica Bettega[2], Christie O'Halloran[2], Rebecca Cherubin[2], Jaime Heiniger[1,3], Abby Hine[2], Guy Ballard[1,2]

[1] School of Environmental and Rural Science, University of New England, Armidale, NSW 2351

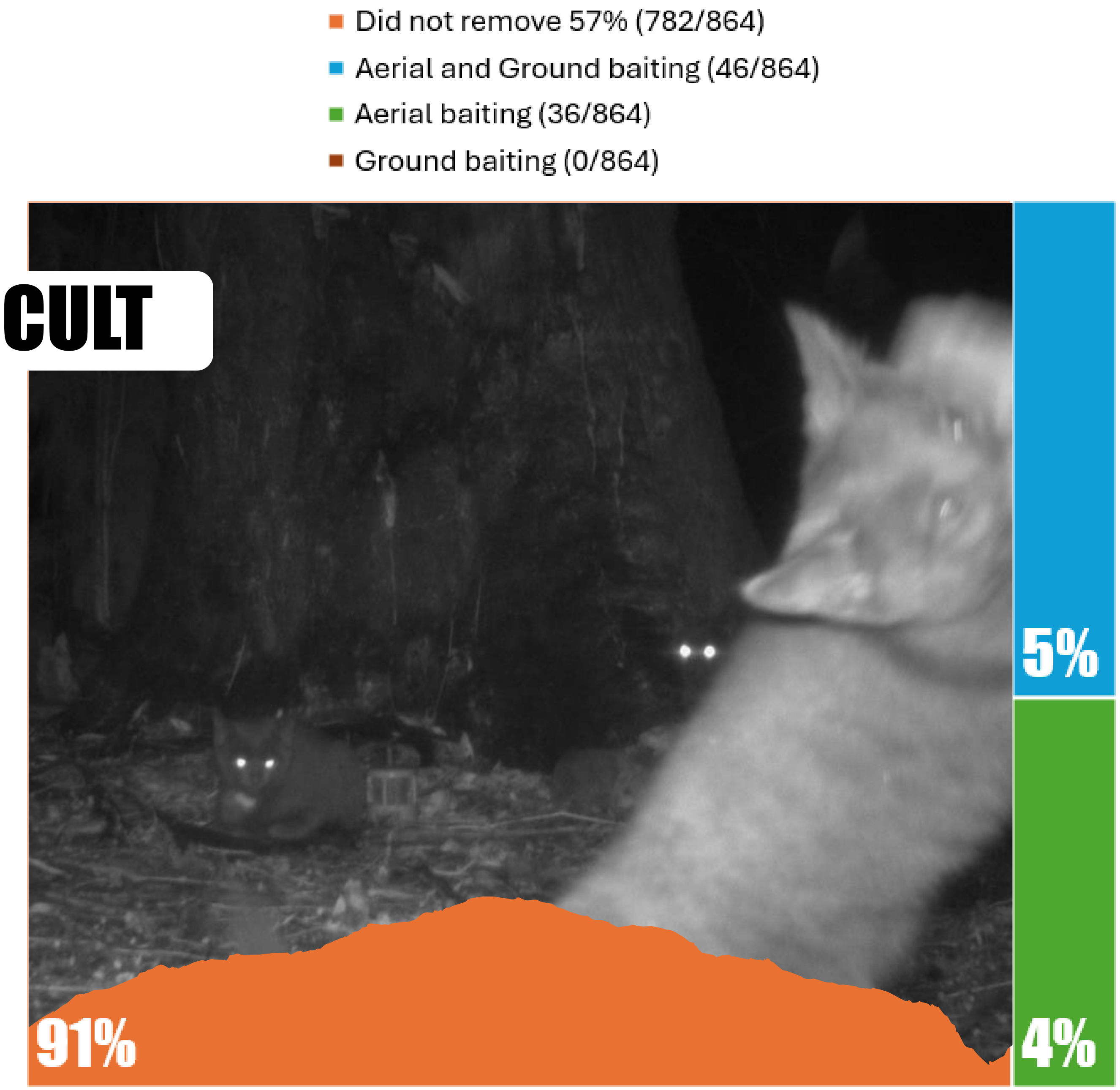
[2] Vertebrate Pest Research Unit, NSW Department of Primary Industries and Regional Development, Armidale, NSW 2351

[3] NSW National Parks and Wildlife Service, Armidale, NSW 2351

We would like to acknowledge the Traditional Owners of the lands where this work was primarily conducted, the Anaiwan people and the traditional owners of the land we are on today the Gumbaynggirr people.

PROJECT BACKGROUND

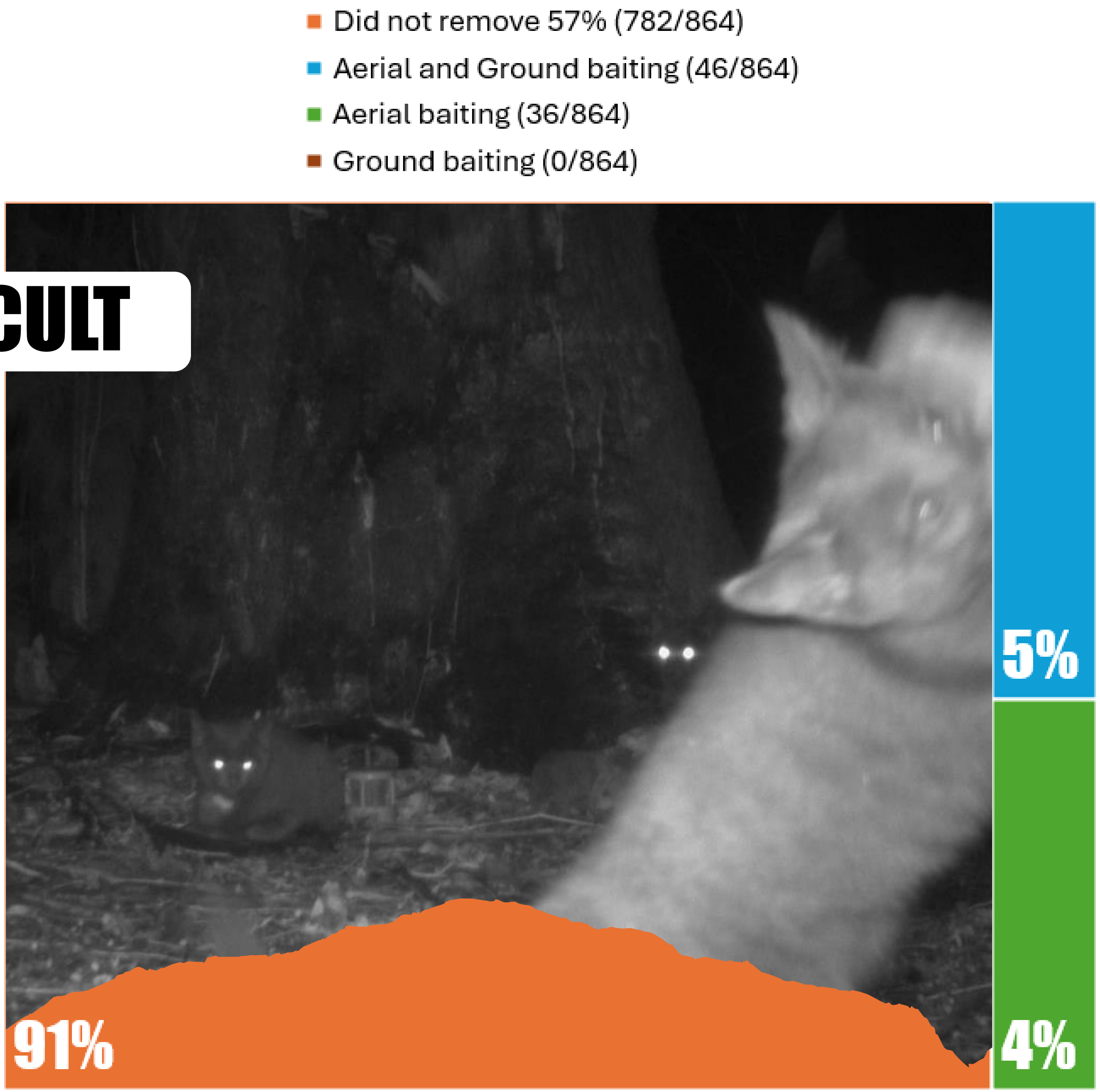
CAT MANAGEMENT IS DIFFICULT



PROJECT BACKGROUND

CAT MANAGEMENT IS DIFFICULT

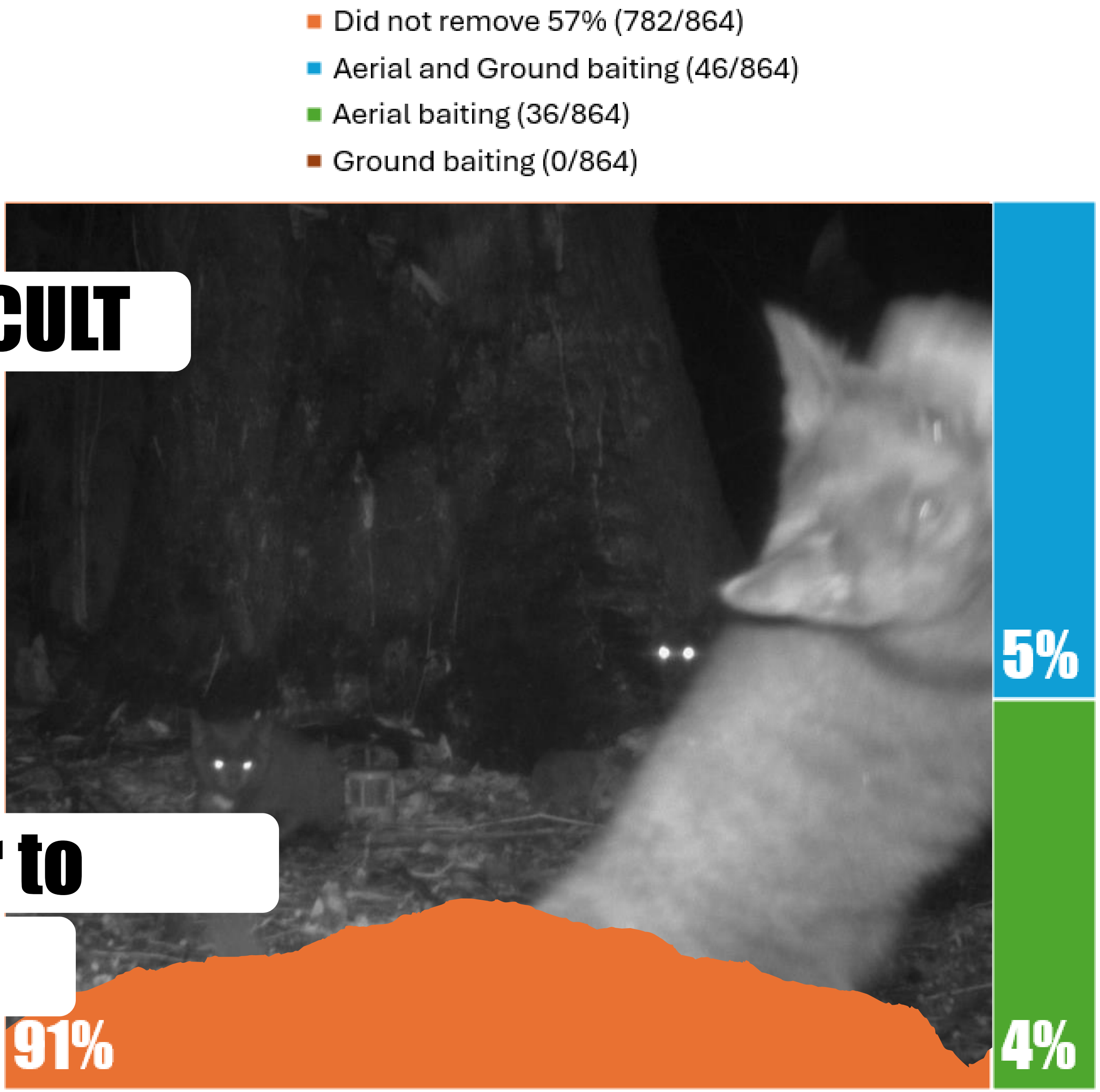
Experts predict only **<u>9%</u>** of management scenarios **<u>remove 57%</u>** of the cat population



PROJECT BACKGROUND

CAT MANAGEMENT IS DIFFICULT

Experts predict only **<u>9%</u>** of management scenarios **<u>remove 57%</u>** of the cat population



How do we "best" monitor to inform management?

PROJECT BACKGROUND

Predator monitoring is often road-based

PROJECT BACKGROUND

Predator monitoring is often road-based

Alternative methods of monitoring use a more intensive grid-based design

PROJECT BACKGROUND

Predator monitoring is often road-based

Alternative methods of monitoring use a more intensive grid-based design

But what do we need to detect change following a management program?

PROJECT BACKGROUND

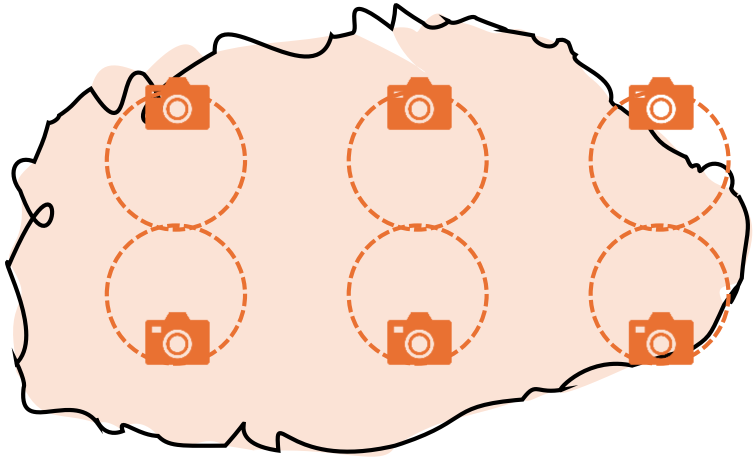
HOW DO WE MEASURE ACTIVITY?

ACTIVITY

=

DETECTIONS / TOTAL NIGHTS

A Cameras deployed at several locations

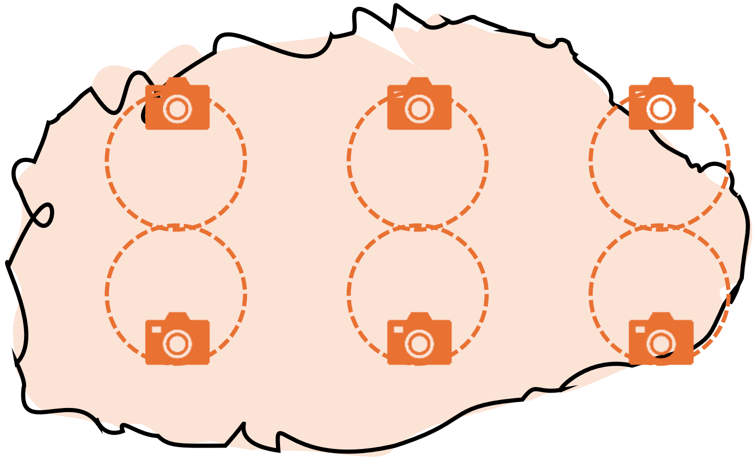


PROJECT BACKGROUND

HOW DO WE MEASURE ACTIVITY?

ACTIVITY = # DETECTIONS / TOTAL NIGHTS

A Cameras deployed at several locations



B Calculate sampling effort for the survey (total camera nights)

CAMERA	1	2	3	4
NIGHTS	40	40	40	40

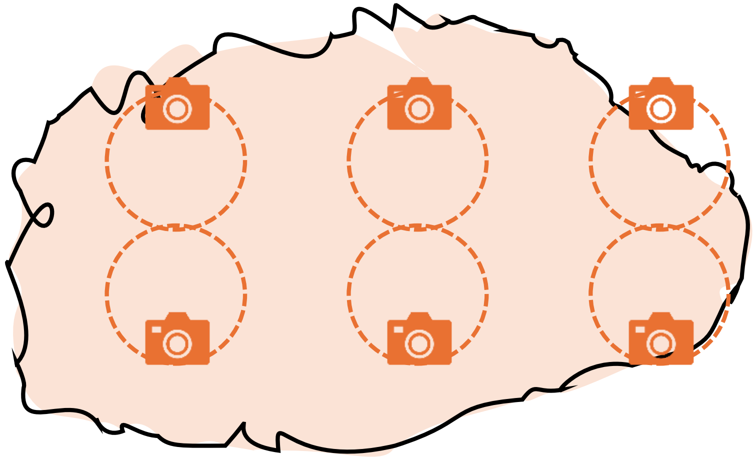
SAMPLING EFFORT:
4 cameras x 20 nights
= 80 camera trap nights

PROJECT BACKGROUND

HOW DO WE MEASURE ACTIVITY?

ACTIVITY
=
 # DETECTIONS / TOTAL NIGHTS

A Cameras deployed at several locations

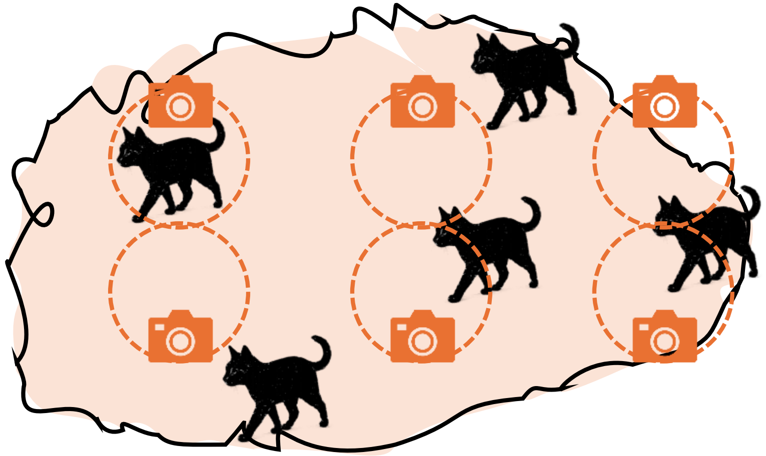


B Calculate sampling effort for the survey (total camera nights)

CAMERA	1	2	3	4
NIGHTS	40	40	40	40

SAMPLING EFFORT:
4 cameras x 20 nights
= 80 camera trap nights

C Each time a cat is recorded counts as one detection

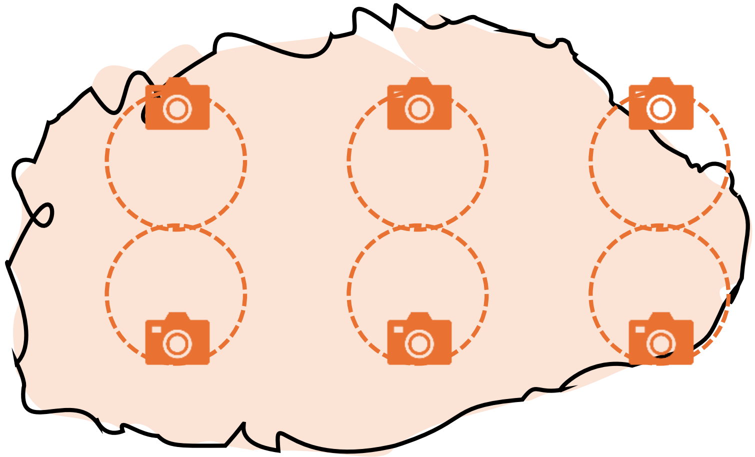


PROJECT BACKGROUND

HOW DO WE MEASURE ACTIVITY?

ACTIVITY
=
 # DETECTIONS / TOTAL NIGHTS

A Cameras deployed at several locations

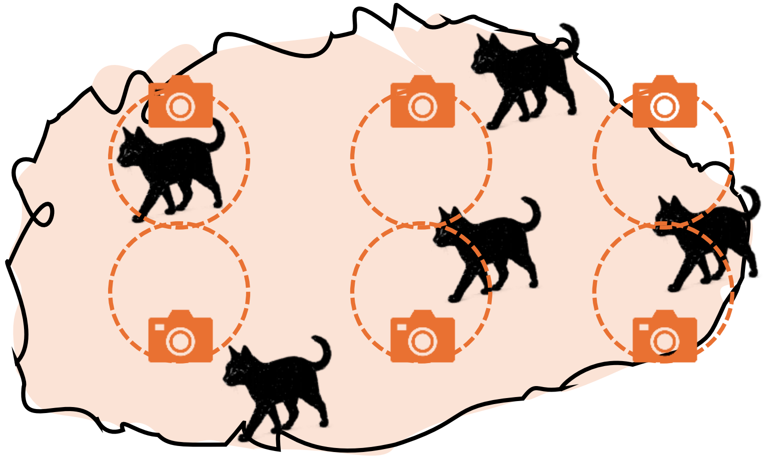


B Calculate sampling effort for the survey (total camera nights)

CAMERA	1	2	3	4
NIGHTS	40	40	40	40

SAMPLING EFFORT:
4 cameras x 20 nights
= 80 camera trap nights

C Each time a cat is recorded counts as one detection



But is activity enough to detect change?

PROJECT BACKGROUND

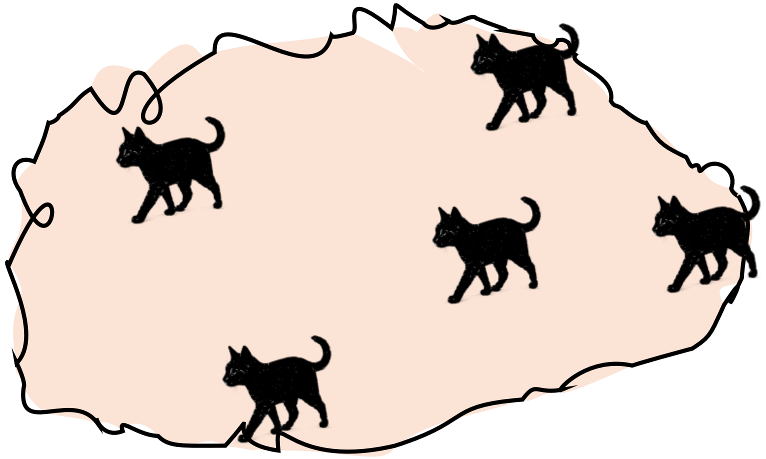
HOW DO WE MEASURE DENSITY?

DENSITY

=

INDIVIDUALS PER KILOMETRE^2

A Cats at an unknown density in the landscape

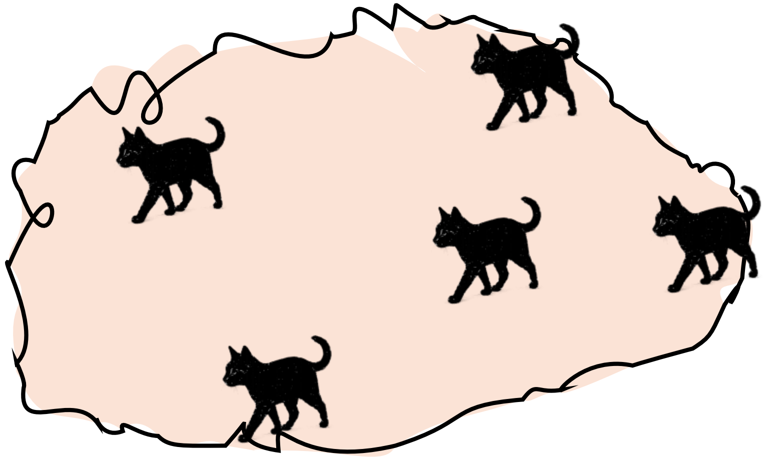


PROJECT BACKGROUND

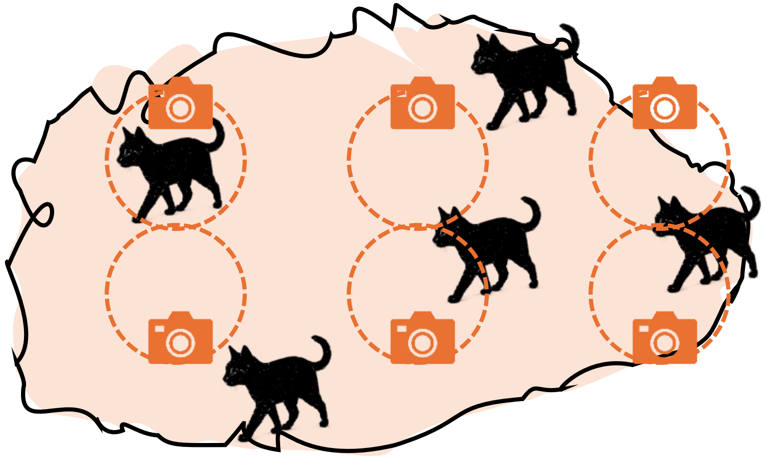
HOW DO WE MEASURE DENSITY?

DENSITY
=
INDIVIDUALS PER KILOMETRE^2

A Cats at an unknown density in the landscape



B Cameras record individuals and their detection rates



PROJECT BACKGROUND

HOW DO WE MEASURE DENSITY?

DENSITY

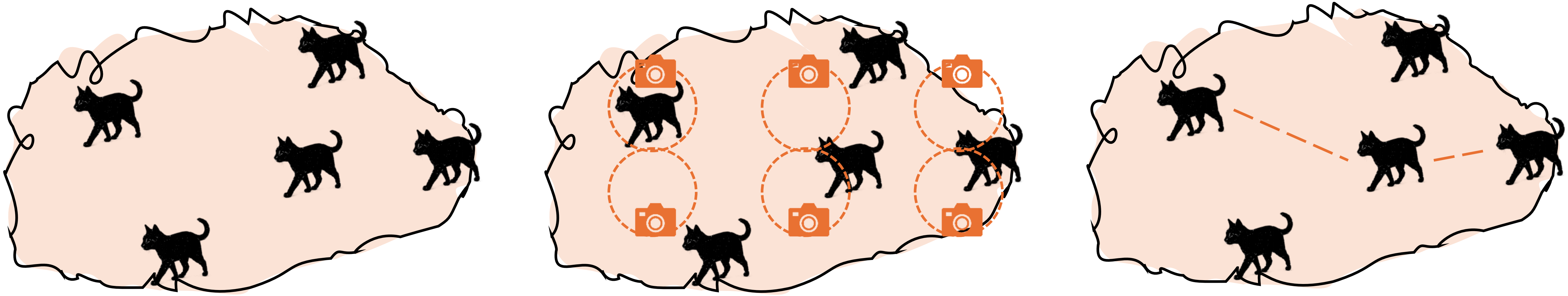
=

INDIVIDUALS PER KILOMETRE^2

A Cats at an unknown density in the landscape

B Cameras record individuals and their detection rates

C Each detection provides information about an individual's movement

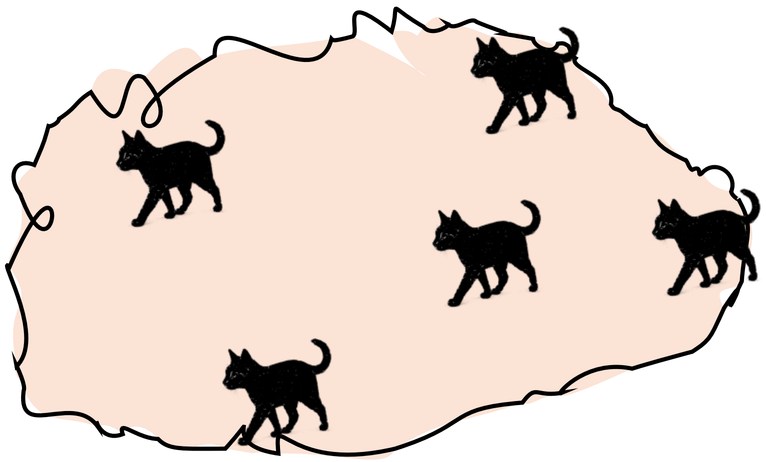


PROJECT BACKGROUND

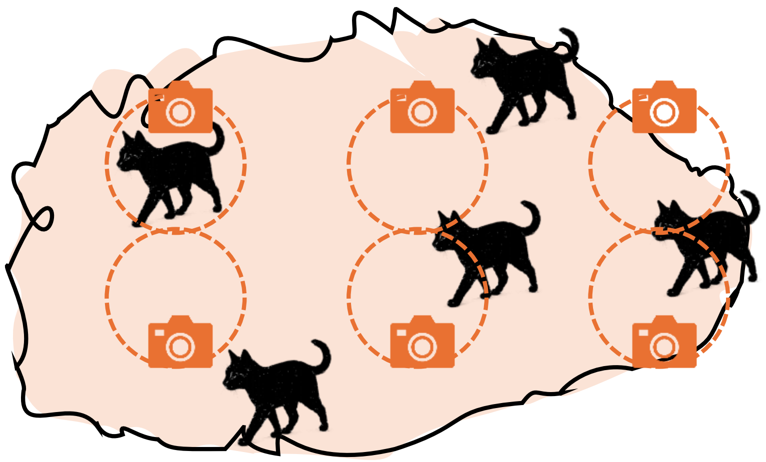
DENSITY
=
INDIVIDUALS PER KILOMETRE²

HOW DO WE MEASURE DENSITY?

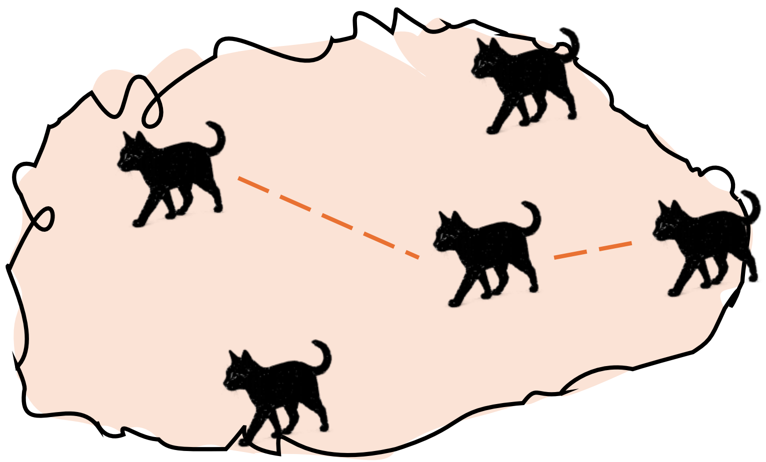
A Cats at an unknown density in the landscape



B Cameras record individuals and their detection rates



C Each detection provides information about an individual's movement



Is it worth the effort to calculate density?

PROJECT QUESTIONS

QUESTION 1: MEASURING POPULATIONS

WHAT IS THE “BEST” WAY TO MEASURE FERAL CAT POPULATIONS?

PROJECT QUESTIONS

QUESTION 1: MEASURING POPULATIONS

WHAT IS THE "BEST" WAY TO MEASURE FERAL CAT POPULATIONS?

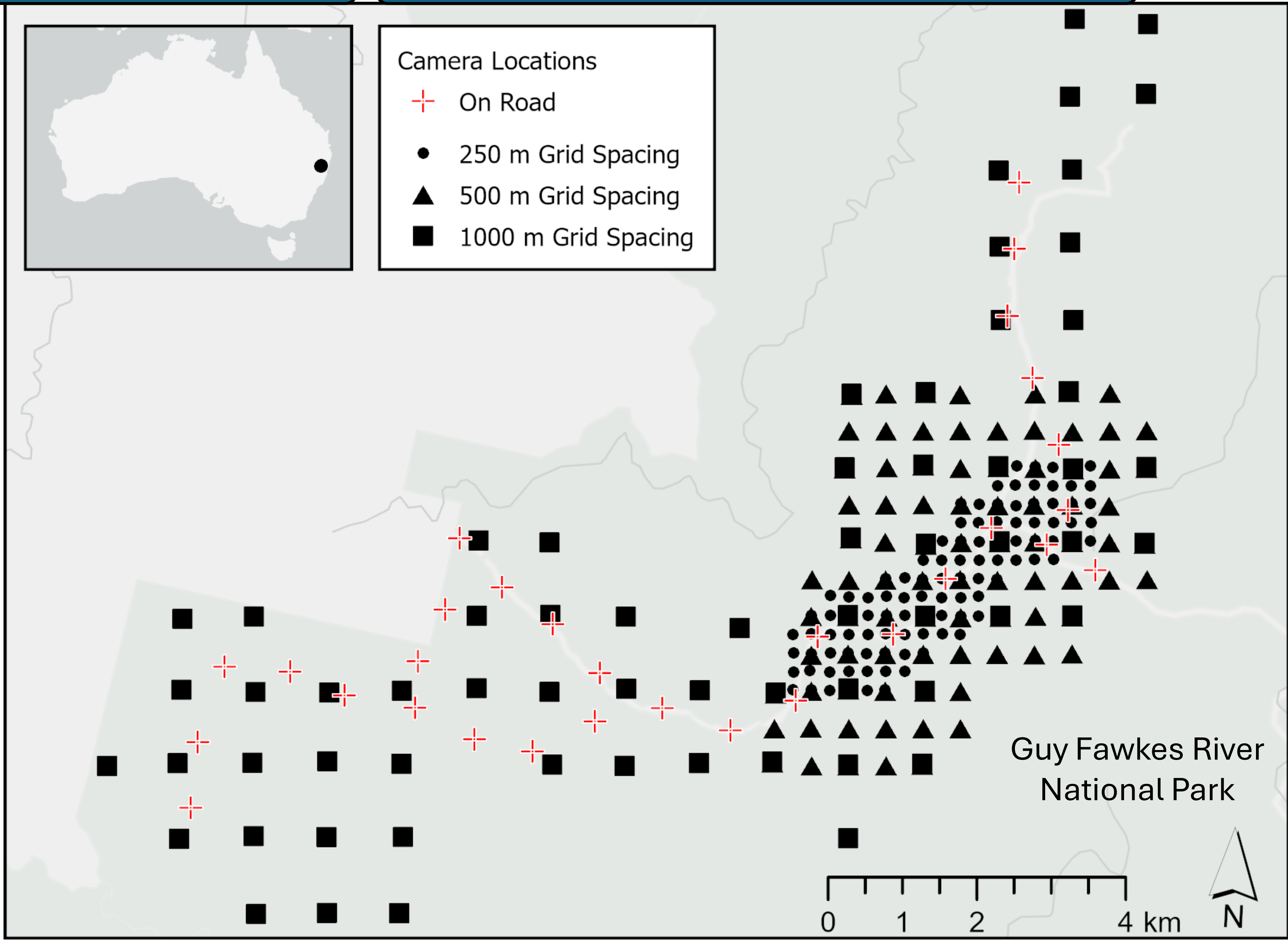
QUESTION 2: DETECTING CHANGE

WHAT IS THE "BEST" WAY TO DETECT A CHANGE IN THE POPULATION FOLLOWING A SIMULATED MANAGEMENT PROGRAM?

QUESTION 1: MEASURING POPULATIONS

QUESTION 2: DETECTING CHANGE

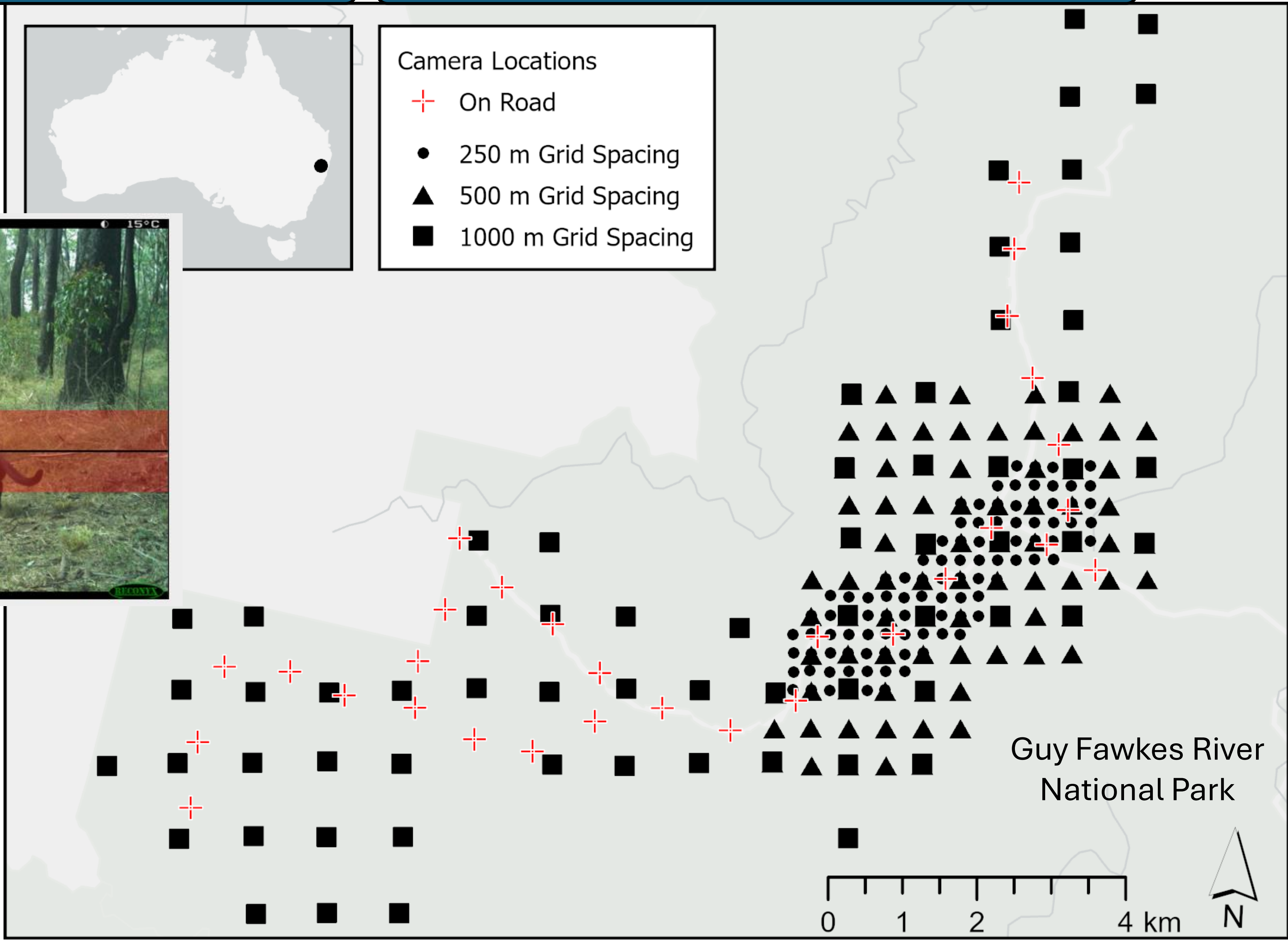
PROJECT DESIGN



QUESTION 1: MEASURING POPULATIONS

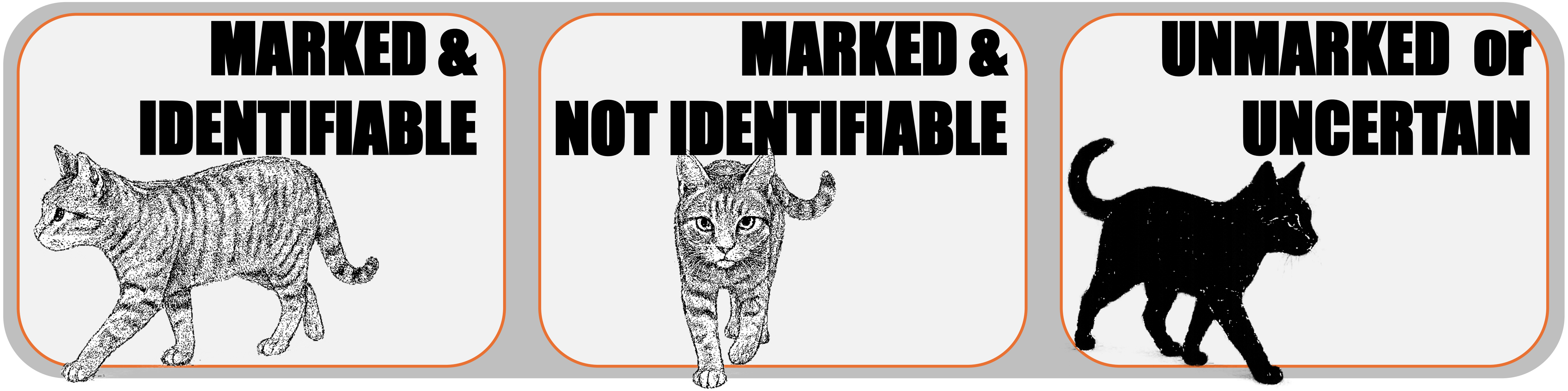
QUESTION 2: DETECTING CHANGE

PROJECT DESIGN



QUESTION 1: MEASURING POPULATIONS

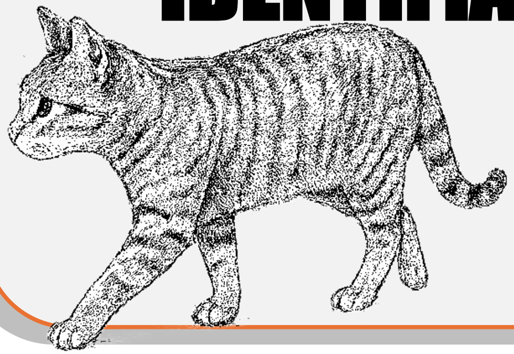
PROJECT ANALYSIS



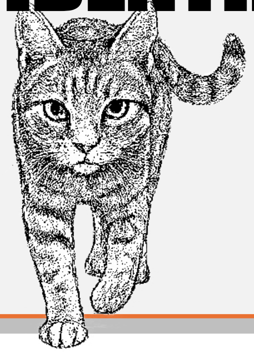
QUESTION 1: MEASURING POPULATIONS

PROJECT ANALYSIS

MARKED & IDENTIFIABLE



MARKED & NOT IDENTIFIABLE



UNMARKED or UNCERTAIN

METHOD 1: 'secr' PACKAGE

METHOD 2: 'nimble' PACKAGE

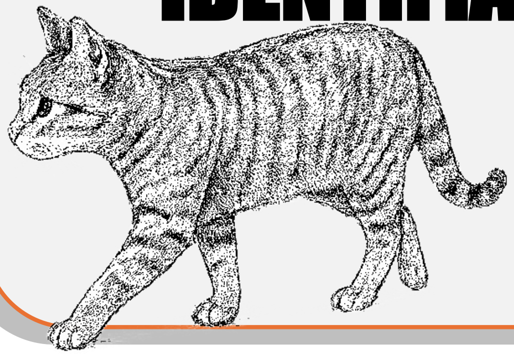
DENSITY ESTIMATION

SPATIAL-MARK-RESIGHT

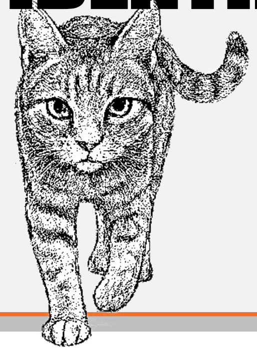
QUESTION 1: MEASURING POPULATIONS

PROJECT ANALYSIS

MARKED & IDENTIFIABLE



MARKED & NOT IDENTIFIABLE



UNMARKED or UNCERTAIN

DENSITY ESTIMATION

SPATIAL-MARK-RESIGHT

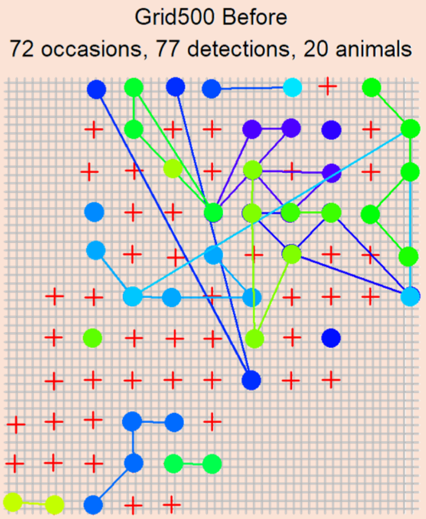
METHOD 1: 'secr' PACKAGE

METHOD 2: 'nimble' PACKAGE

includes identifying features & a better process for unmarked cats

QUESTION 2: DETECTING CHANGE

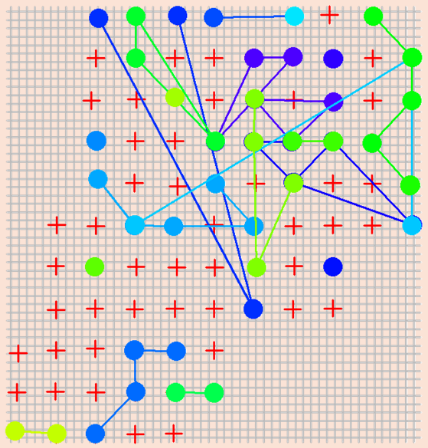
PROJECT ANALYSIS
SIMULATING POPULATION REDUCTION



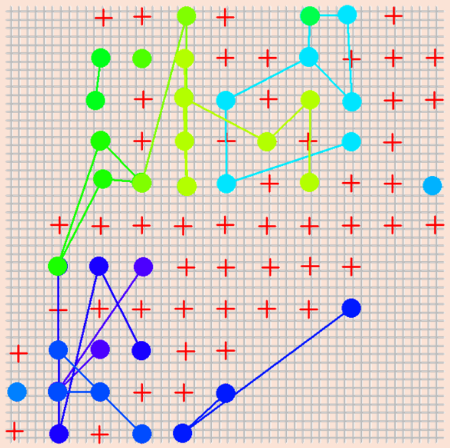
PROJECT ANALYSIS
SIMULATING POPULATION REDUCTION

10 % Reduction

Grid500 Before
72 occasions, 77 detections, 20 animals



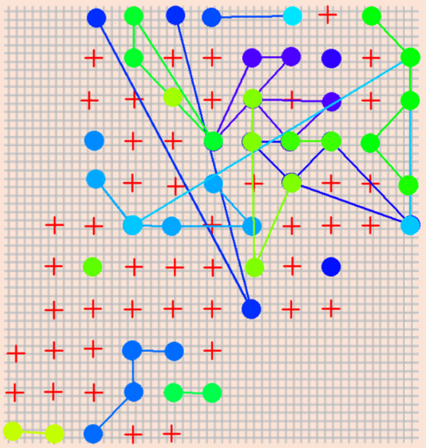
Grid500 After
Removed: 0.1 Simulation: 9
72 occasions, 44 detections, 13 animals



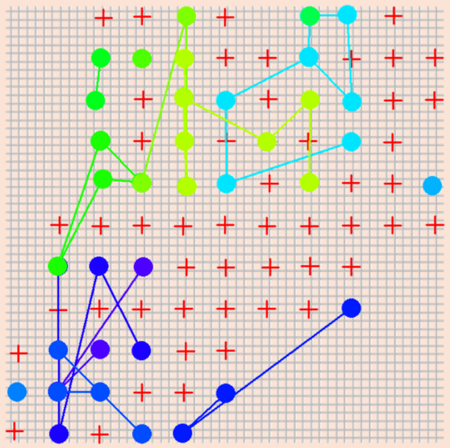
PROJECT ANALYSIS
SIMULATING POPULATION REDUCTION

10 % Reduction

Grid500 Before
72 occasions, 77 detections, 20 animals

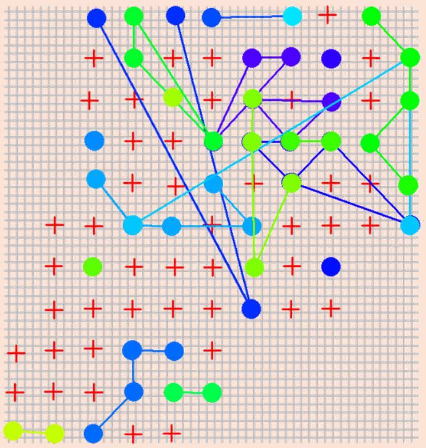


Grid500 After
Removed: 0.1 Simulation: 9
72 occasions, 44 detections, 13 animals

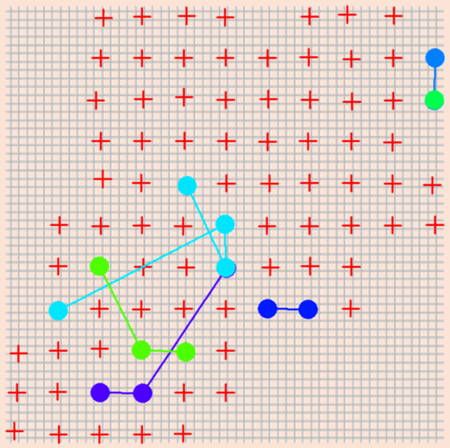


60 % Reduction

Grid500 Before
72 occasions, 77 detections, 20 animals



Grid500 After
Removed: 0.6 Simulation: 10
72 occasions, 15 detections, 6 animals



QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

	CAMERAS DEPLOYED	SITES OCCUPIED
250 M GRID	103	60 %
500 M GRID	85	70 %
1000 M GRID	65	74 %
ROAD	30	100 %

QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

	CAMERAS DEPLOYED	SITES OCCUPIED	CAMERA ACTIVITY (# DETECTIONS / TOTAL NIGHTS)
250 M GRID	103	60 %	0.03
500 M GRID	85	70 %	0.03
1000 M GRID	65	74 %	0.03
ROAD	30	100 %	0.23

QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

	CAMERAS DEPLOYED	SITES OCCUPIED	CAMERA ACTIVITY (# DETECTIONS / TOTAL NIGHTS)
250 M GRID	103	60 %	0.03
500 M GRID	85	70 %	0.03
1000 M GRID	65	74 %	0.03
ROAD	30	100 %	0.23

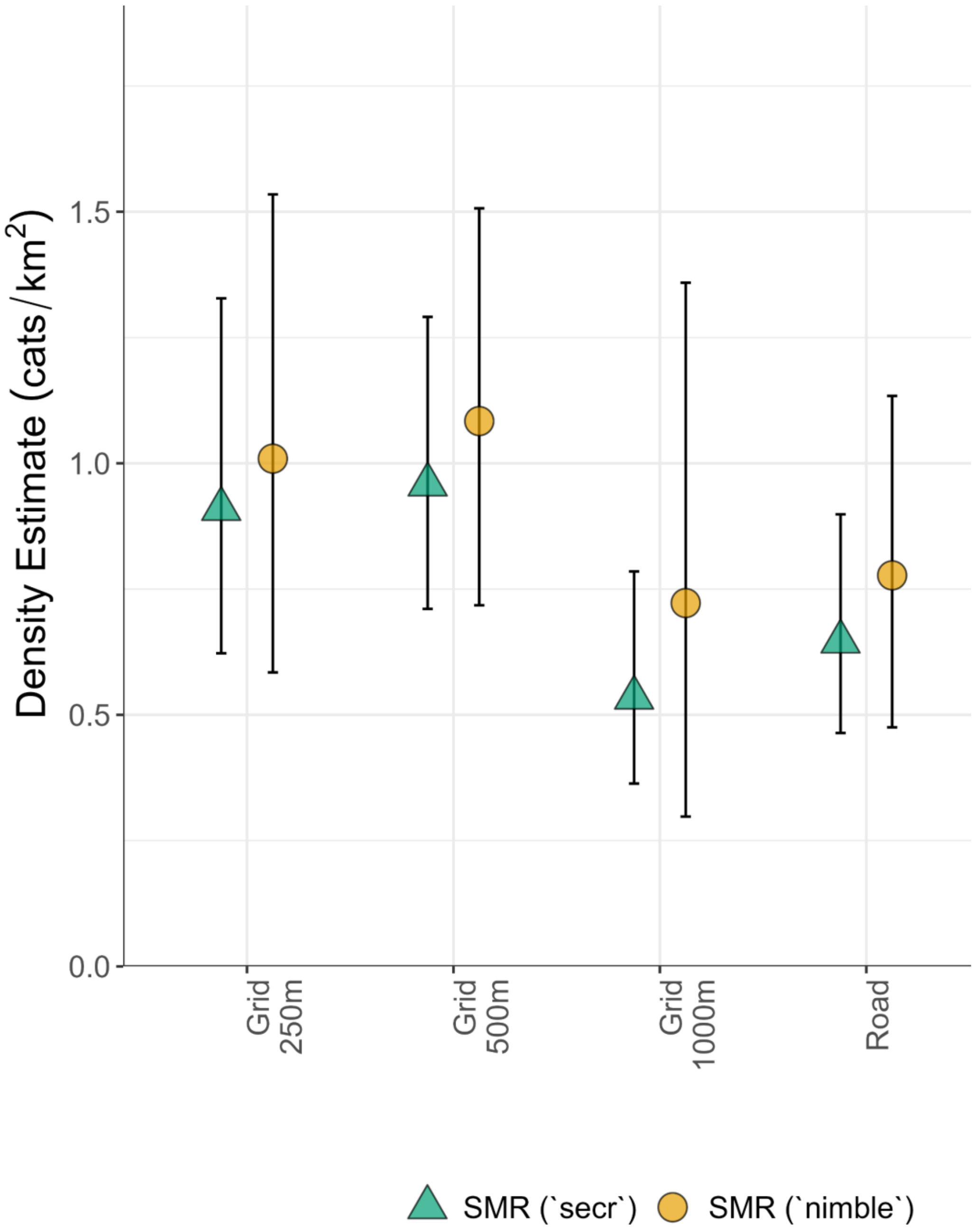
QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

DENSITY

=

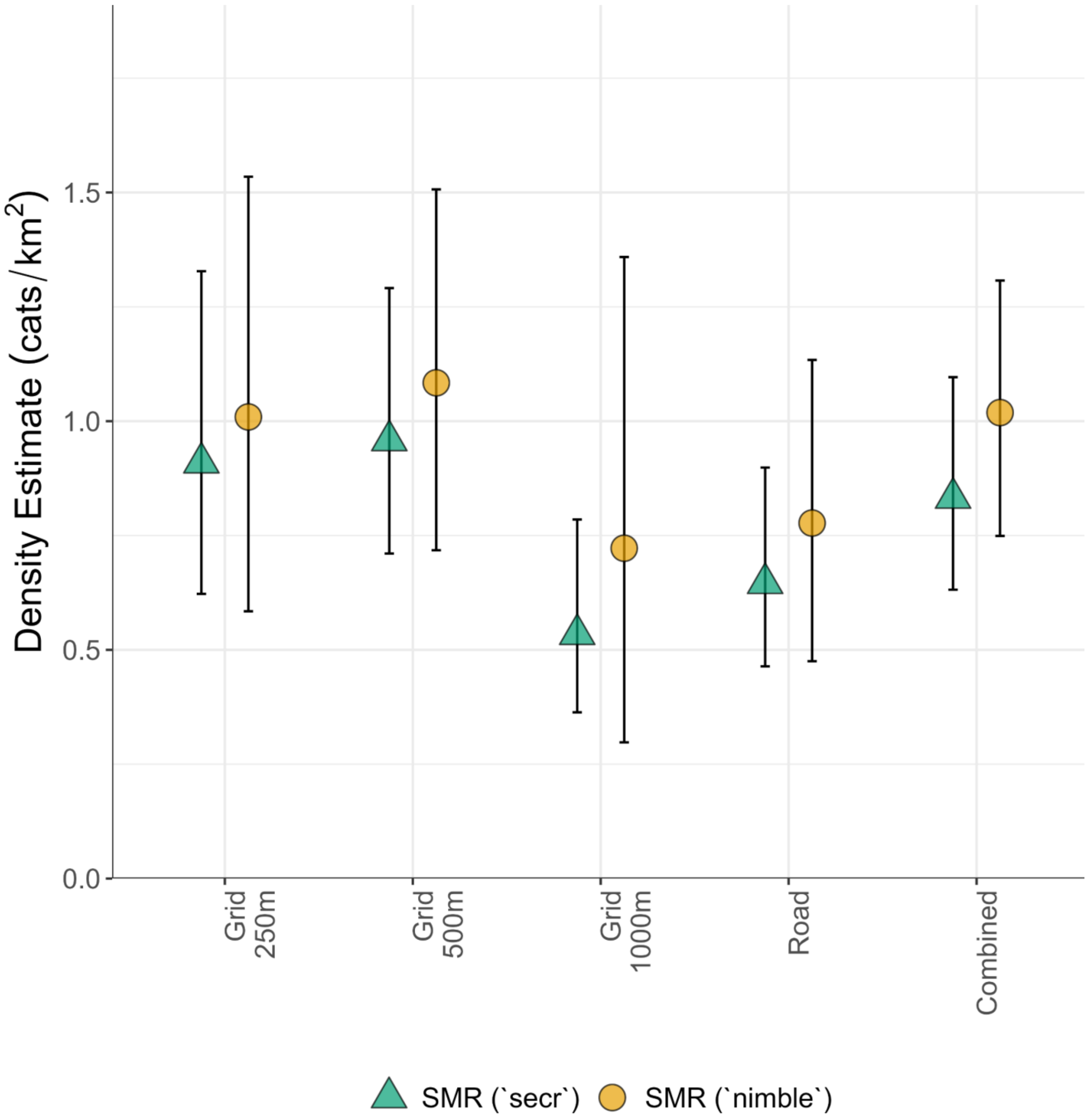
INDIVIDUALS PER KILOMETRE^2



QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

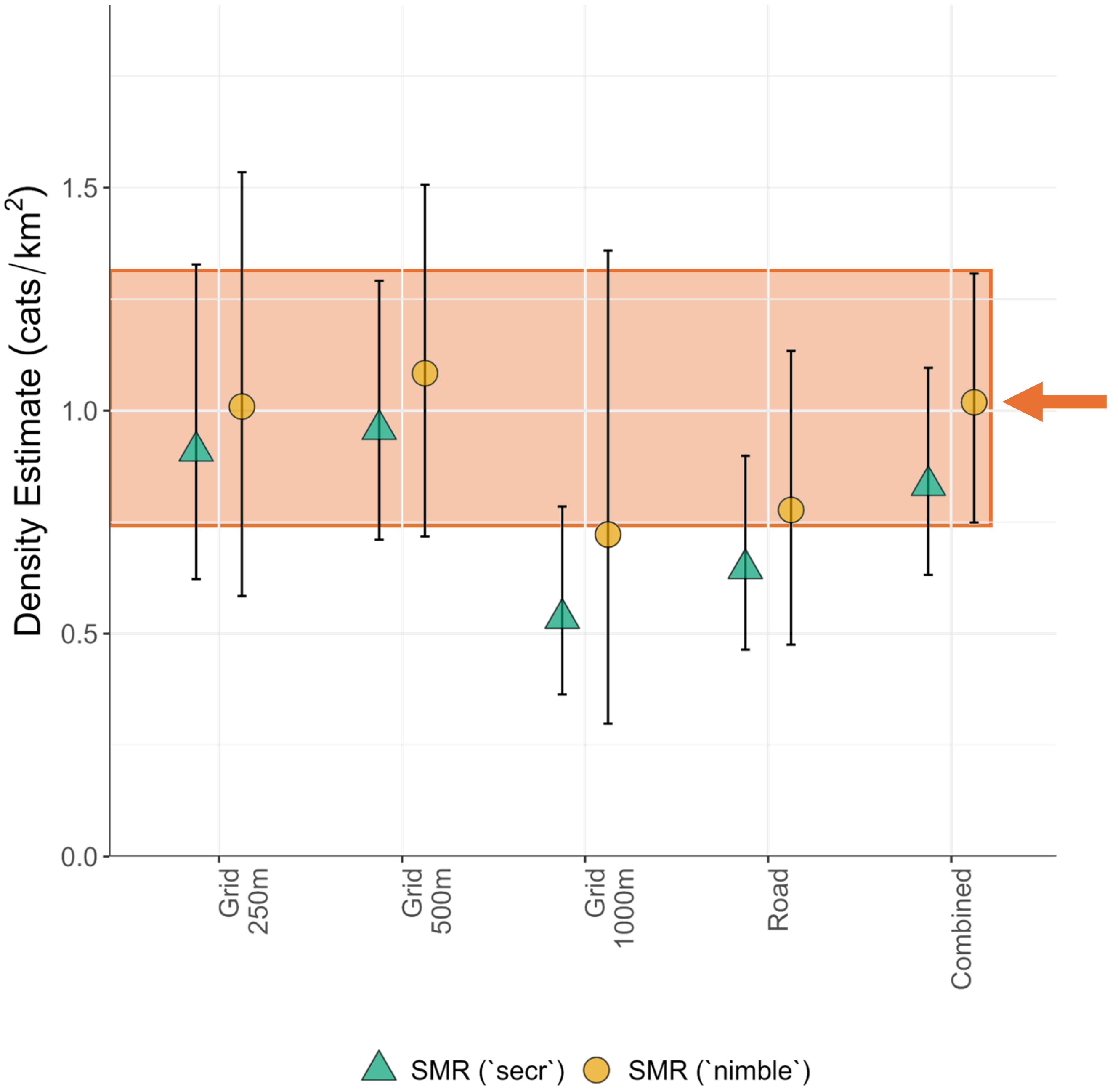
DENSITY
=
INDIVIDUALS PER KILOMETRE^2



QUESTION 1: MEASURING POPULATIONS

PROJECT RESULTS

DENSITY
=
INDIVIDUALS PER KILOMETRE^2



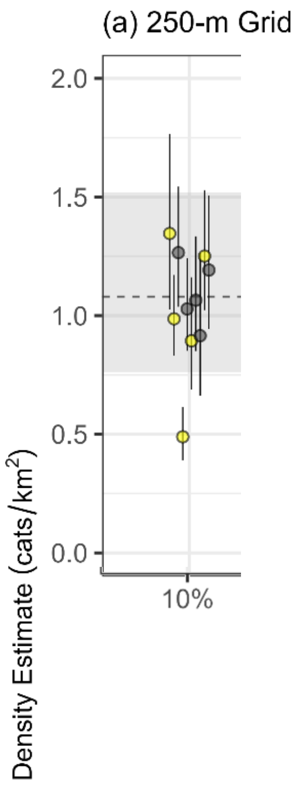
QUESTION 2: DETECTING CHANGE

CAN WE DETECT DENSITY REDUCTIONS?

DENSITY

=

INDIVIDUALS PER KILOMETRE²



Population Reduction

Yellow points:

Density is significantly different from before simulated management

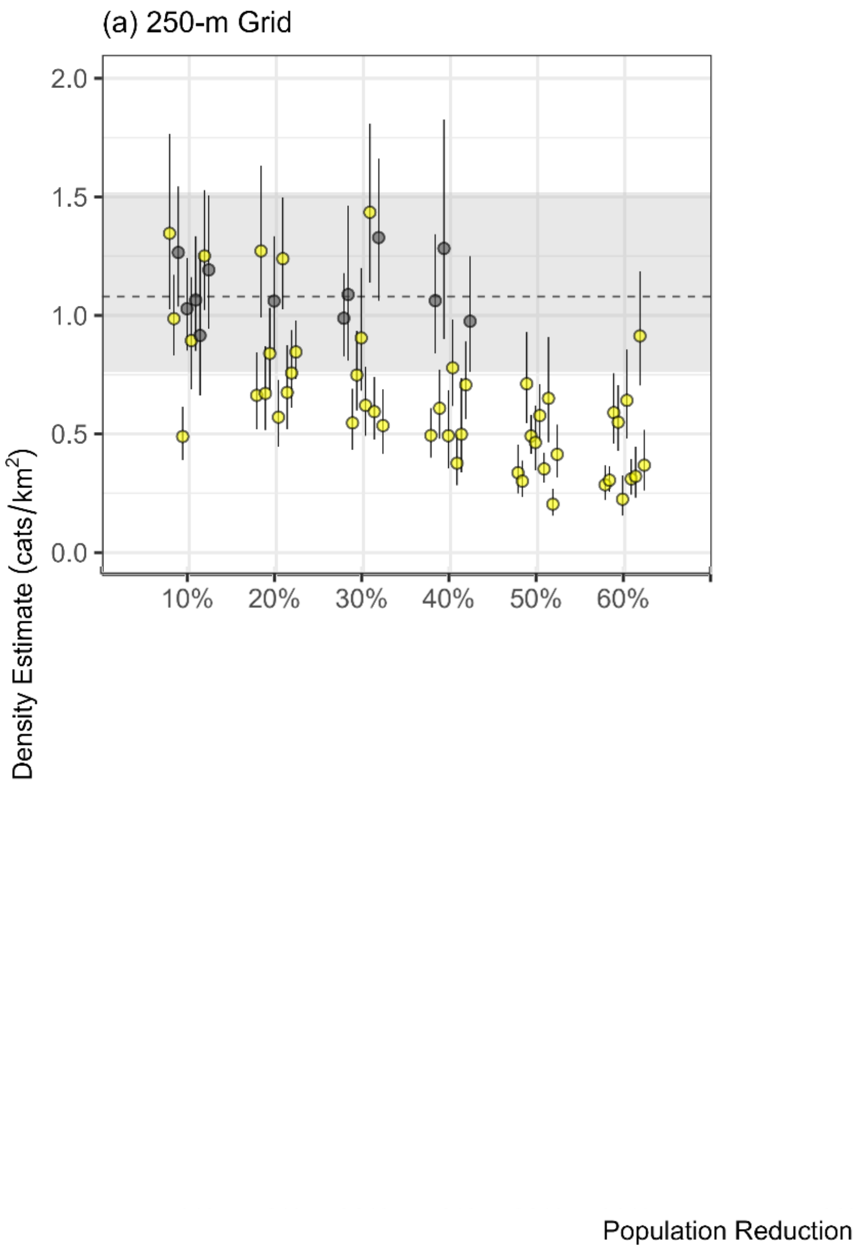
QUESTION 2: DETECTING CHANGE

CAN WE DETECT DENSITY REDUCTIONS?

DENSITY

=

INDIVIDUALS PER KILOMETRE^2



Yellow points:

Density is significantly different from before simulated management

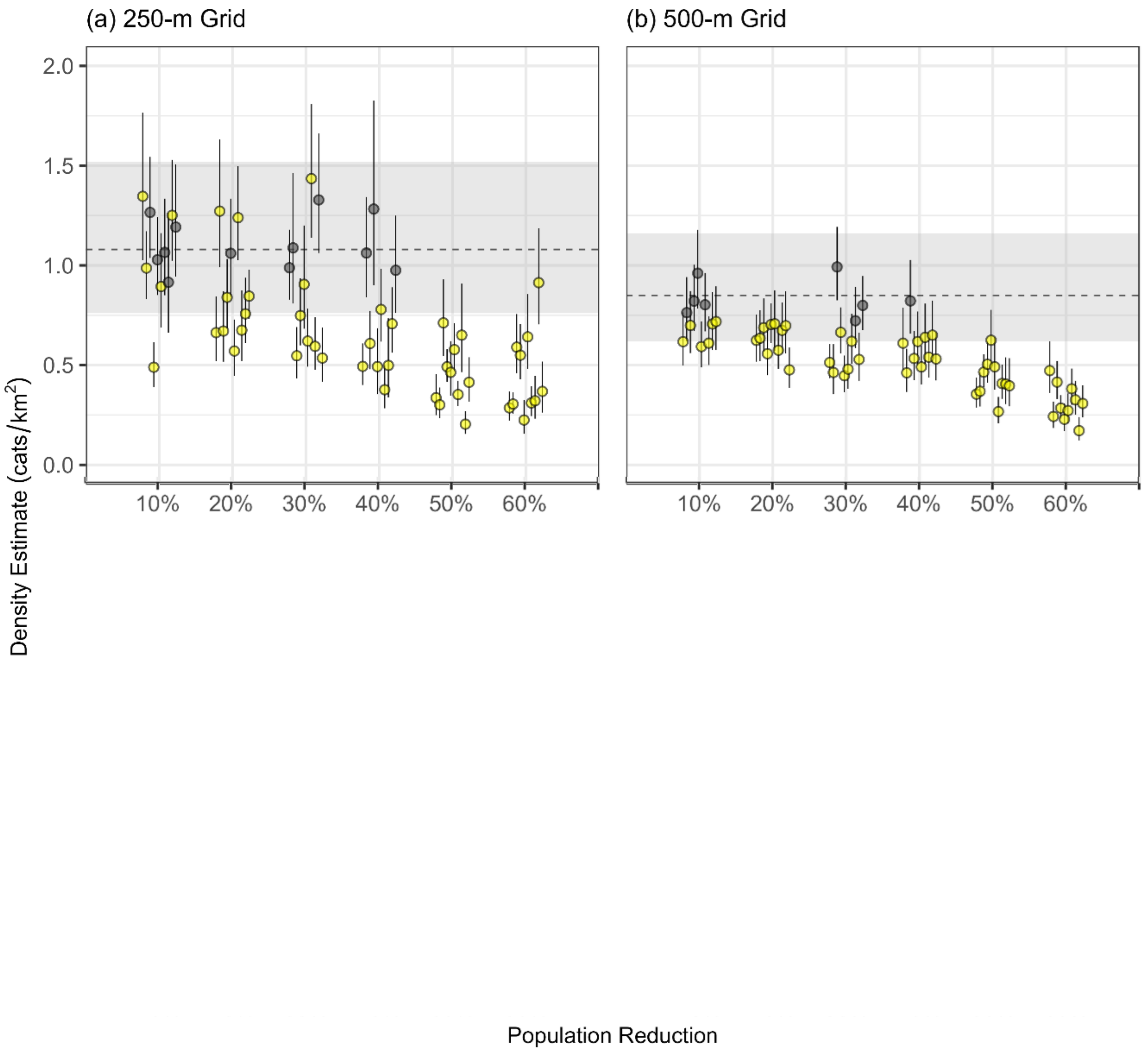
QUESTION 2: DETECTING CHANGE

CAN WE DETECT DENSITY REDUCTIONS?

DENSITY

=

INDIVIDUALS PER KILOMETRE²

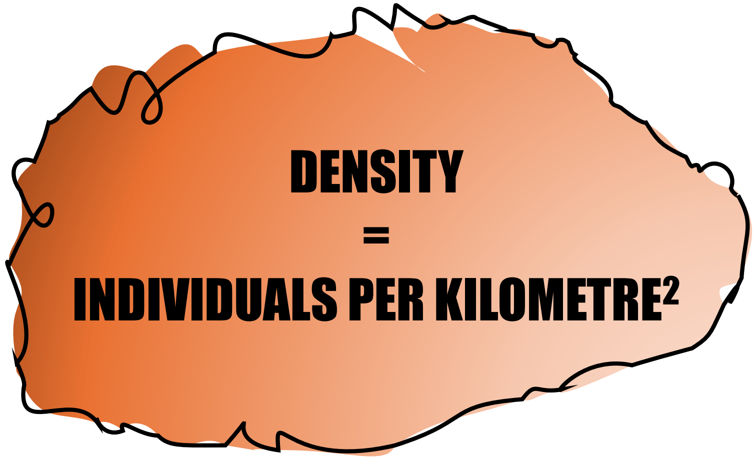


Yellow points:

Density is significantly different from before simulated management

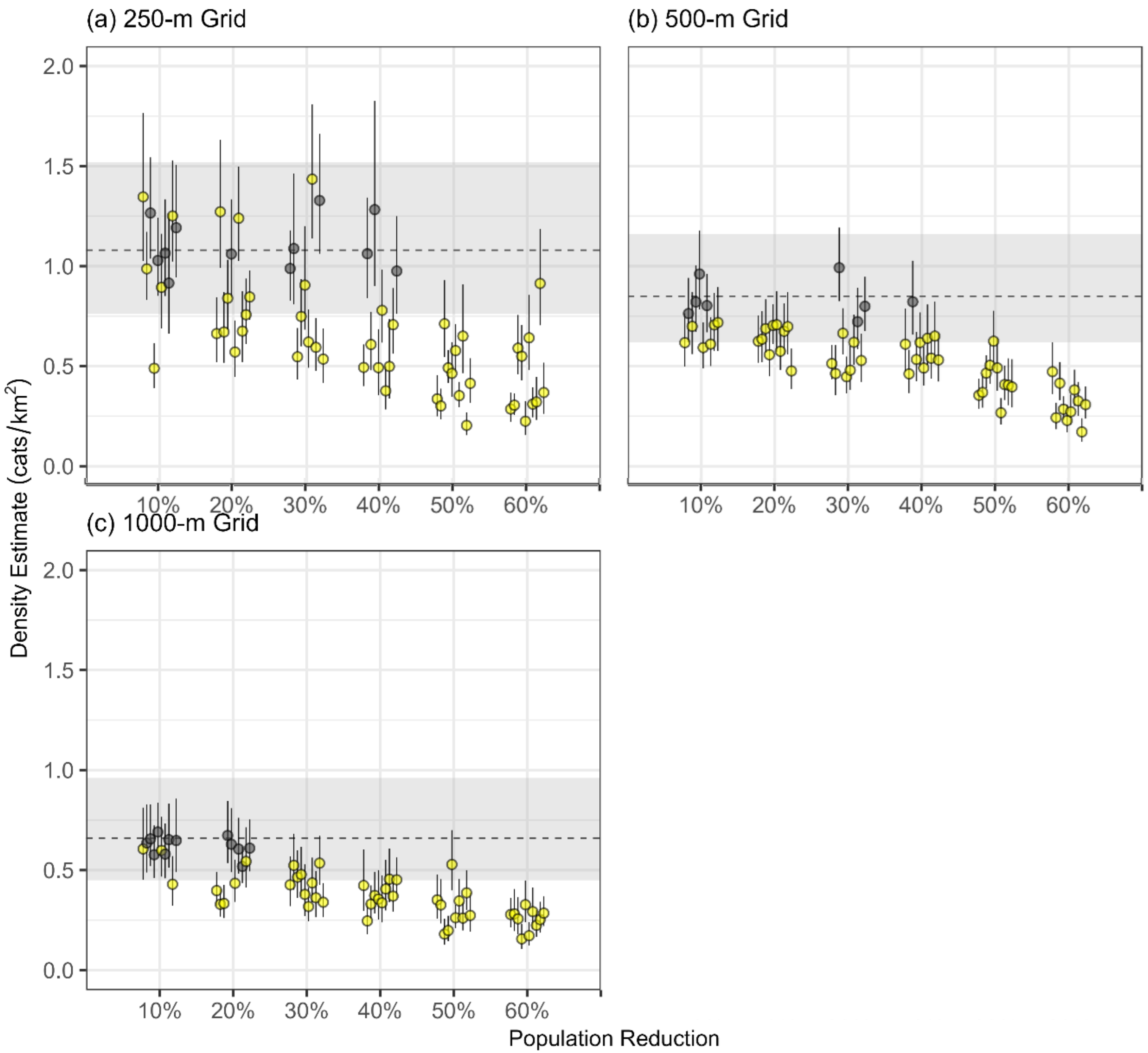
QUESTION 2: DETECTING CHANGE

CAN WE DETECT DENSITY REDUCTIONS?



Yellow points:

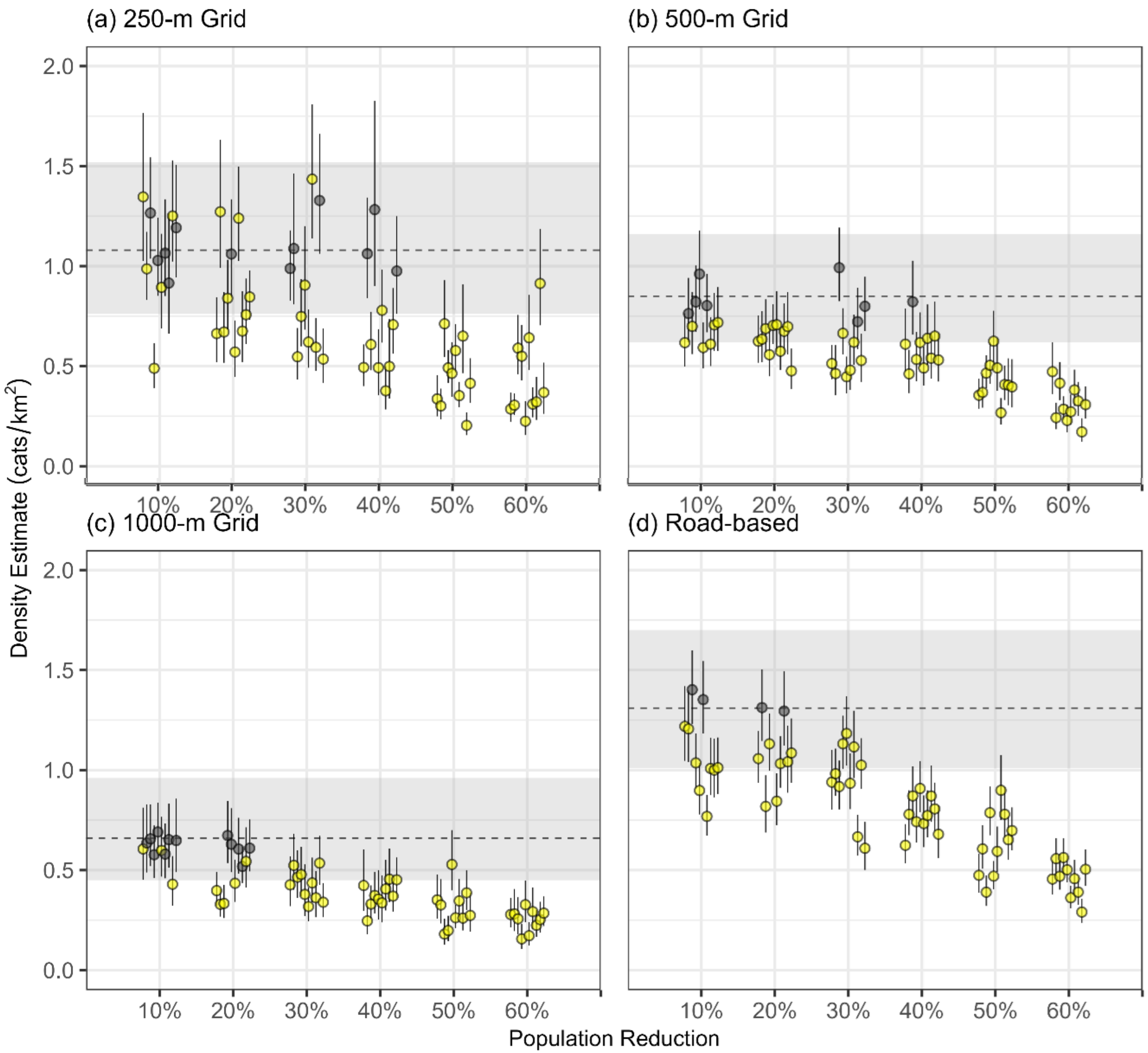
Density is significantly different from before simulated management



QUESTION 2: DETECTING CHANGE

CAN WE DETECT DENSITY REDUCTIONS?

DENSITY
=
INDIVIDUALS PER KILOMETRE²



Yellow points:

Density is significantly different from before simulated management

PROJECT CONCLUSIONS

QUESTION 1: MEASURING POPULATIONS

WHAT IS THE “BEST” WAY TO MEASURE FERAL CAT POPULATIONS?

- All grid arrays detected similar activity, road-based array was seven times greater
- All measures of density overlapped
  - 250 m and 500 m grid arrays were most likely to get most “accurate” measures of density

PROJECT CONCLUSIONS

QUESTION 2: DETECTING CHANGE

WHAT IS THE "BEST" WAY TO DETECT A CHANGE IN THE POPULATION FOLLOWING A SIMULATED MANAGEMENT PROGRAM?

- Both activity and density could detect population change
- 1000 m grid or 1000 m road-based array were more sensitive to changes

ADDITIONAL CONSIDERATIONS

THE IMPACTS OF INTER-SITE VARIATION

- Variation between sampling locations
- Replication required

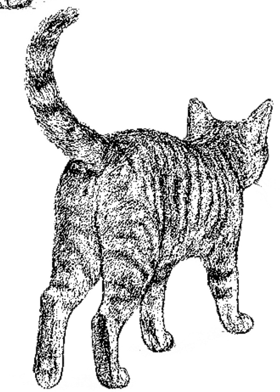
TWO METRICS ARE BETTER THAN ONE

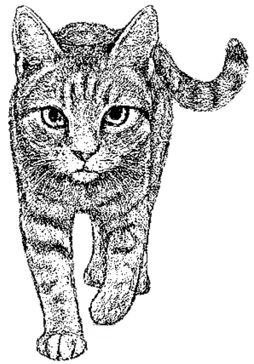
- Best practice is to report multiple metrics to assess change

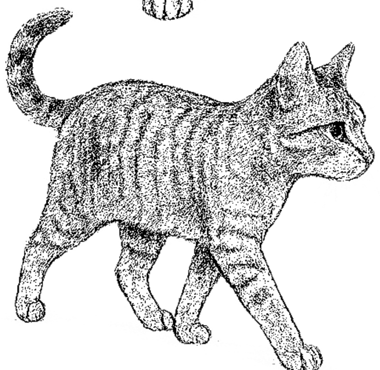
IMPLICATIONS FOR MONITORING AND MANAGEMENT

DENSITY ESTIMATES WILL VARY

- Dependant on array spacing and method of analysis







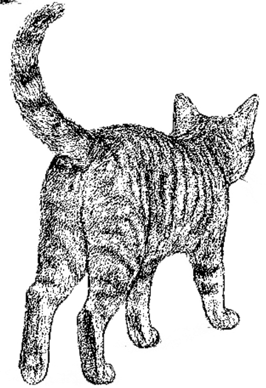
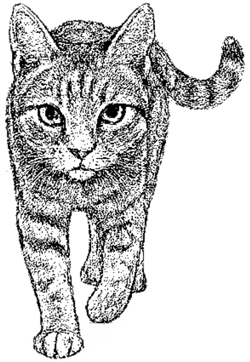
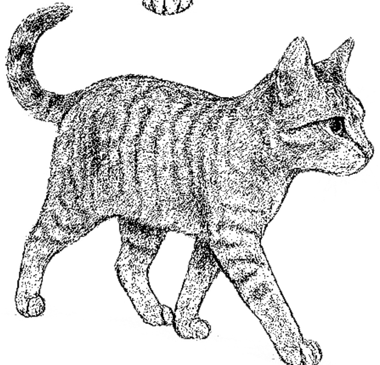
IMPLICATIONS FOR MONITORING AND MANAGEMENT

DENSITY ESTIMATES WILL VARY

- Dependant on array spacing and method of analysis

ITS HARD TO DETECT SMALL CHANGES RELIABLY

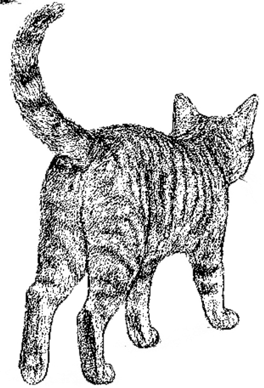
- 10-20 % reduction : not reliably detected
- 30% + reduction : can be measured using activity index or density using 1000m grid or road-based arrays
- 40% + reduction : 500 m grid array is more viable

IMPLICATIONS FOR MONITORING AND MANAGEMENT

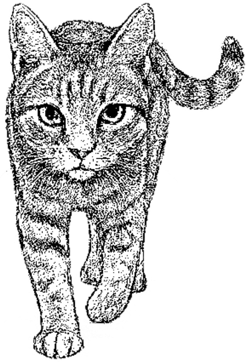
DENSITY ESTIMATES WILL VARY

- Dependant on array spacing and method of analysis



ITS HARD TO DETECT SMALL CHANGES RELIABLY

- 10-20 % reduction : not reliably detected
- 30% + reduction : can be measured using activity index or density using 1000m grid or road-based arrays
- 40% + reduction : 500 m grid array is more viable



NEED TO BALANCE : CAMERA DESIGN (+ EFFORT), DENSITY ESTIMATE ACCURACY, AND THE ABILITY TO DETECT CHANGE