Practical monitoring of flying-fox camps for management

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(Presentation given at the National Flying-fox Forum, September 2023, Port Macquarie, NSW)

Those responsible for managing flying-fox camps – particularly in urban areas – can experience considerable problems as they attempt to balance the conflicting needs of local residents, flying-fox supporters, relevant legislative requirements, financial constraints, the flying-foxes themselves, and the resulting political realities. In addition, the problem of heat stress and the related fatalities are a concern needing to be addressed. As land managers come to the realisation that dispersals are expensive, ineffective and indeed counter-productive, they now have to concentrate on managing the flying-foxes and camps *in-situ*.

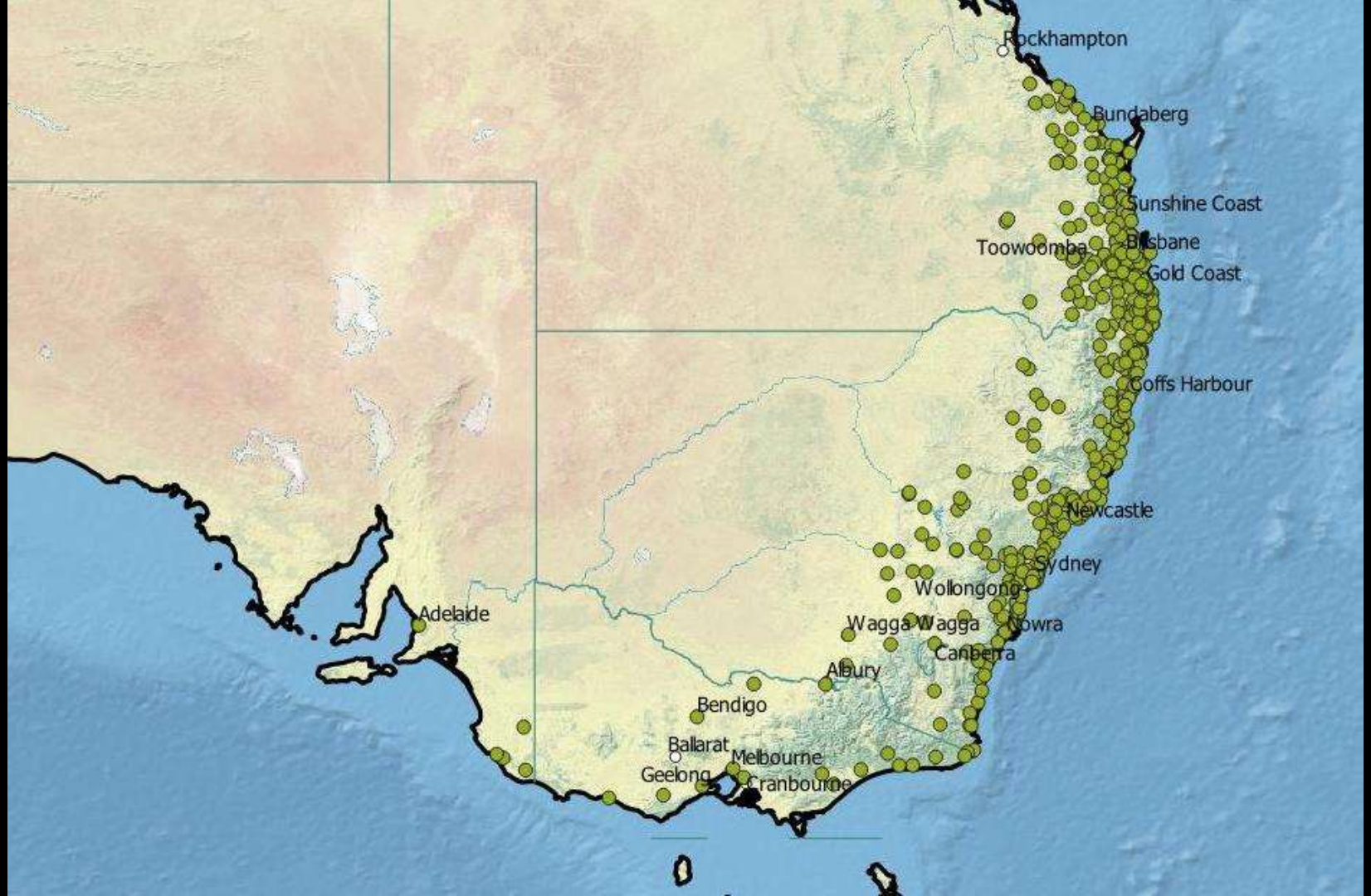
Effectively managing a flying-fox camp requires detailed knowledge of the camp environs, its local environment, and the behaviours of the animals resident there. This data can influence decisions on public awareness, resident expectations, habitat restoration, and wildlife management – including preparedness for heat stress events, and is in effect vital to manage expectations and responsibilities. A program of regular monitoring of a flying-fox camp can provide this data to support management, and need not be difficult or overly expensive to implement.

We examine a number of techniques used to monitor aspects of flying-fox camps: population counts, roost extent mapping, microclimate monitoring, fauna and flora surveys, etc., and look at how monitoring programs have been implemented and used to influenced decision making by land managers in a number of urban flying-fox camps.

Practical monitoring of flying-fox camps for management

Tim Pearson, Martin Fallding, Emily Rix, and Chelsea Costello

Image: Tim Pearson


Rockhampton
Bundaberg
Sunshine Coast
Toowoomba
Brisbane
Gold Coast
Coffs Harbour
Newcastle
Sydney
Wollongong
Adelaide
Wagga Wagga
Nowra
Canberra
Albury
Bendigo
Ballarat
Melbourne
Geelong
Cranbourne

Some truisms about flying-fox camps…

- Flying-fox camps are dynamic
- Camps may be fundamentally similar in some ways but every camp is different

Image: Tim Pearson

Image: Viv Jones

Images: Tim Pearson

Some truisms about flying-fox camps…

- Flying-fox camps are dynamic
- Camps may be fundamentally similar in some ways but every camp is different
- Dispersals don't really work (e.g. Roberts et al. 2012 & 2021)
- Knowing what is happening in the camp is vital for effective *in-situ* management

A monitoring program to provide the basic information required does not need to be hugely complex and expensive!


Ku-ring-gai Flying-fox Reserve


Blackalls Park Flying-fox Camp


Bellingen Island
Blackalls Park
Gordon


Bellingen Island Flying-fox Camp

What do Land Managers need to know?

- How many bats are present? And how does that vary over time?
- Where in the area are they roosting? How close are they to people? Do they move?
- What species are present?
- Is the camp a maternity camp?
- Is the vegetation in the camp being damaged? What can we do about it?
- Are there going to be problems (i.e., mass fatalities) during heat waves?
- What's the history, and future, of the camp?
- What else lives in the area?

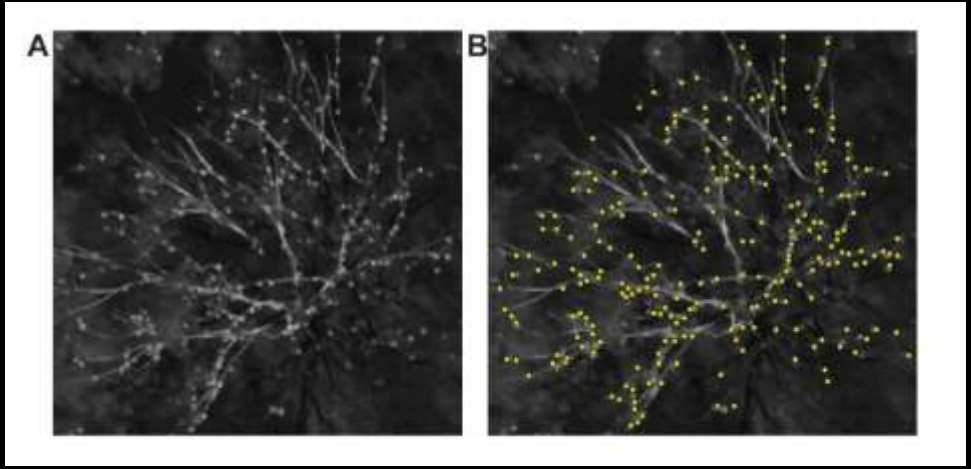
- What can I do to manage the camp and its human neighbours?

What do Land Managers need to know?

- How many bats are present? And how does that vary over time?

Millions!

Numbers…



(A) Thermal image of flying-foxes roosting in a Eucalyptus sp. in the Centennial Park roost.
(B) Image with yellow markers depicting counts of every flying-fox in the tree.

From: McCarthy et al - 2021 - Drone based thermal remote sensing for monitoring flying foxes

FLIR video of camp and flyout, Karbeethong, Victoria.

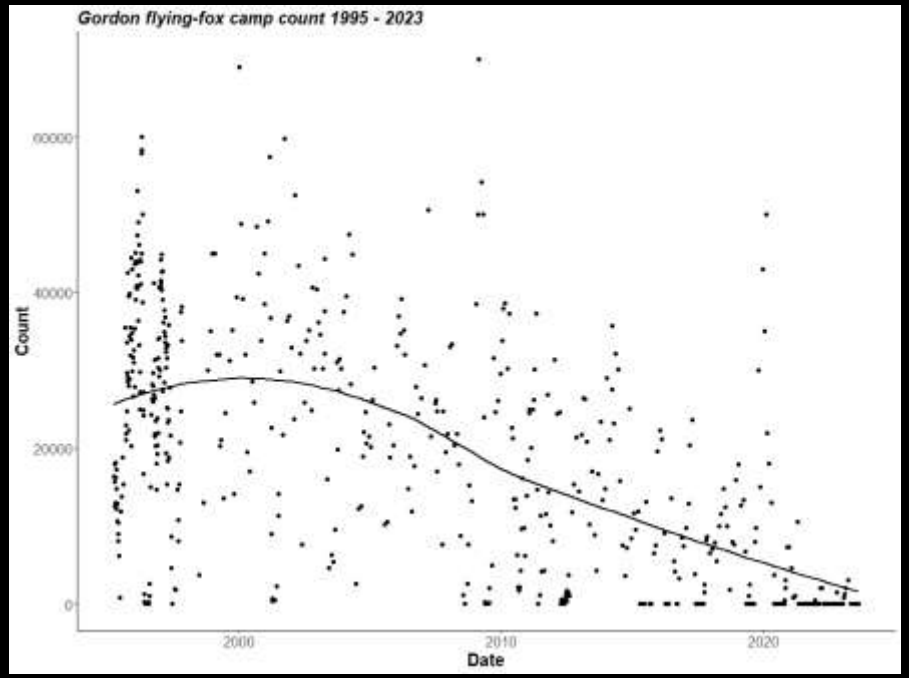
Video courtesy Michael Pennay

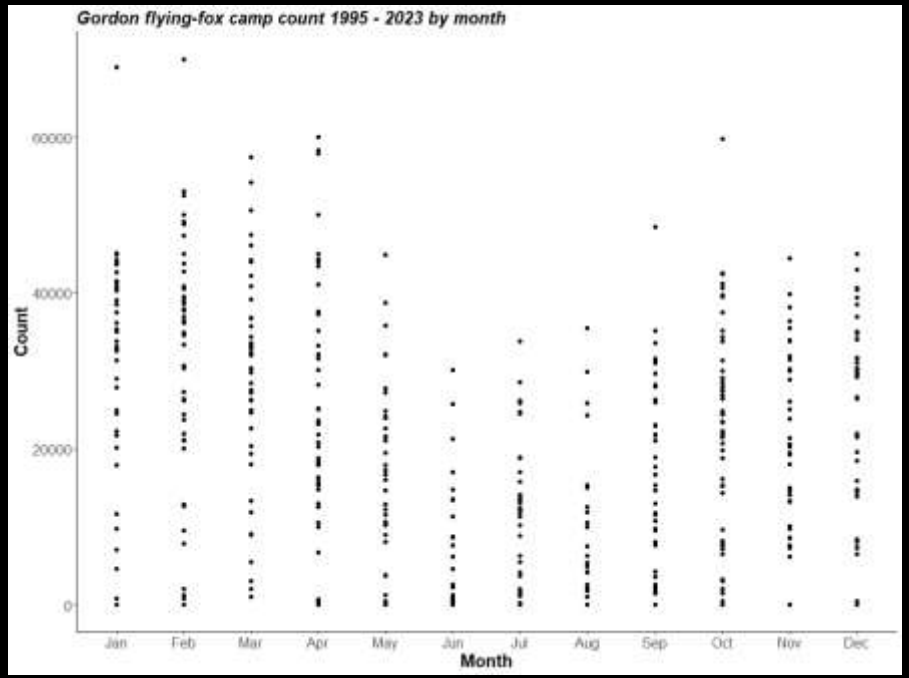
Numbers…

Practically speaking, however…

- Choose a method that works for the particular camp, and use it consistently
  - Fly-out count
  - Static (ground) count
  - A statistical method (e.g., point-based distance sampling)
  - A combination

Numbers… (Gordon camp)

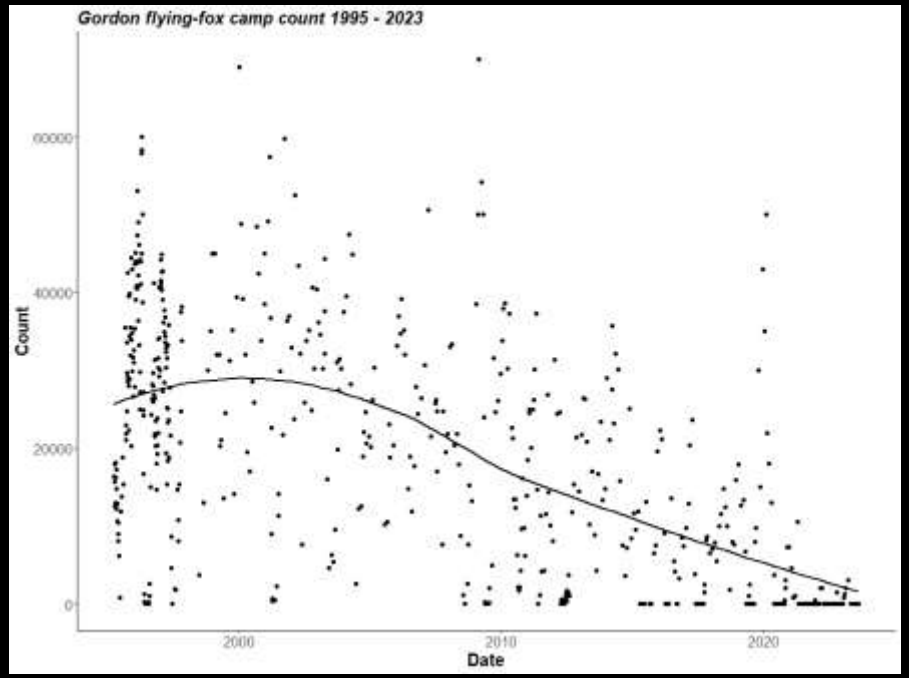


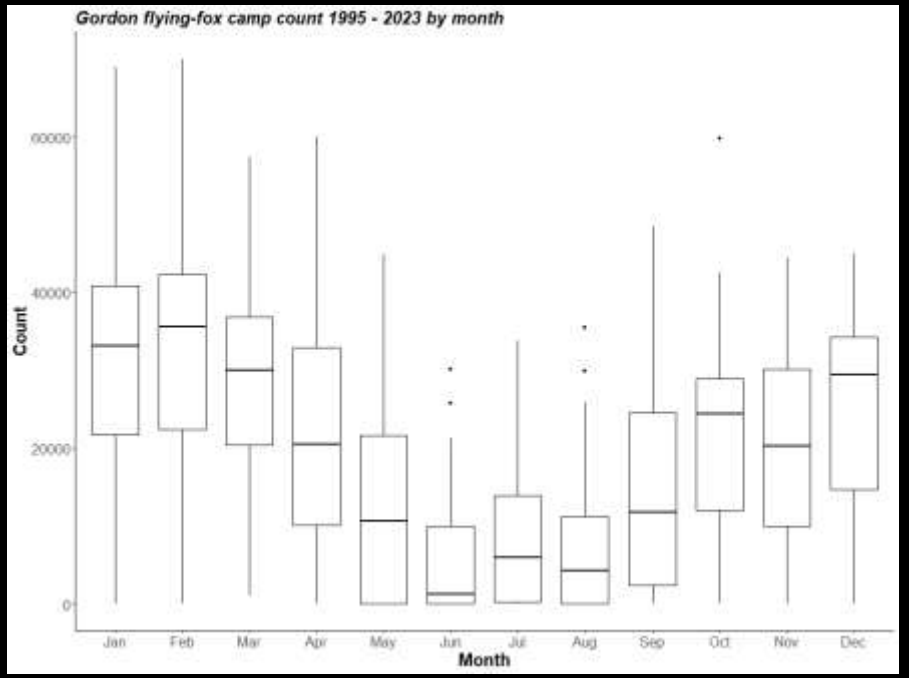


(Data collected by fly-out count, monthly, over 28 years)

Count data courtesy of the KBCS

Numbers… (Gordon camp)





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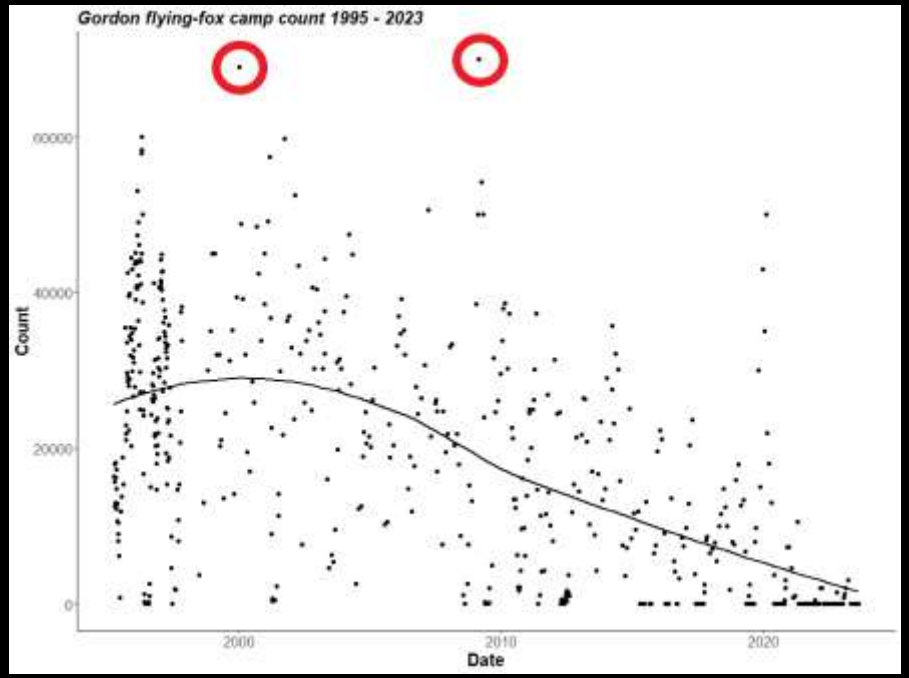

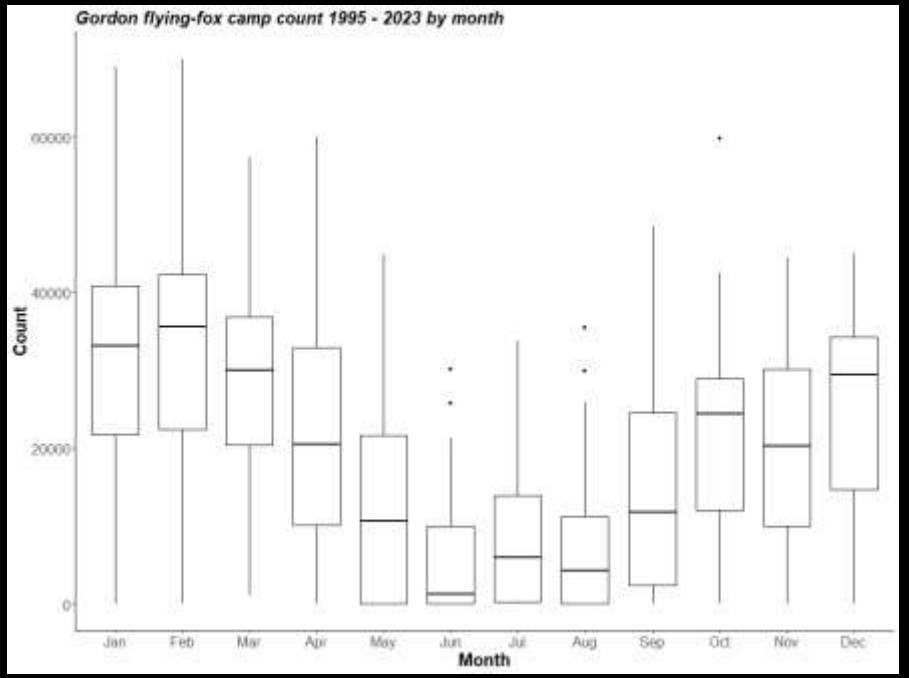

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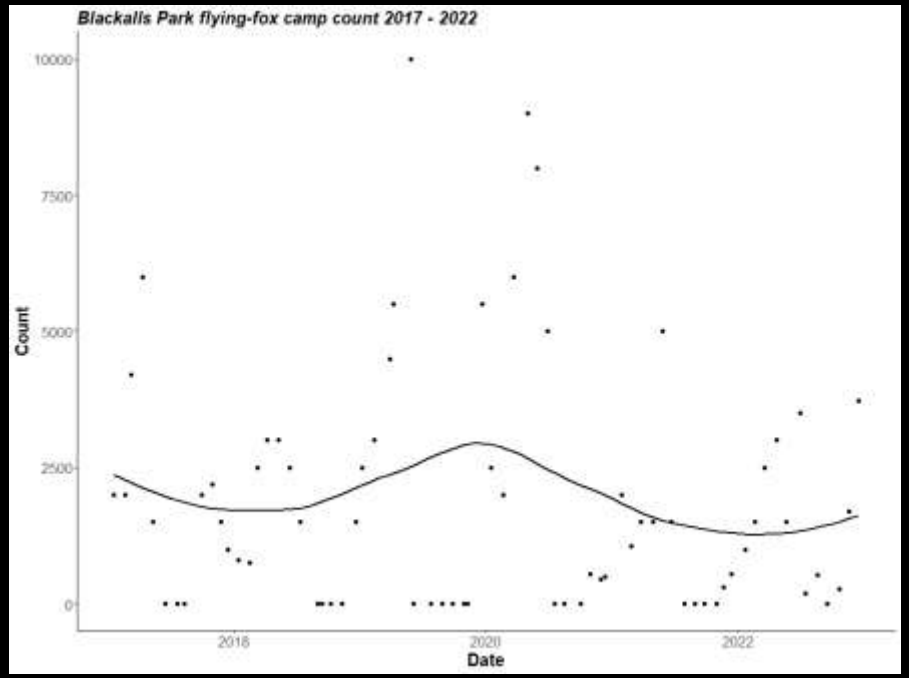
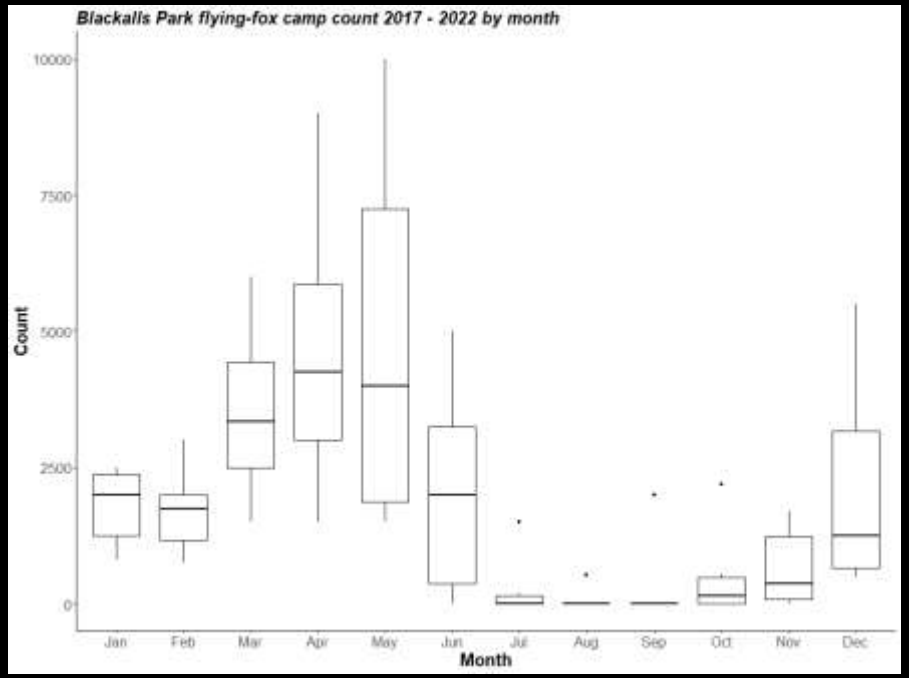
Numbers… (Blackalls Park camp)





(Data collected by ground count, monthly, over 6 years)

Count data courtesy of Lake Macquarie Council

What do Land Managers need to know?

- How many bats are present? And how does that vary over time?
- Where in the area are they roosting? How close are they to people? Do they move?

Extents… (Gordon camp)

Extent mapping courtesy of KBCS and Council

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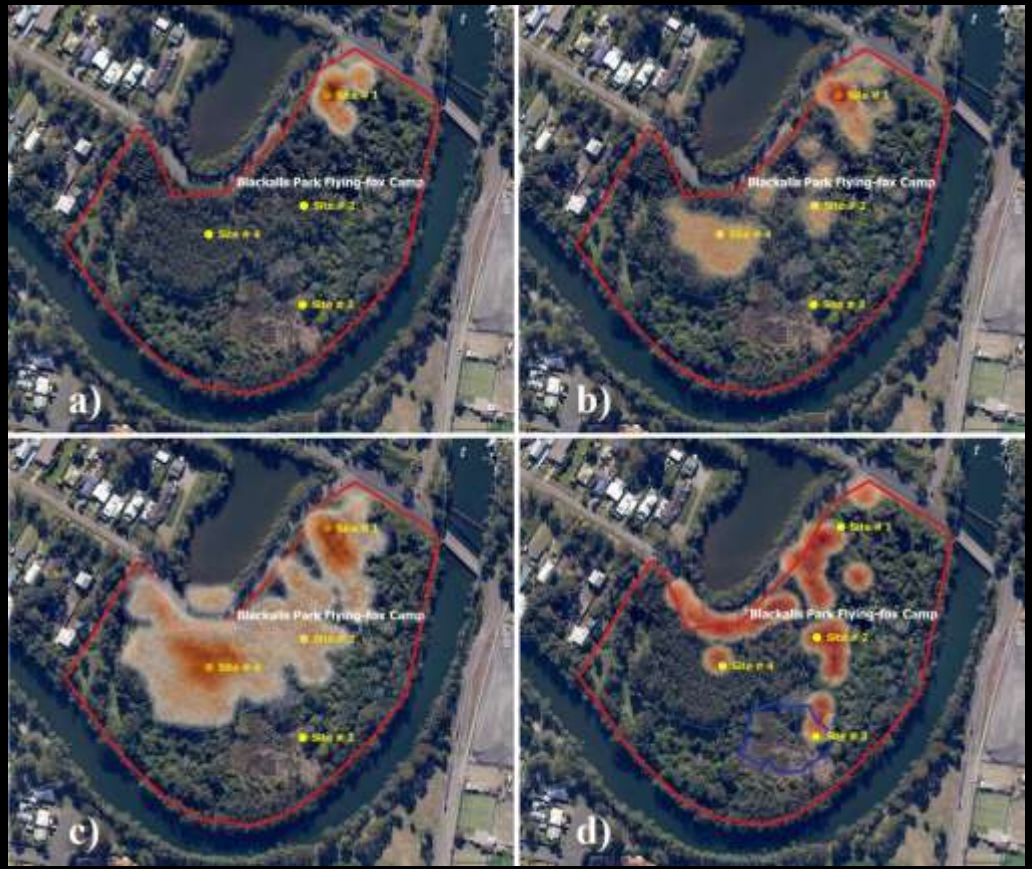
Extents… (Blackalls Park camp)



Blackalls Park Flying-fox camp, Lake Macquarie, New South Wales, Australia, showing approximate areas occupied by flying-foxes in:
a) February, 2018. Estimated count – 750 flying-foxes.
b) January, 2019. Estimated count – 2,500 flying-foxes, widely spread.
c) May 2019. Estimated count – 10,000 flying-foxes, spread over the area.
d) June 2020. Estimated count – 3,500 flying-foxes, starting to extend into the revegetation area.

Extent maps courtesy of Lake Macquarie Council

Extents… (Blackalls Park camp)

Extent maps courtesy of Lake Macquarie Council

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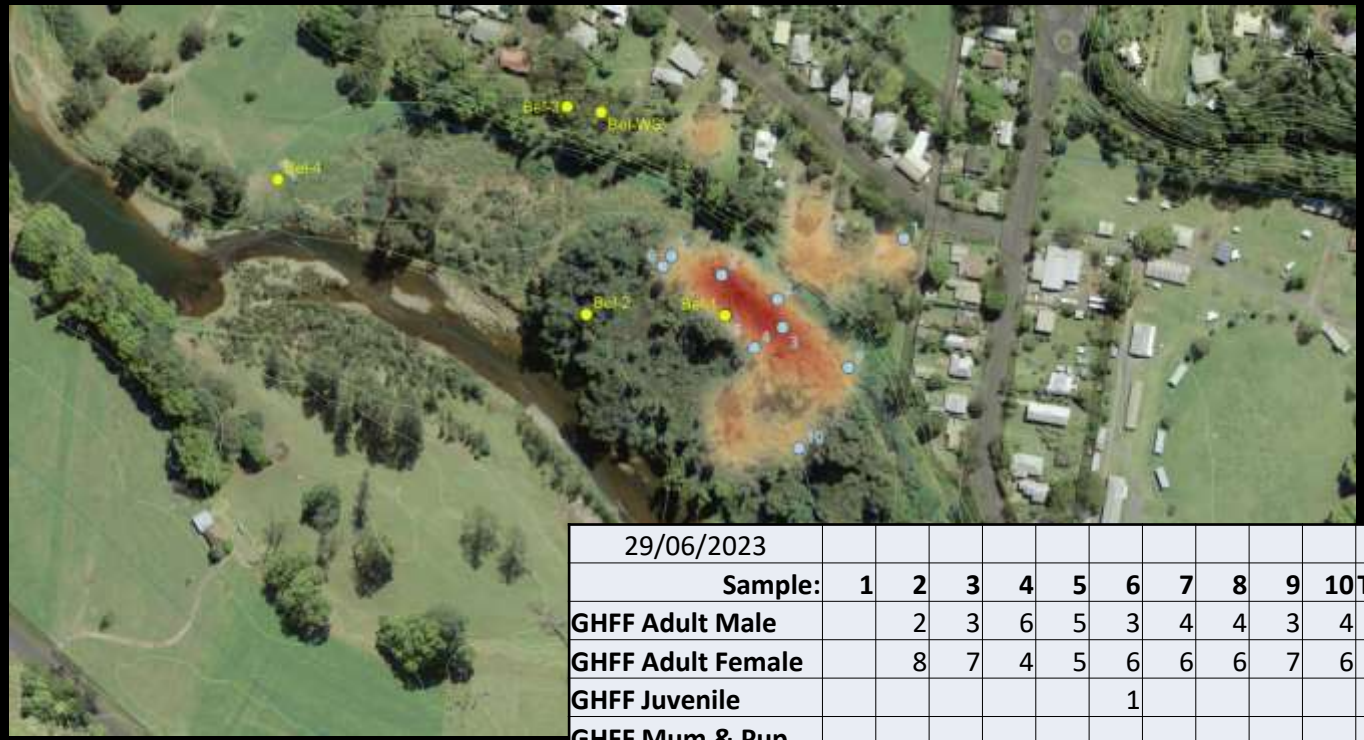
Images: Viv Jones, Tim Pearson

Maternity… (nominally October – March. *-ish.*)

Images: Viv Jones

Demographics… (Bellingen Island camp)



29/06/2023														
Sample:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Totals**	**Percentages**		
GHFF Adult Male		2	3	6	5	3	4	4	3	4	34	34%		
GHFF Adult Female		8	7	4	5	6	6	6	7	6	55	55%		
GHFF Juvenile						1					1	1%		
GHFF Mum & Pup											0	0%	90%	Greys
BFF Adult Male	4										4	4%		
BFF Adult Female	6										6	6%		
BFF Juvenile											0	0%		
BFF Mum & Pup											0	0%	10%	Blacks

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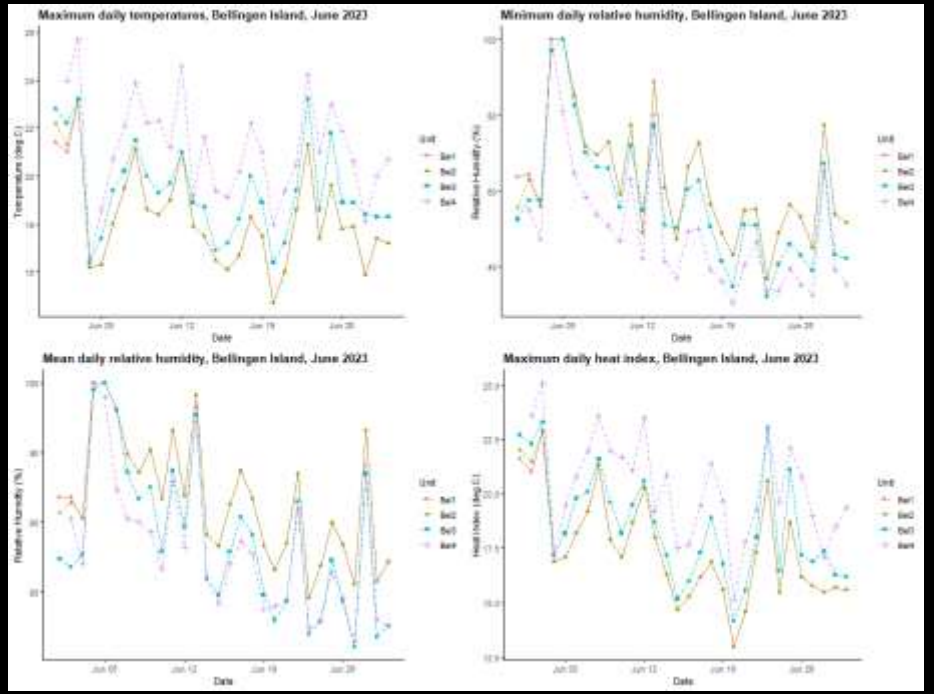
Image: Tim Pearson

Habitat restoration and monitoring…

SYDNEY BATS

Images: Nancy Pallin

Environmental monitoring…



Data courtesy of Bellingen Council

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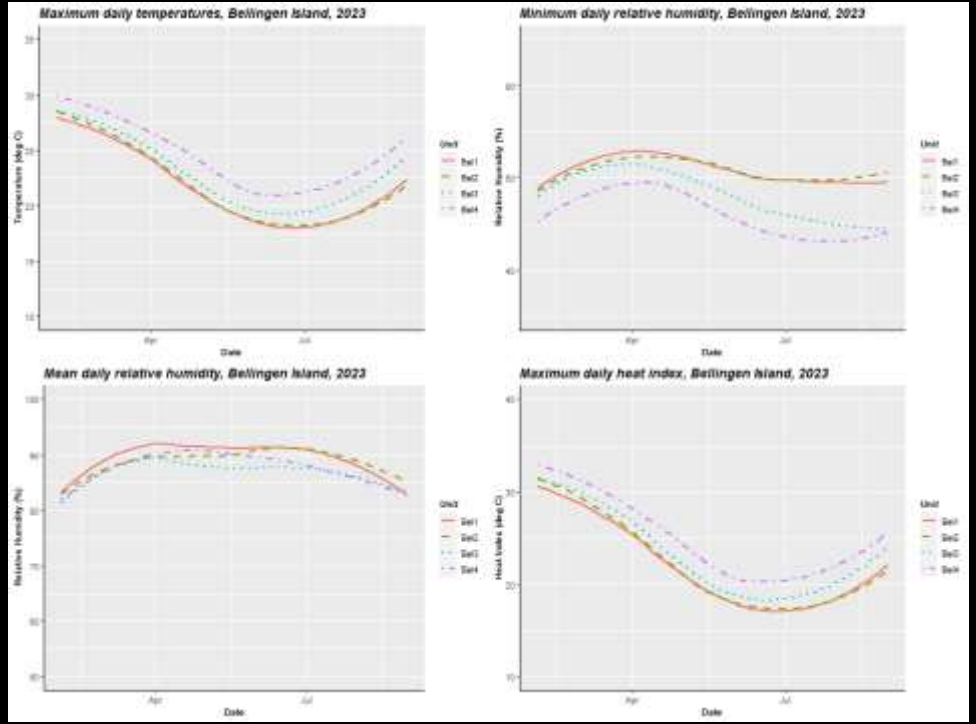

Data courtesy of Bellingen Council

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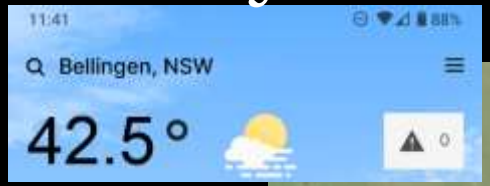
Heat Stress…

- Flying-foxes start suffering from heat stress at around 38°C
- They can start dying from above 42°C
- Mass fatality events can involve up to tens of thousands of animals
- Conditions inside a camp can be hugely different from outside

Know your camp!



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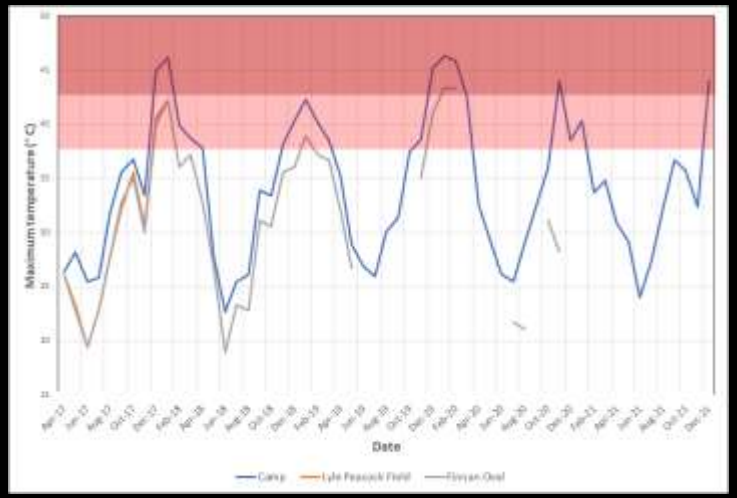

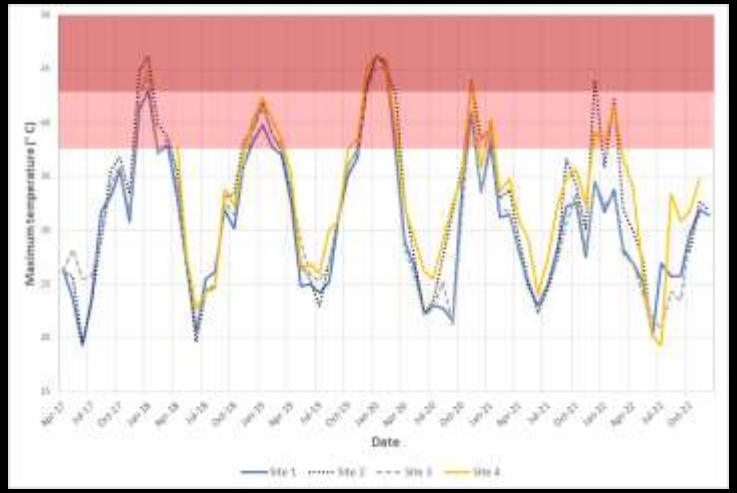

Know your camp!

Year	Site	Days ≥ 38°C	Days ≥ 43°C	Notes
2017	1	1	0	Heatwaves 10-11 Feb, and 14 Dec - no mass mortality recorded
	2	6	3 - Max 44.9°C	
	3	4	0	
	4	N/A	N/A	
2018	1	3	1 - Max 43.0°C	Heatwave 7 Jan, est > 1,000 fatalities
	2	8	1 - Max 46.2°C	
	3	7	1 - Max 44.8°C	
	4	N/A	N/A	
2019	1	7	1 - Max 43.7°C	Heatwave 31 Dec, est. 4,500 fatalities plus extensive pup abandonment
	2	7	1 - Max 43.6°C	
	3	6	1 - Max 43.2°C	
	4	11	2 - Max 45.2°C	
2020	1	7	2 - Max 46.3°C	Heatwave 4 Jan, est. > 1,200 fatalities
	2	11	5 - Max 46.3°C	
	3	6	2 - Max 45.2°C	
	4	8	4 - Max 46.3°C	
2021	1	1	0	No mass mortality recorded
	2	1	0	
	3	1	0	
	4	2	0	
2022	1	0	0	No mass mortality recorded
	2	3	0	
	3	0	0	
	4	3	0	

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A monitoring program should include:

Preferably monthly:

- Rough estimate of numbers present
  - Use whatever method is appropriate for the particular camp, but make it consistent!
- Extent of the roost area
  - Chart the area being used by the bats
- Rough demographics of the population
  - Species, maternity
- Know what's flowering in the area!

❖ Vegetation monitoring

- ❖ Pick some locations in the camp and monitor how they're changing

❖ Environmental monitoring

- ❖ Compare microclimate areas inside the camp, and externally

Other things to consider:

- Data storage and retention
- Data sharing
- Opportunities for Community engagement, Volunteer groups, and Citizen Science
- Encouraging Scientific Research

In conclusion…

- Monitoring is vital to successfully managing flying-fox camps
- A monitoring program doesn’t have to be huge, complex, and expensive to get the basic data needed to assist with camp management
- It does, however, have to take into consideration an individual camp’s characteristics
- Volunteer groups, local Wildlife Rescue, Citizen science, and Scientific research all potentially have a role to play

Thanks to:
Ku-ring-gai Council
Ku-ring-gai Bat Conservation Society
Lake Macquarie Council
Bellingen Council

Picture: Viv Jones