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ADELAIDE FLYING-FOX POPULATION TREND

FINAL

May 2023

SA POWER NETWORKS

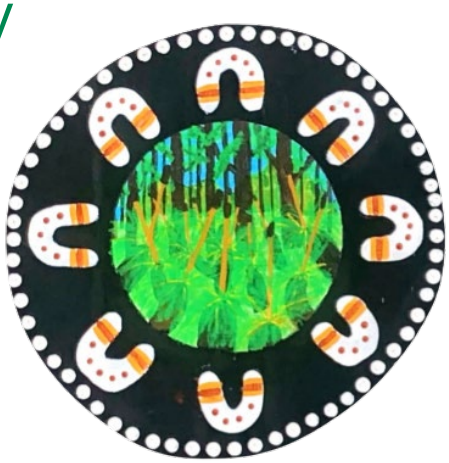
Executive summary

Flying-foxes are keystone species given their contribution to the health, longevity, and diversity of vegetation communities through long-distance seed dispersal and pollination. These ecological services ultimately protect the long-term health and biodiversity of Australia's bushland and wetlands, particularly in the face of threats such as habitat fragmentation and climate change. Despite their importance, living with flying-foxes in urban areas can be challenging for community members and some industries, with impacts associated with noise, odour, faecal drop, damage to vegetation, property, and concern about human and animal health.

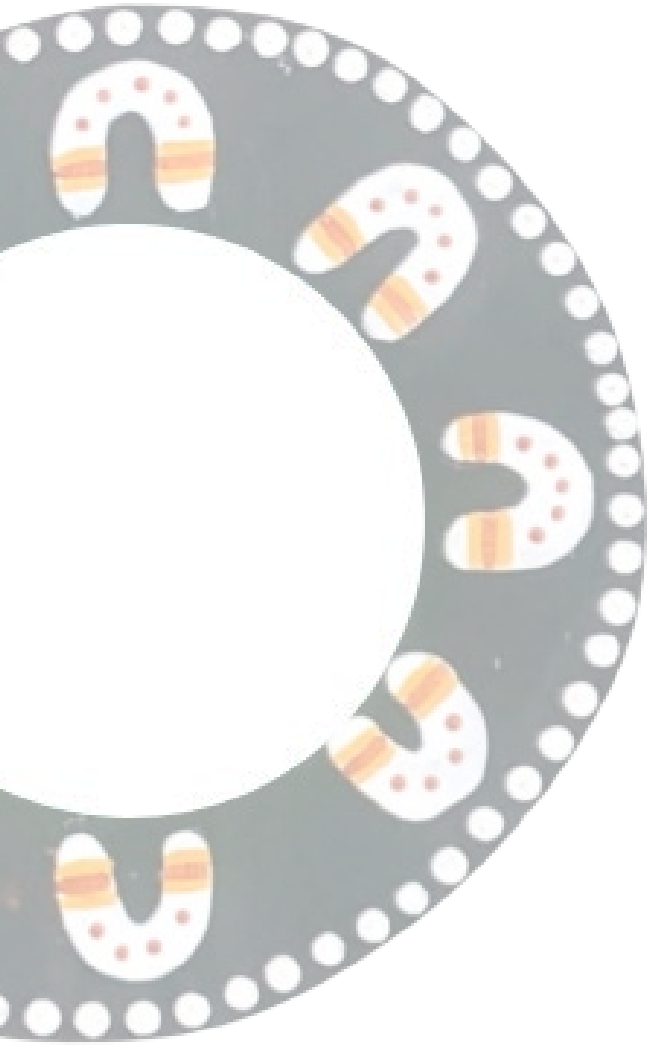
There are currently five known grey-headed flying-fox (*Pteropus poliocephalus*) roosts in South Australia. These are: Adelaide Botanic Park, Port Augusta, Wangolina, Mount Burr, and Dismal Swamp. Botanic Park is the only permanently occupied roost, although monitoring is sporadically conducted at the other sites.

This report outlines the recent establishment of a permanent and growing flying-fox population in South Australia, primarily Adelaide. In the report we compare the growth of roosts across South Australia with the recent establishment of a permanent and growing flying-fox population in Victoria and the increasingly urban populations in Melbourne and Sydney. We conclude that based upon the pattern observed in the Sydney and Melbourne regions, it is likely that the flying-fox population and number of roosts will increase in the Adelaide region and South Australia.

Acknowledgement of Country



Ecosure acknowledge the Traditional Custodians of the lands and waters where we work. We pay deep respect to Elders past and present who hold the Songlines and Dreaming of this Country. We honour and support the continuation of educational, cultural and spiritual customs of First Nations peoples.



Abbreviations

ALA	Atlas of Living Australia
DEW	Department of Environment and Water
FF	Grey-headed flying-fox
NFFMP	National Flying-Fox Monitoring Program
NSW	New South Wales
QLD	Queensland
SA	South Australia

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1 Introduction

SA Power Networks has engaged Ecosure to write a report describing the status and trends of the South Australian (SA) flying-fox population and compare the pattern observed in SA with other urban regions to provide an insight into potential future flying-fox population trends. Roost establishment has been used as a proxy for population data when comparing urban trends.

The grey-headed flying-fox (hereafter FF, *Pteropus poliocephalus*) is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Threatened Species Scientific Committee 2001). Endemic to Australia, the population of this species is found from Port Augusta, South Australia, through to Ingham, Queensland (Westcott et al. 2015).

1.1 Flying-foxes in urban Australia

Over the past 40 years FF have increasingly roosted and foraged within urban areas of Australia (Meade et al. 2021; Timmiss et al. 2021). In 1986 a permanent roost established at the Royal Botanic Garden Melbourne, surrounded by the high-rise and high-density city (Williams et al. 2006). The roost in Melbourne was surprising as it represented a significant southern range expansion, 450 km from the nearest known roost at Mallacoota, on the border between Victoria and New South Wales (NSW). In 1989 a roost established at the Royal Botanic Garden Sydney, surrounded by another high-rise and high-density city. This roost was less surprising as there were five other roosts in the Sydney region, two of these were large roosts that occurred in the urban areas of Cabramatta (up to 30,000 FF) and Gordon (up to 75,000 FF; Larsen et al. 2002).

The Melbourne and Sydney Botanic Garden roosts grew to over 30,000 FF, prompting management action to protect the trees that form part of the living botanical collection. The Melbourne roost was dispersed in 2003, establishing the Yarra Bend and Geelong roosts as no other roosts existed in the region. The Sydney roost was dispersed in 2012, no new roosts established, and the dispersed FF joined the over twenty existing roosts located within 30 km. Monitoring associated with the dispersal showed that over 200 roosts were used by the FF caught at the Sydney roost, the satellite tracked FF moved through NSW, Queensland (QLD) and Victoria (Welbergen et al. 2020). Critically, the FF observed at any roost readily move to near-by and distant roosts in response to food availability.

1.1.1 Flying-foxes in South Australia

Prior to 2010 FF were considered as vagrants or accidental visitors to SA. The Atlas of Living Australia (ALA) notes only five records of FF in SA prior to 2010, near the Victorian border at Mount Gambier and Naracoorte in 1994, 1997, and three in 2007. In all instances a single individual was observed. It is worth noting that in general species occurrence records are incomplete, yet the lack of FF observations highlights how infrequently they historically occurred in SA.

During 2010 the ALA notes 50 records of FF in SA, including several hundred FF roosting in Fullarton, in suburban Adelaide. The persistent presence of FF in Adelaide represents a significant range expansion for this species, with the nearest known roost over 600km away at Geelong, Victoria.

A roost was first observed in the Adelaide suburb of Toorak Garden in April 2010, moving in

May 2010 to Fullarton, and to the Adelaide Botanic Garden in January 2011. It was then actively moved to the adjoining Adelaide Botanic Park, where the colony is located presently. Since 2011 the population has steadily grown, with a peak estimate of 29,700 FF (Figure 1). The population growth observed stems from FF moving into SA primarily through Victoria (Welbergen et al. unpublished data). In addition to FF moving in and out of SA, local population growth is occurring with breeding observed at Adelaide Botanic Park. Arguably only a small number of FF have been locally recruited through reproduction as there have been significant mortalities of adults and pups in association with 11 heat stress events and to a lesser extent due to electrocution on powerlines and other threats.

Aiming to reduce the high incidence of FF mortalities associated with heat stress events, in late 2021 a sprinkler system was installed within the Adelaide Botanic Park. This system adds to the ground sprinkler system that was present to water the grass and has been used during heat stress events. Uniquely for a FF roost sprinkler system, hoses were installed within the canopy with the express aim of wetting (cooling and hydrating) the FF earlier during a heat stress event (see Mo & Roache 2020). Reducing the ambient heat within the roost before the temperature becomes leathal was seen as desirable for this roost as the FF have been observed to move from the roost to the River Torrens and the Adelaide Botanic Garden seeking water and more shaded vegetation (Department of Environment and Water (DEW), pers. comm.).

2 Methods

Flying-fox population estimates, presence, and roosting records were sourced from the Atlas of Living Australia (ALA), the National Flying-Fox Monitoring Program (NFFMP), and published literature (Atlas of Living Australia, 2023; van der Ree et al. 2009; Westcott et al. 2015; Williams et al. 2006). The ALA database collates and assesses the quality of biodiversity records from a range of sources including citizen scientist reports, industry and expert surveys, and State and Territory databases, such as the Biological Databases of South Australia.

The NFFMP is a joint Commonwealth and State funded initiative, coordinated by CSIRO in partnership with State agencies. The quarterly counts are conducted by a mix of volunteers and staff, using several methods (Westcott et al. 2015). The two main FF counting methods are a diurnal 'static count' or a sunset 'fly-out count'. Both methods provide an estimate of the number of FF, in most cases both methods are likely to underestimate the true number of FF. Research is ongoing to improve and validate FF counting methods (McCarthy et al. 2021; Westcott and McKeown 2004; Westcott et al. 2018).

3 Results

3.1 Adelaide flying-fox population growth

The Adelaide FF population has grown from a few hundred individuals in 2010 to a peak of 30,000 FF in 2022 (Figure 1). The population increased gradually from 2010, reaching 5000 FF in November 2016. Significant population growth then occurred, reaching 10,000 FF in May 2017 and 20,000 in August 2018. The next phase of population growth was observed in November 2020, reaching 27,000 FF, followed by November 2021 reaching almost 30,000. We note that data is missing for parts of 2020 and 2021 due to Covid lockdowns and that the data for 2023 is not available (NFFMP 2023).

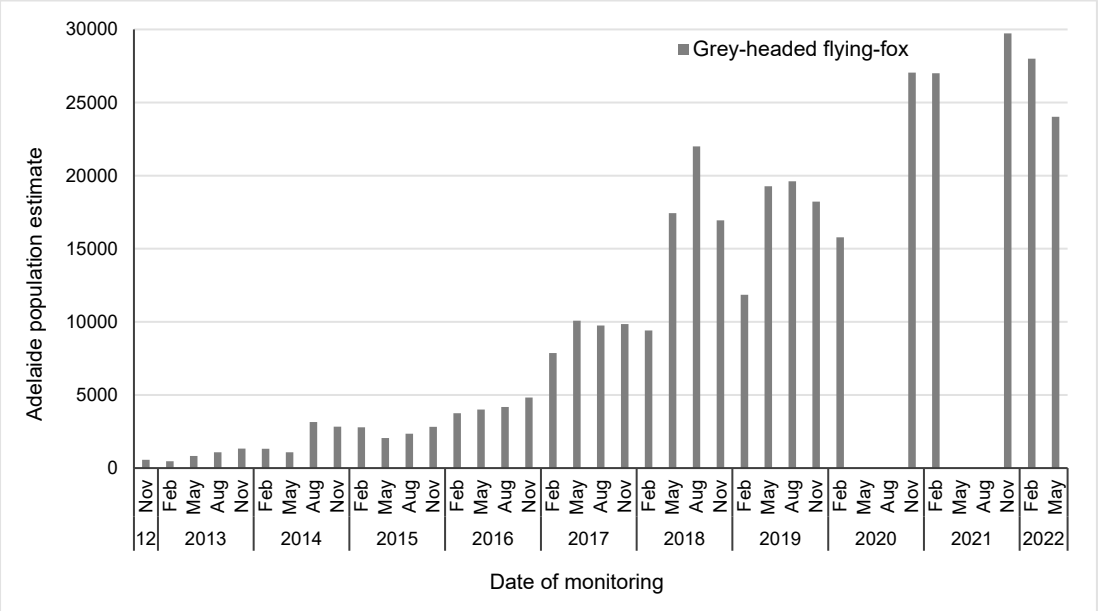


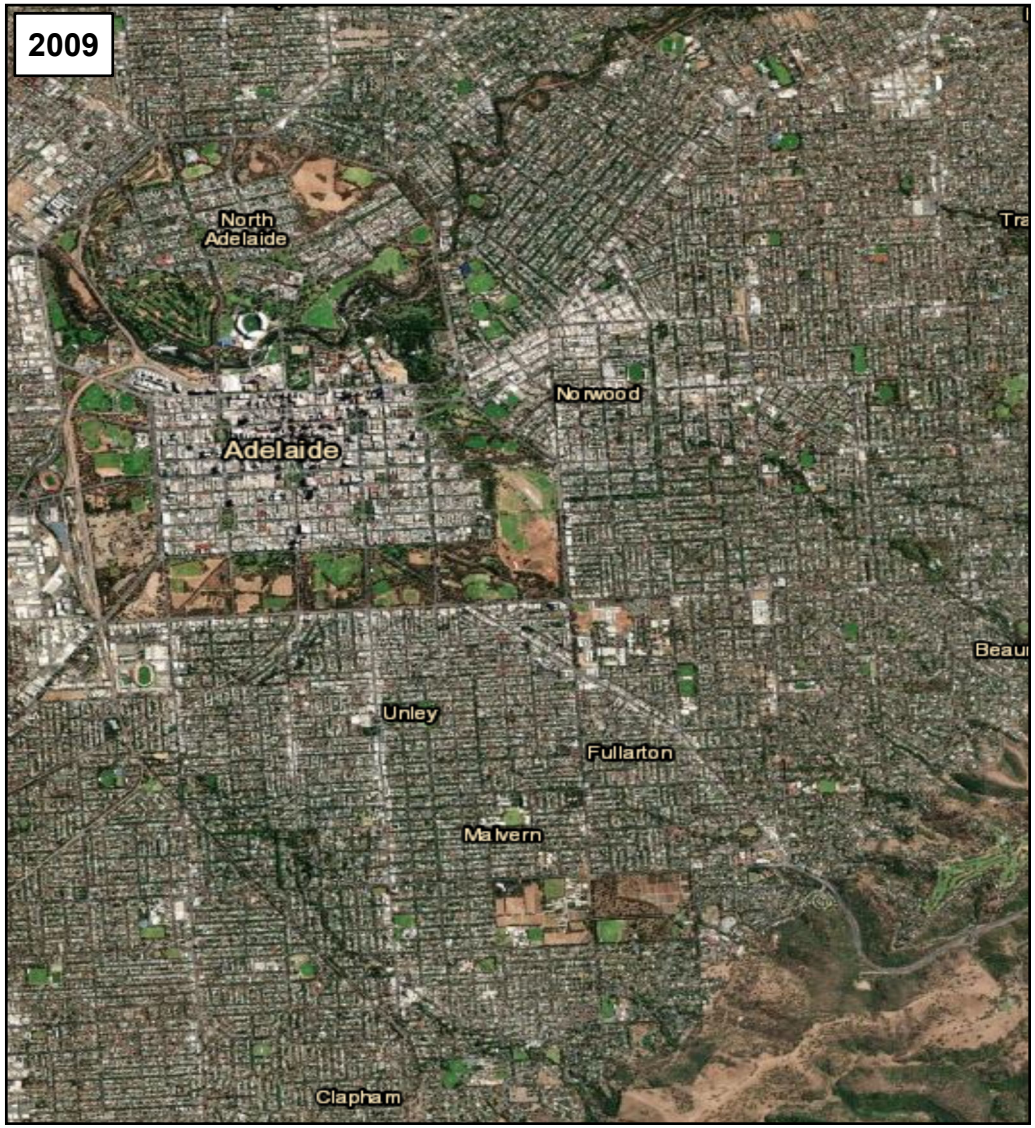
Figure 1 Grey-headed flying-fox population estimate at the Adelaide Botanic Park roost, as reported to the National Flying Fox Monitoring Program. Surveys were conducted quarterly; four surveys are missing due to Covid lockdown.

3.1.1 Flying-foxes in South Australia

In 2009 no FF roosts had been observed in SA (Figure 2). Only five observations of individual FF are recorded in the ALA. In April 2010 the first observation of FF roosting in SA was documented, with 30 observed in Naracoorte. The number grew quickly to approximately 600 roosting FF. Later that April, 20 FF were observed roosting in Toorak Gardens, in Adelaide. In May over 300 were observed roosting in Fullarton, in Adelaide, with the number quickly increasing to approximately 1,300 during May 2010.

During 2010 two observations were recorded of FF roosting at the Adelaide Botanic Garden. However, it wasn't until January 2011 that multiple FF roosted at this site, including female FF carrying pups; incidentally, this is the first record of FF breeding in SA. Consistent roosting of approximately 150 FF was observed during April and May, no other roosting was recorded in the Adelaide region or SA suggesting that over 1,000 FF flew back to Victoria, although this is unknown. During 2011 a roost nudging program was implemented to move the FF from Adelaide Botanic Garden to Adelaide Botanic Park, this is where the roost is currently located.

To learn more about FF movements in Adelaide and SA, and in particular their roosting behaviour, a GPS tracking project was conducted (see Yabsley et al. 2022). Tracking of adult FF with solar powered GPS transmitters, caught at Adelaide Botanic Park, identified movements from Adelaide to Victoria and back, with FF roosting at Port Augusta, Wangolina, Mount Burr, and Dismal Swamp (Figure 3). Subsequent surveys of the roost locations identified through GPS tracking confirmed the presence of FF roosting periodically at these sites.



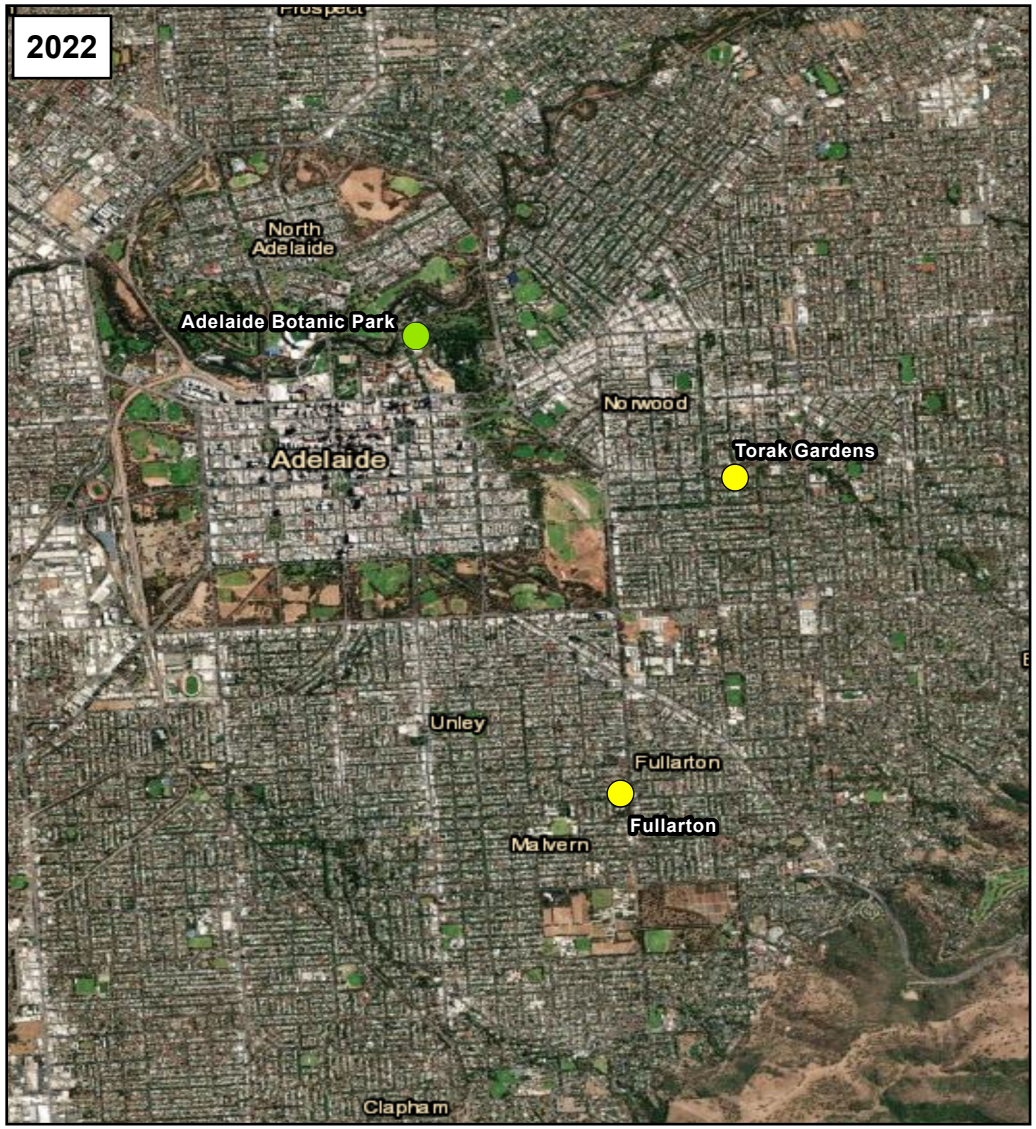


Figure 2: Roost locations of grey-headed flying-fox within the Adelaide region

South Australia Power Network

Adelaide Flying-Fox Population Trend

Temporary roost 2010

Roost present

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Author: KF
Date: 8/05/2023

0 1 2 4
Kilometers

Data Sources: Ecosure Pty Ltd, 2023; Image: Service Layer Credits: World Imagery: Earthstar Geographics
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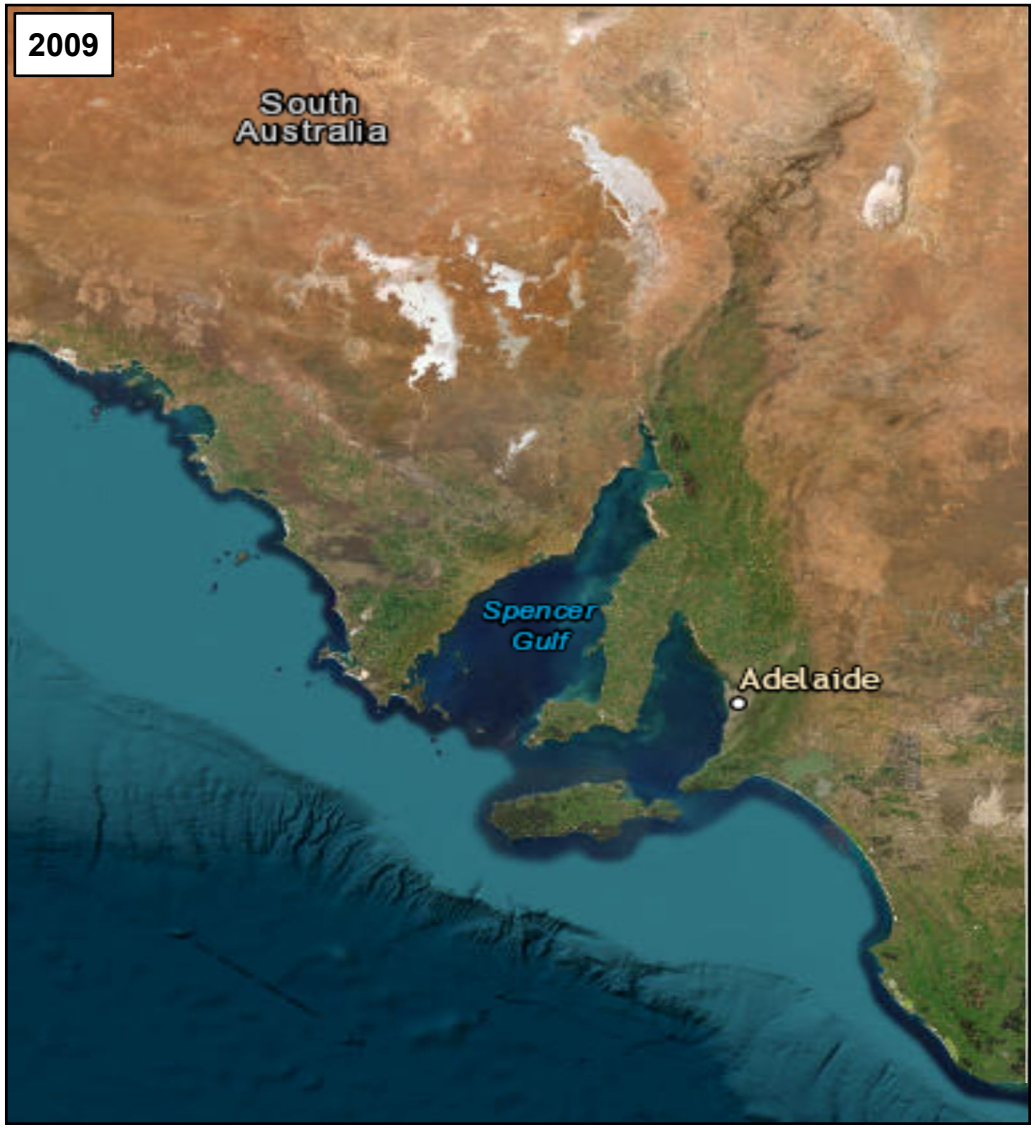

Figure 3: Roost locations of grey-headed flying-fox within the South Australia

South Australia Power Network

Adelaide Flying-Fox Population Trend

Temporary roost 2010

Roost present

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improving ecosystems

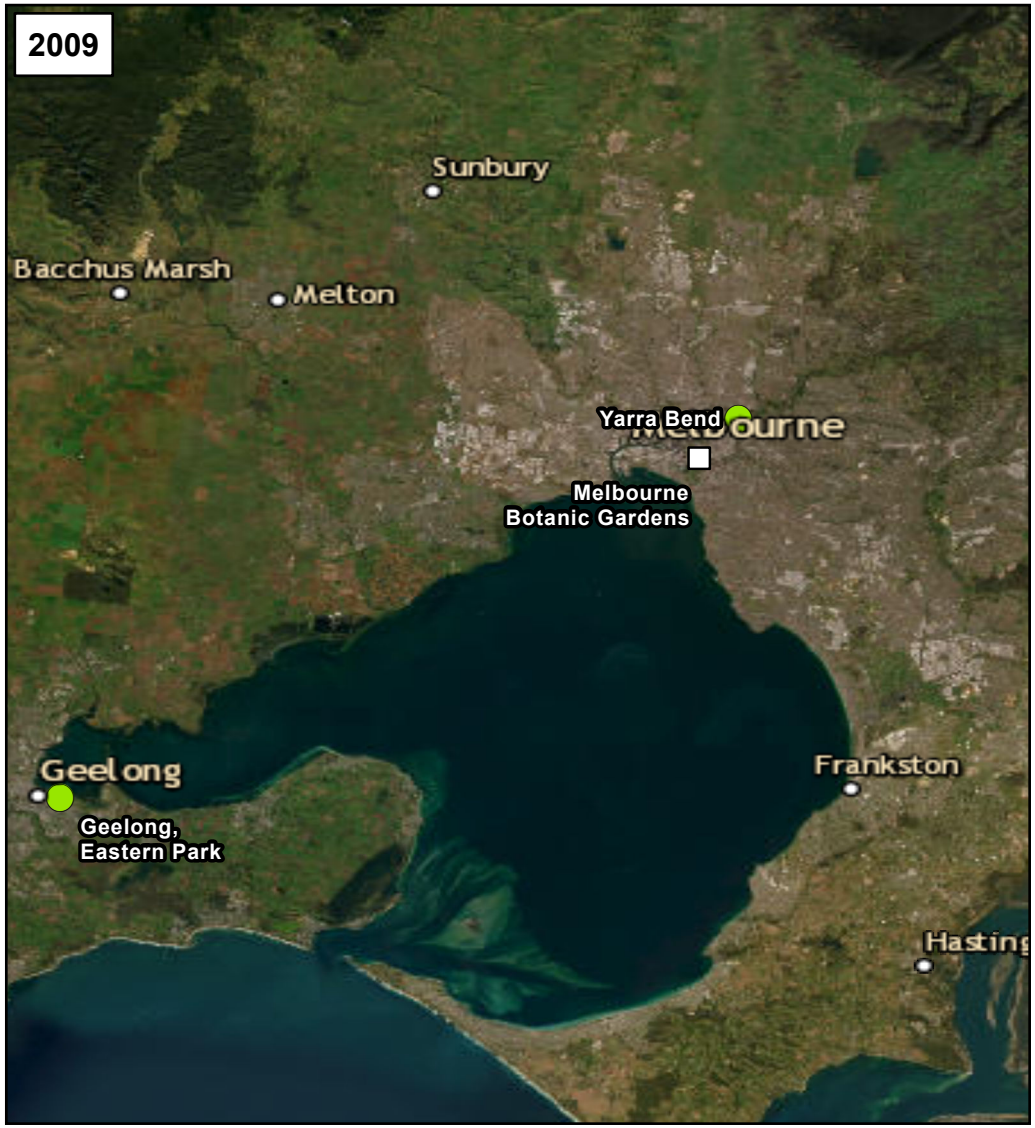
Job number: PR8072
Revision: 0
Author: KF
Date: 8/05/2023

0 100 200 300
Kilometers

3.2 Flying-foxes in Victoria

Flying-foxes were first recorded in Melbourne in 1986, at this time two infrequently used roosts were known in regional Victoria. In recent years two urban Melbourne roosts have established, Doveton and Werribee (Figure 4), in addition to Yarra Bend and Geelong which both established in 2003 following the dispersal of the roost at the Royal Botanic Garden Melbourne.

By 2009 FF had established a permanent presence across Vicotria utilising at least nine roosts. Since 2009 FF have continued to establish new roosts and increasingly large numbers of FF have been recorded roosting across the 33 known sites (Figure 5). The additional roost sites have often occurred in regional towns, including Bendigo, Bairnsdale, Colac, Hexham, Warburton, and Warrnambool. The Yarra Bend roost in Melbourne generally supported the largest number of FF, with up to 50,000 recorded.



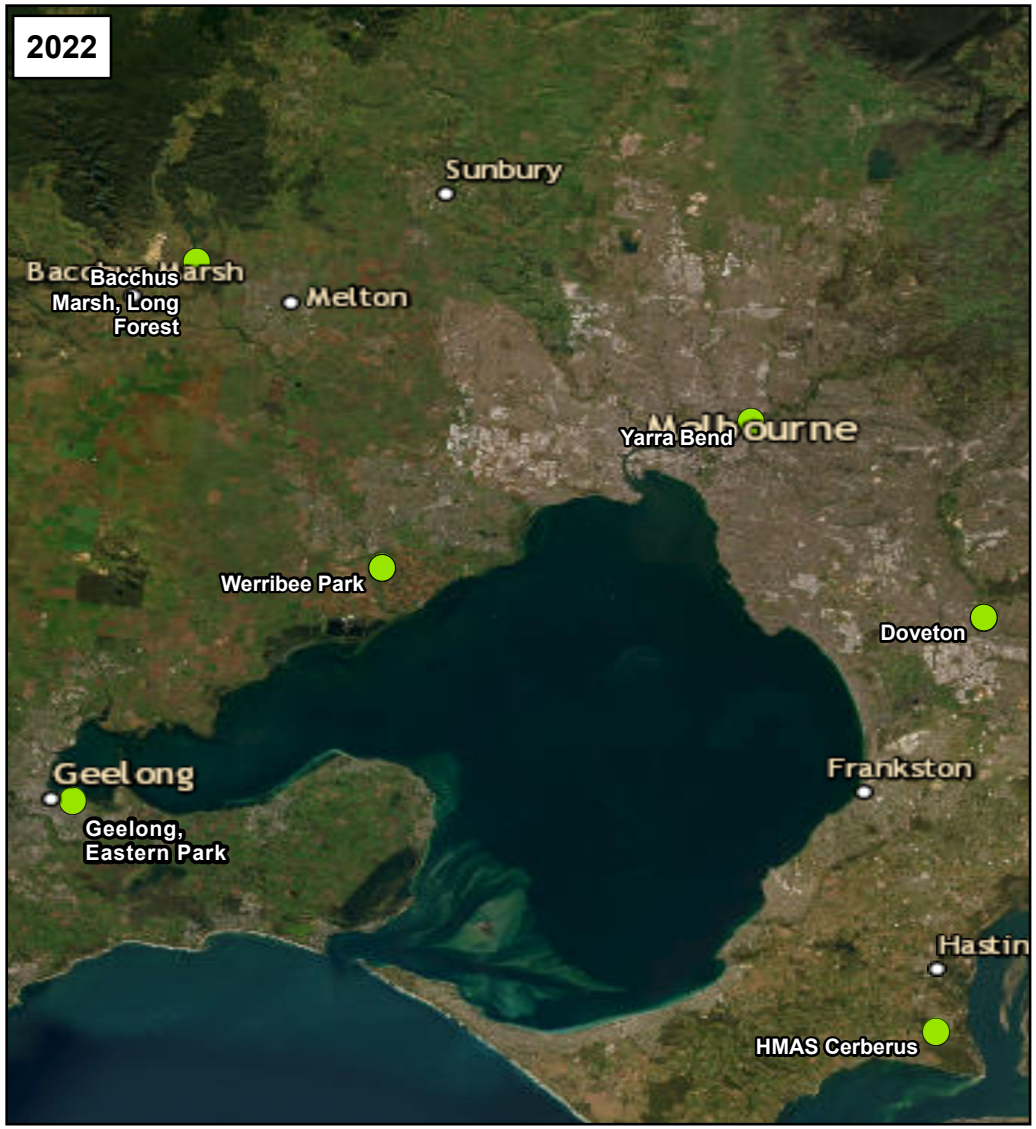


Figure 4: Roost locations of grey-headed flying-fox within the Melbourne region

South Australia Power Network

Adelaide Flying-Fox Population Trend

Roost present

Dispersed roost

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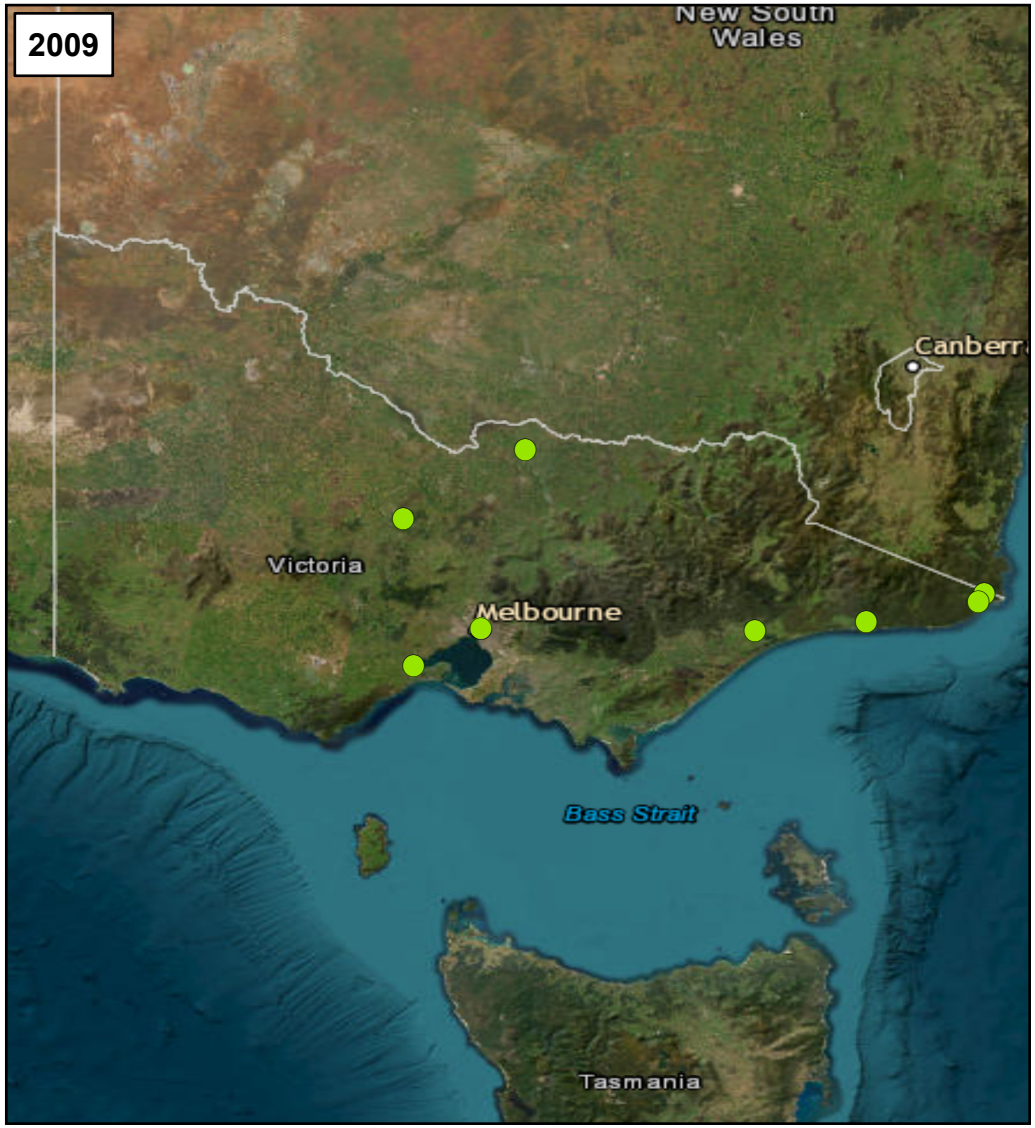
Author: KF
Date: 8/05/2023

0 12.5 25 50
Kilometers



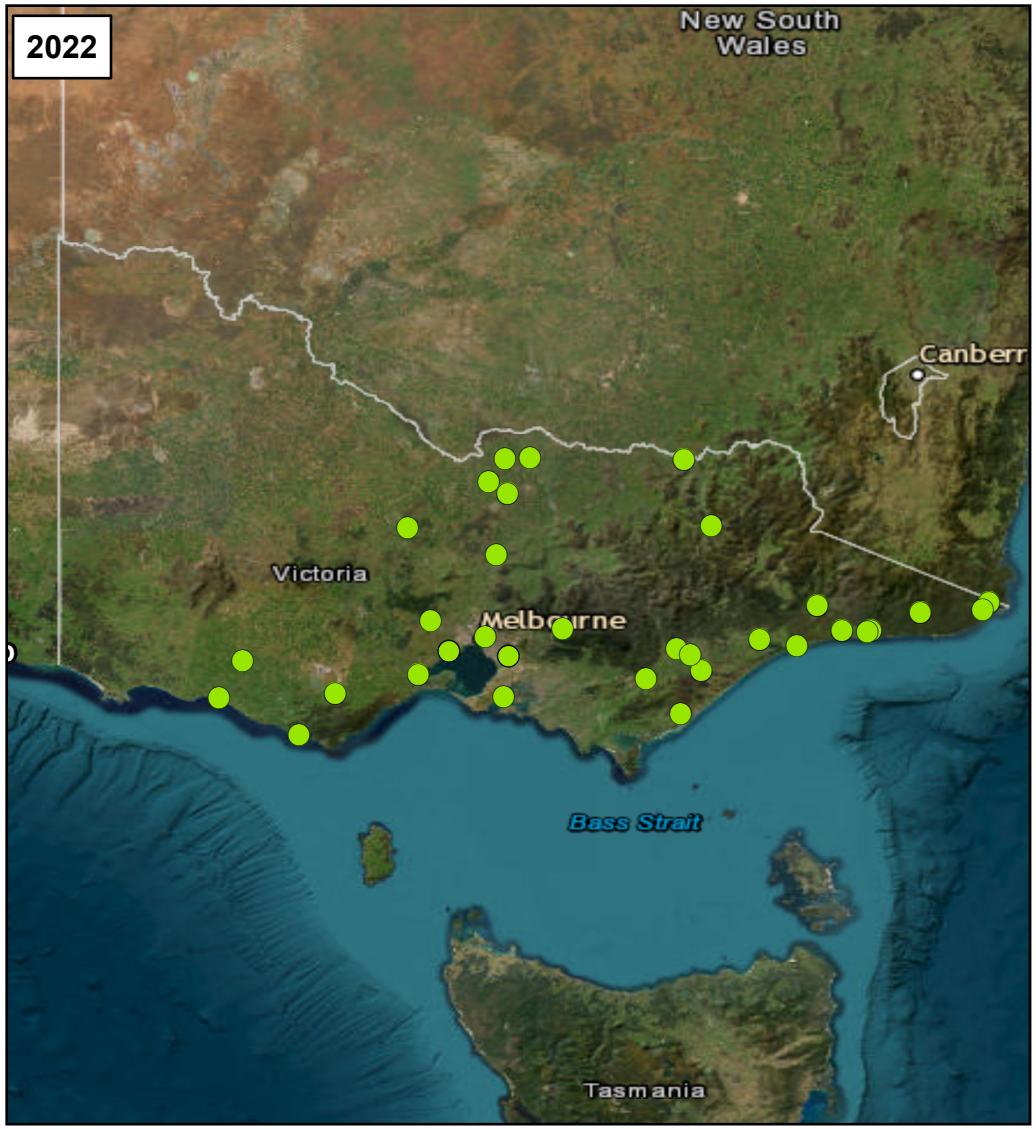


Figure 5: Roost locations of grey-headed flying-fox within Victoria.

South Australia Power Network

Adelaide Flying-Fox Population Trend

Roost present

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Author: KF
Date: 8/05/2023

0 125 250 500
Kilometers

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World Boundaries and Places: Esri, HERE, Garmin.

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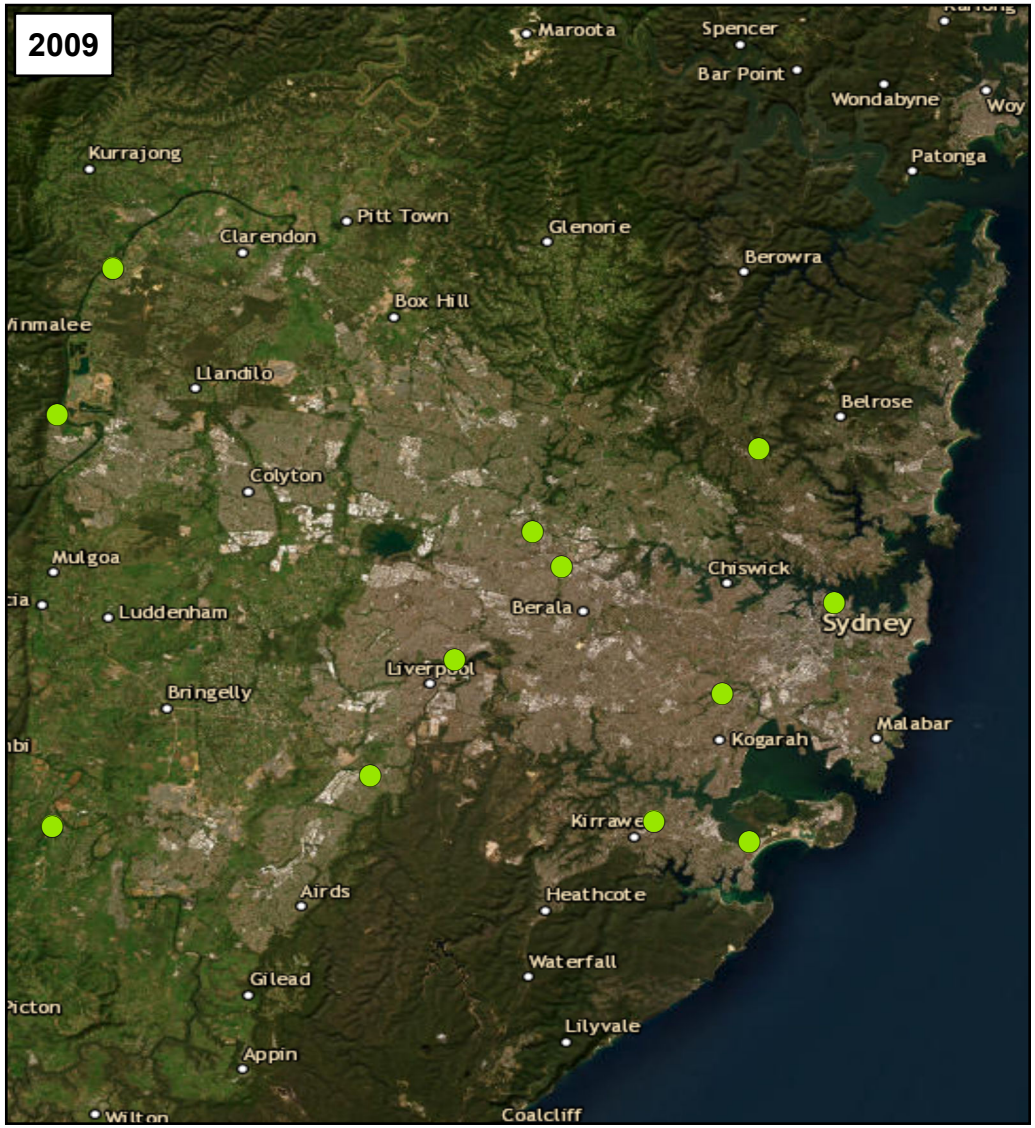
3.3 Flying-foxes in the Sydney region

As of 2009, FF in the Sydney region had been recorded at 12 roosts, 10 of which occurred in urban areas (Figure 6). This included the roost that established at the Royal Botanic Garden Sydney in 1989, a highly urban site. In 2010 a regional food shortage event occurred, and FF were observed to roost in new locations, closer to the limited food resources available. Several of these roosts were subsequently established as permanent roosts. As of 2022, the number of FF roosts had doubled to 24 in the Sydney region (Figure 6). Over 150,000 FF have been recorded roosting in the Sydney region across these sites (NFFMP, unpublished data).



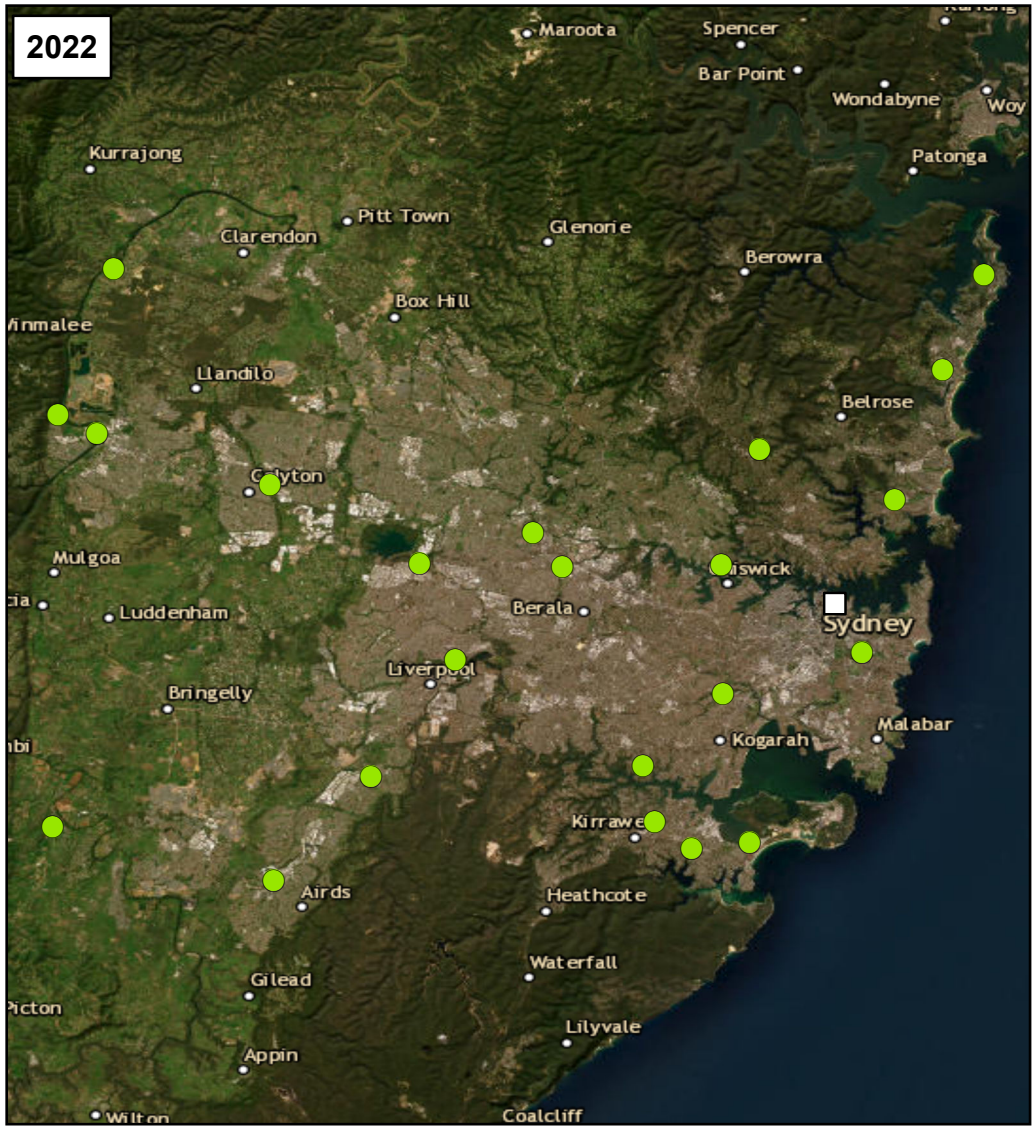


Figure 6: Roost locations of grey-headed flying-fox within the Sydney region

South Australia Power Network

Adelaide Flying-Fox Population Trend

Roost present

Dispersed roost

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Author: KF
Date: 8/05/2023

0 10 20 40
Kilometers

Data Sources: Ecosure Pty Ltd, 2023; Image: Service Layer Credits: World Imagery: Earthstar Geographics
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4 Discussion

Increased diversity of plant species in the Adelaide region provides additional foraging resources that support the FF population (Yabsley et al. 2022). Many of the introduced species are native to eastern Australia and are known as FF forage plants. An increase in the diversity of plant species suitable for FF foraging was also noted as a likely driver of the establishment of a permanent roost in Melbourne (Williams et al. 2006). Over the past 40 years the Melbourne and Victorian FF population has increased from a few hundred animals sporadically present during the 1980's (Atlas of Living Australia 2023) to peaks of over 200,000 FF present across the state (NFFMP 2023). Based upon the observed FF population growth across Victoria and the increased population and number of roosts in SA, we can speculate that the FF population in SA and the Adelaide region will continue to increase.

Flying-foxes are otherwise known as fruit bats; however, they predominantly forage upon the nectar from eucalypt blossom. Mass flowering events recorded in eastern Australia has seen over 300,000 FF temporarily roosting in urban areas including Batemans Bay and Tamworth in regional NSW (NFFMP 2023). The establishment of new roosts, temporary or permanent, can occur in response to the availability of abundant foraging resources; such an event may be the catalyst for the establishment of a new roost in the Adelaide region or other urban areas of SA.

4.1 Flying-fox urbanisation

Three concurrent examples have been presented demonstrating significant increases in FF use of Australian cities for roosting and foraging. It is noteworthy that historically FF were infrequently observed in the Sydney region, being noted as seasonal visitors from northern NSW and QLD. Furthermore, historically FF were rarely observed in Victoria with sporadic observations recorded in the ALA of single individuals between 1869 and 1981 (Atlas of Living Australia 2023). Consequently, FF were not recorded in SA until 1994, and this was a deceased individual found in Mount Gambier, approximately 17 km from the Victorian border. It is worth noting that presence records are incomplete, yet the 1994 record suggests FF rarely visited SA during the twentieth century.

Across Australia FF have been documented to be increasingly common in urban areas. For the four mainland species of FF between 42-59% of roosts occur in urban areas (Timmiss et al. 2021). Food has been highlighted as the driver, with FF in urban areas found to travel shorter distances compared to FF in non-urban areas (Meade et al. 2021). Consequently, it is speculated that FF are likely to increasingly roost and forage in urban areas.

4.1.1 Flying-foxes in Adelaide

Over the past decade the FF population has significantly increased in the Adelaide region. The population growth can be interpreted to represent that there is an abundance of foraging resources. Significant FF mortalities have occurred due to heat stress, the sprinkler system installed in 2021 aims to reduce this threat and increase local breeding success (DEW pers. comm.). Sprinkler systems are being installed around Australia, however there is limited data informing this method; Adelaide presents an opportunity for research. At most roosts we see a seasonal variation in the number of FF present, this was documented for the Adelaide roost (Figure 1). This reflects the high mobility of this species with individuals readily moving between Victoria and SA, searching for foraging resources. The high mobility of this species, capable of travelling over 300 km in a night between roosts (Welbergen et al. 2020), enables the rapid establishment of new roosts when abundant foraging resources are available.

5 Conclusion

The grey-headed flying-fox population has dramatically increased in SA, and specifically Adelaide, over the past decade. This increase represents a significant range expansion, driven by FF moving from Victoria and possibly NSW into SA. The population growth observed indicates that Adelaide is an attractive roost and foraging region. The consistent large number of FF roosting in Adelaide over the past five years suggests that foraging resources in the region are abundant, and likely to be able to support a larger number of FF than have been recorded to date.

In addition to the movement of FF into SA, breeding has been recorded at the Adelaide roost, representing local population recruitment if not population growth. Eleven heat stress events have killed a significant number of adults and pups in many years. Efforts by local wildlife care groups has resulted with several hundred pups being locally released over recent years. The additional threat of electrocution on powerlines has emerged, in addition to posing a threat to FF there is also an impact to households and businesses when power outages occur. The electrocution of FF is expected to continue in association with the consistent large number of FF roosting and breeding in Adelaide. Based on the pattern observed in the Sydney and Melbourne regions, it is likely that the FF population and number of roosts will increase in the Adelaide region.

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Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	05/05/2023	Adelaide Flying-Fox Population Trend	Dr John Martin, Environmental Scientist	Carla McKevitt, Senior Ecologist	Jess Bracks, Principal Wildlife Biologist
01	10/5/2023	Adelaide Flying-Fox Population Trend-Final	Dr John Martin, Environmental Scientist	Carla McKevitt, Senior Ecologist	Carla McKevitt, Senior Ecologist

Distribution List

Copy #	Date	Type	Issued to	Name
1	10/05/2023	Electronic	SA Power Networks	Eirin Lawton
2	10/05/2023	Electronic	Ecosure	Administration

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