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**SOUTH AUSTRALIAN  
FLYING-FOX CAMP TRENDS**

October 2024

**SOUTH AUSTRALIAN POWER NETWORKS**

## Executive summary

The grey-headed flying-fox (*Pteropus poliocephalus*) is listed nationally as vulnerable to extinction. This species is well known in Queensland, New South Wales, and Victoria; historically there are a small number of records of individual grey-headed flying-foxes and little red flying-foxes (*P. scapulatus*) in South Australia. However, in 2010 the first grey-headed flying-fox camp established in Adelaide, South Australia. Since then, the number of flying-foxes in South Australia has dramatically increased to a peak of over 46,000 in 2023. The number of recognised camps has also increased to eight with three new camps identified during 2024.

Grey-headed flying-fox movements from the eight camps occur across an area of approximately 80,000 km<sup>2</sup> of southeast South Australia, as shown through GPS tracking in 2020. Whereas during 2024 flying-foxes were recorded across an area of approximately 120,000 km<sup>2</sup>; this larger area stems from observations and is likely to be an underestimate. As such, additional flying-fox camps (locations currently unknown) already exist on a temporary basis across a larger extent of South Australia than is currently understood and documented. These temporary camps may become permanent in the future, supporting further increases in the number of flying-foxes and increases in the distribution of flying-foxes across suitable habitat in South Australia.

This report outlines the recent establishment of a permanent and growing flying-fox population in South Australia, primarily Adelaide. We conclude that based upon the pattern observed it is likely that the flying-fox population and number of camps will increase in the Adelaide region and across South Australia. Increased numbers of flying-foxes across a larger area of South Australia are likely to result with a higher frequency of electrocutions and associated power outages. We reiterate:

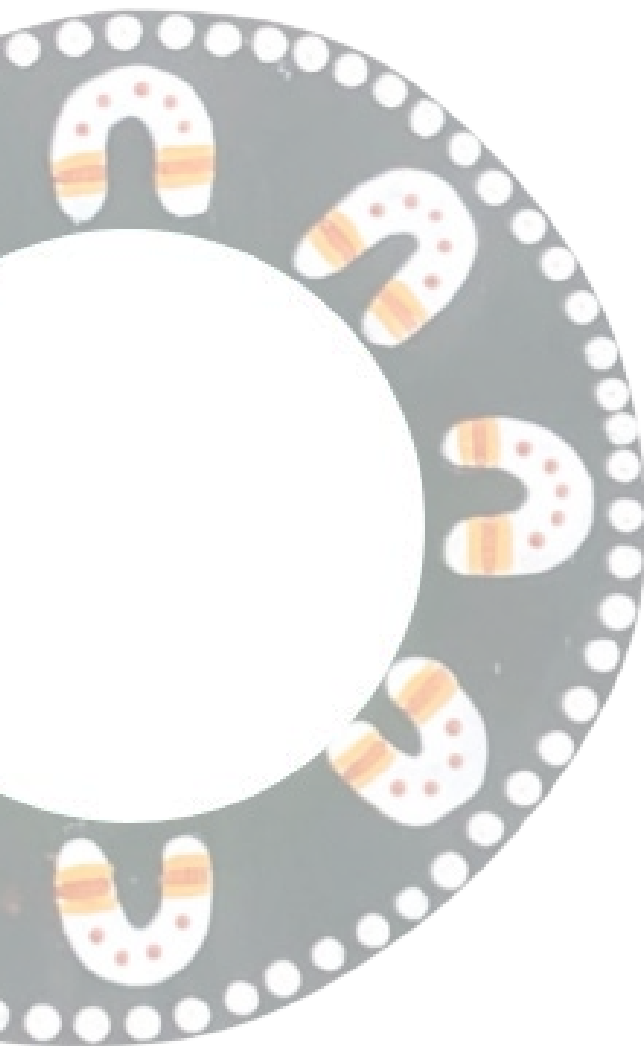
- it is likely that the flying-fox population and number of camps will increase in the Adelaide region
- it is likely that the flying-fox population and number of camps will increase in South Australia.

*This report is intended to be published on the Australian Energy Regulator's website as part of SA Power Networks' revised regulatory proposal.*



## 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.



## Acknowledgements

We thank Jason Van Weenen and Dr Liberty Olds from the Department of Environment and Water and Adam McKeown from CSIRO for contributing flying-fox population and camp location data. We acknowledge the data contributed by the community and scientists to the Biological Database of South Australia and the Atlas of Living Australia. We acknowledge the data contributed by the wildlife care community and South Australian Power Networks regarding flying-fox electrocutions.

## Acronyms and abbreviations

ALA	Atlas of Living Australia
BDBSA	Biological Database of South Australia
DEW	Department of Environment and Water
GHFF	Grey-headed flying-fox
LRFF	Little red flying-fox
NFFMP	National Flying-Fox Monitoring Program
SA	South Australia

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# 1 Introduction

South Australia Power Networks has engaged Ecosure to update a report written in 2023 describing the status and trends of the flying-fox population in South Australian (SA) (Ecosure 2023). Two species of flying-fox have been recorded in SA. The grey-headed flying-fox (GHFF; *Pteropus poliocephalus*) is listed as vulnerable to extinction under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Threatened Species Scientific Committee 2001). Endemic to Australia, the GHFF is found from Port Augusta, South Australia, through to Ingham, Queensland (Westcott et al. 2015). The little red flying-fox (LRFF; *P. scapulatus*) occurs from Port Augusta, South Australia, around the east and north coast through to Shark Bay, Western Australia. The LRFF has the largest distribution of the four mainland Australian flying-fox species. Both species are protected in SA under the *National Parks and Wildlife Act 1972*.

## 1.1 Flying-foxes in South Australia

### 1.1.1 Historical flying-fox observations in South Australia

Prior to 2010 flying-foxes were considered as vagrants or accidental visitors to SA. The Atlas of Living Australia (ALA) and Biological Database of South Australia (BDBSA) note 19 records of flying-foxes in SA prior to 2010. The first four presence records document LRFF in 1936, 1968, 1981, and 1986. Following this, GHFF were observed near the Victorian border at Mount Gambier and Naracoorte in 1994, 1997, 2003, and 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 observations highlights how infrequently flying-foxes historically occurred in SA.

### 1.1.2 Establishment of flying-foxes in South Australia

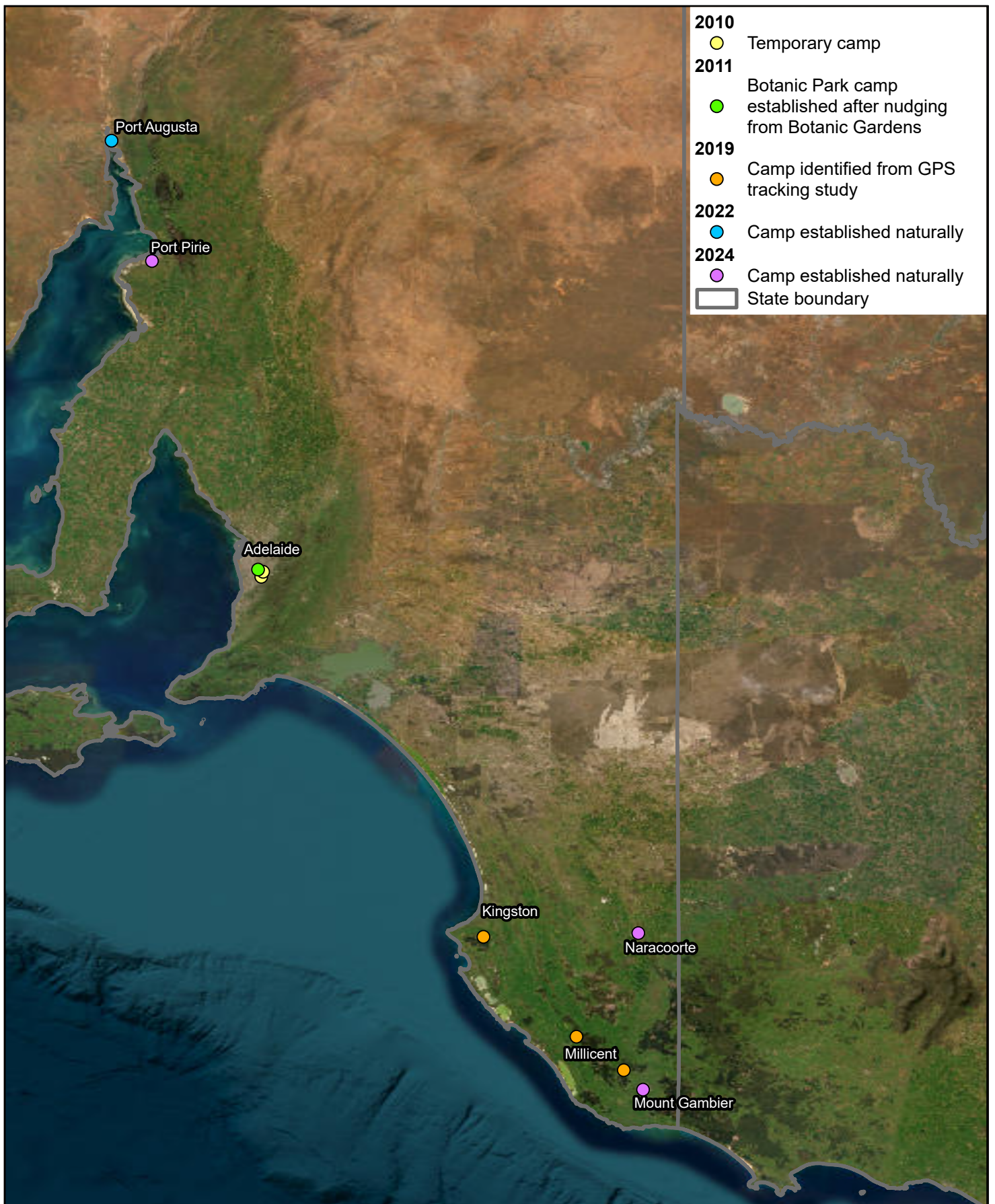
For 2010 the ALA and BDBSA contain 49 records of GHFF and one record of LRFF in SA, more than doubling the number of observations recorded over the previous 80 years. These observations include several hundred GHFF roosting in Toorak Garden, in suburban Adelaide (Figure 1). The persistent presence of GHFF in Adelaide represents a significant range expansion for this species, with the nearest known roost over 600 km away at Geelong, Victoria. Since 2010 over 700 records of GHFF have been documented in SA (Figure 2).

A camp 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 46,000 GHFF (Figure 3). The population growth observed stems from GHFF moving into SA primarily through Victoria, as demonstrated through GPS tracking individuals caught in Adelaide (Figure 4). In addition to GHFF moving in and out of SA, local population growth is occurring with breeding observed at Adelaide Botanic Park. Arguably only a small number of GHFF have been locally recruited through reproduction as there have been significant mortalities of adults and pups in association with 11 heat stress events (Department of Environment and Water (DEW), pers. comm.) and to a lesser extent due to electrocution on powerlines (Figure 5) and other threats.

Aiming to reduce the high incidence of flying-fox mortalities associated with heat stress events, in late 2021 a sprinkler system was installed within 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 flying-fox camp sprinkler system, hoses were installed within the canopy with the express aim of wetting (cooling and hydrating) the GHFF earlier during a heat stress event (see Mo & Roache 2020). Reducing the ambient heat within the camp before the temperature becomes lethal was seen as desirable for this camp as the GHFF have been observed to move to the River Torrens and the Adelaide Botanic Garden seeking water and more shaded vegetation (DEW, pers. comm.). It is noteworthy that the aim of the sprinkler system is to reduce heat stress mortalities. If successful, a direct outcome will be increased survival of adult GHFF and pups born at Adelaide Botanic Park. Increased survival of adults and pups supports population growth, however GHFF are highly mobile and readily move from Adelaide across SA to Victoria and elsewhere.



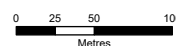


**Figure 1: Grey-headed flying-fox camps in South Australia**

South Australia Power Networks  
 Flying-fox population trend 2024

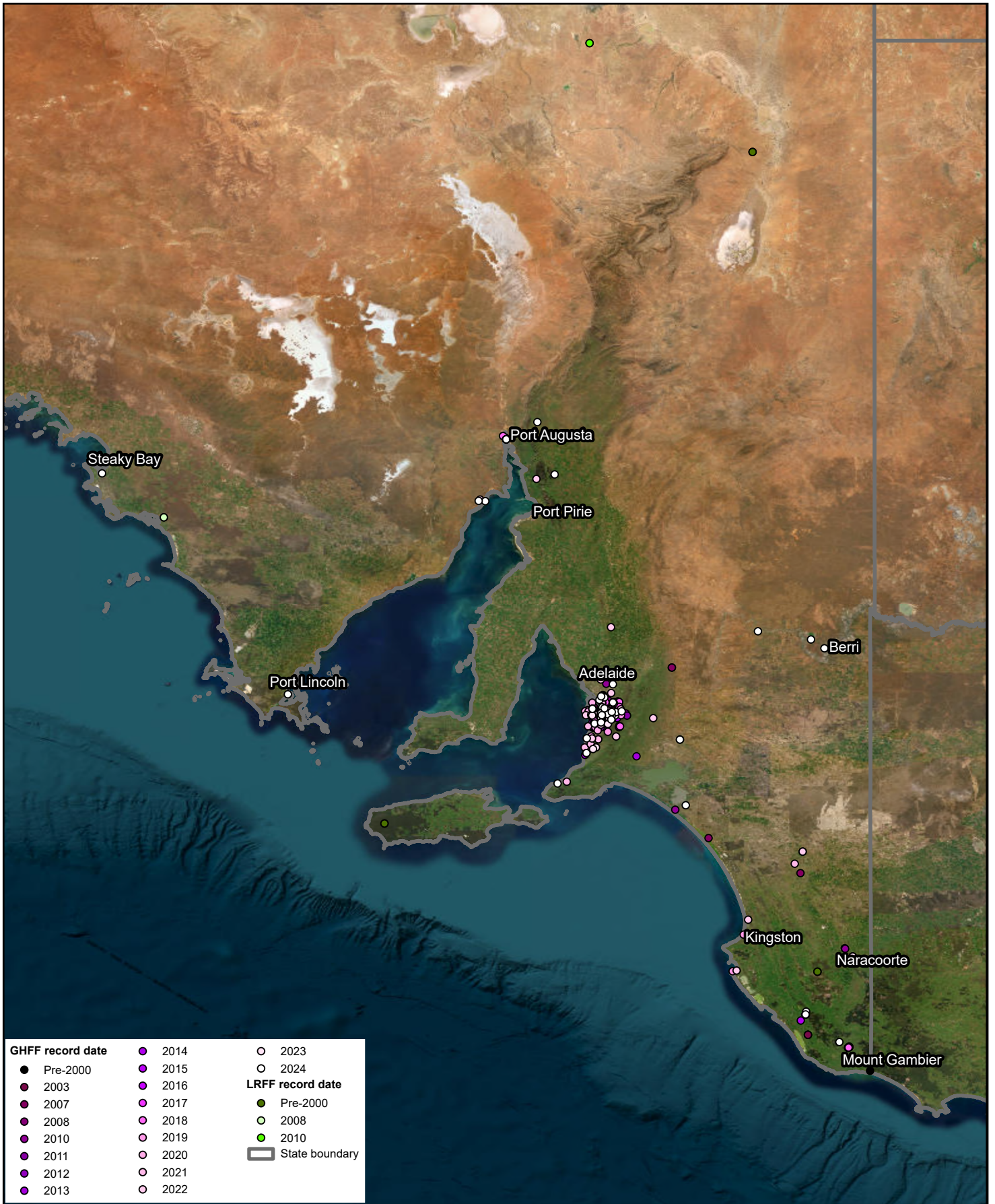


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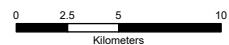


**Figure 2: Wildlife database records of flying-foxes in South Australia**

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## 2 Methods

Flying-fox population estimates, presence, and camp location records were sourced from the ALA, BDBSA, and the National Flying-Fox Monitoring Program (NFFMP) (Atlas of Living Australia 2024). 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 BDBSA. We note that the ALA and BDBSA contained some overlap and unique records of flying-foxes in SA.

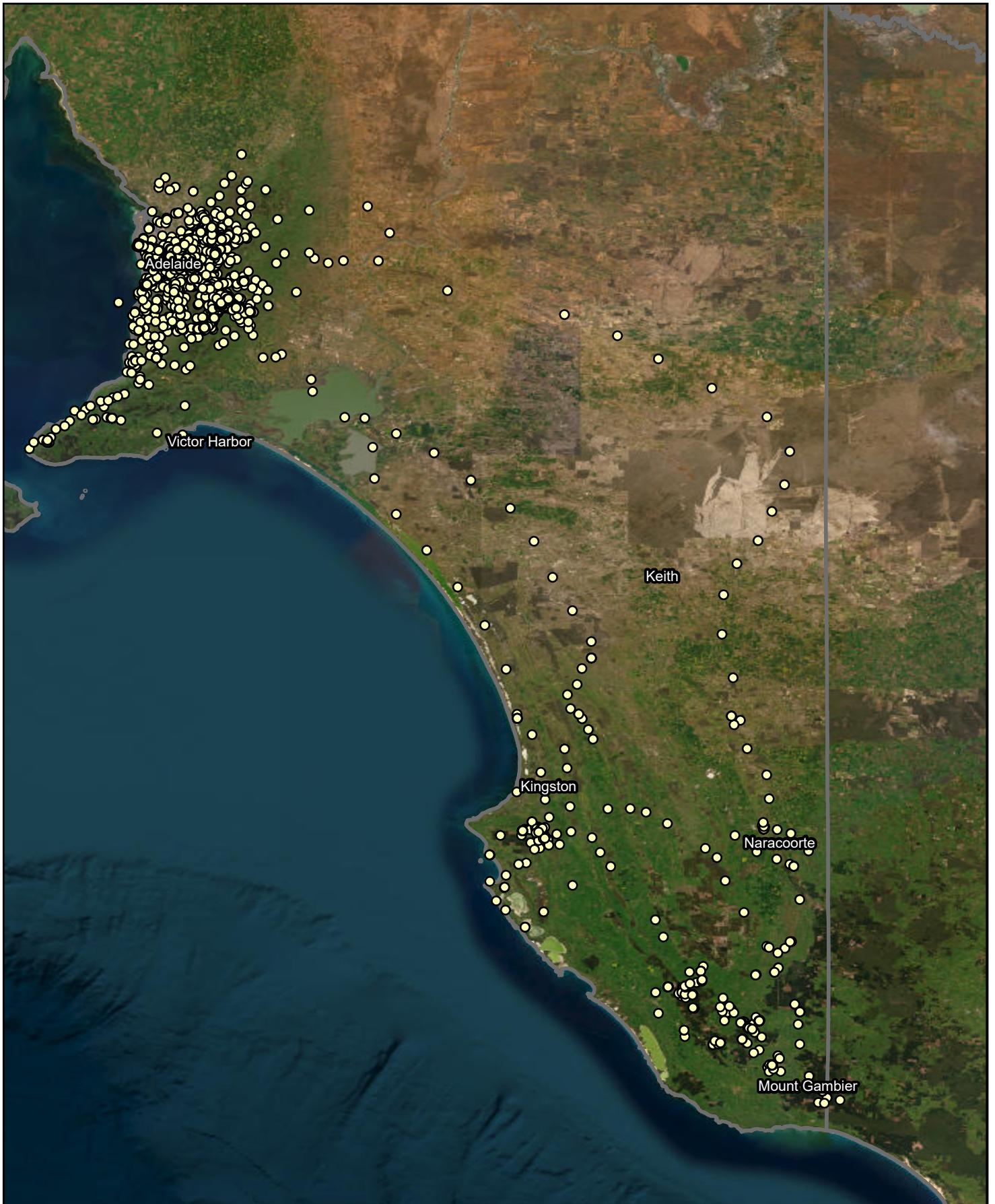
The NFFMP is a joint Commonwealth and State funded initiative, coordinated by CSIRO in partnership with State agencies. Quarterly counts are conducted by a mix of volunteers and staff, using several methods (Westcott et al. 2015). The two main flying-fox counting methods are a diurnal 'static count' or a sunset 'fly-out count'. Both methods provide an estimate of the number of flying-foxes, in most cases both methods are likely to underestimate the true number of flying-foxes. Research is ongoing to improve and validate flying-fox counting methods (McCarthy et al. 2021; Westcott and McKeown 2004; Westcott et al. 2018; Vanderduys et al. 2024).

To learn more about the habitat use and movement behaviour of GHFF, DEW funded a GPS tracking project. In 2019 four adult male and four adult female GHFF were caught at Adelaide Botanic Park and fitted with solar recharging GPS transmitters (see Yabsley et al. 2022). Daily camp and nightly foraging movement data was collected across late 2019 and 2020.

The records of GHFF electrocutions come from the South Australian Power Networks database of outages and maintenance. Additional data comes from two volunteer wildlife care groups, Bat Rescue South Australia and Fauna Rescue South Australia.

It is important to note that these data sources have limitations. As such, this data provides valuable insights yet underestimates the number of flying-foxes, camps, electrocutions, and the distribution of flying-foxes across SA.





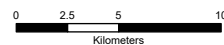
**Figure 3: Grey-headed flying-fox movements shown by GPS tracking from Adelaide Botanic Park 2019-2020**

South Australia Power Networks  
 Flying-fox population trend 2024

○ GHFF GPS location  
 □ State boundary

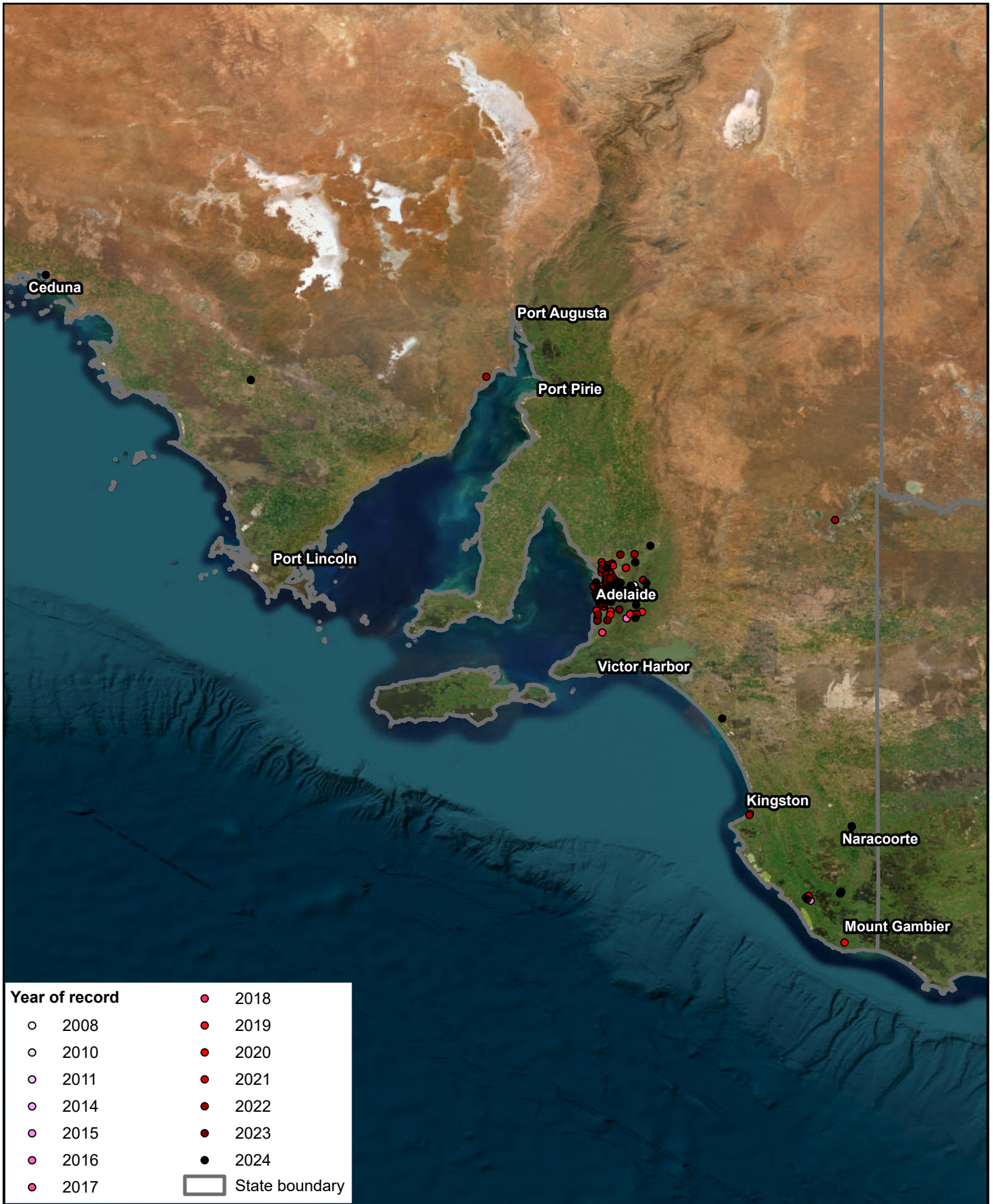


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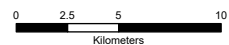


**Figure 4: Recorded flying-fox electrocutions on powerlines in South Australia**

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## 3 Results

### 3.1 Flying-fox population growth in South Australia

The Adelaide GHFF population has grown from a few hundred individuals in 2010 to a peak of ~46,000 in 2023 (Figure 5). The population increased gradually from 2010, reaching ~5000 GHFF in November 2016. A significant population increase occurred over the next two years, reaching ~22,000 in August 2018. The next phase of population increase was observed in November 2020, reaching ~27,000 GHFF. Another significant population increase was observed in November 2023, reaching ~46,000.

A clear trend of population increase is shown, despite this there are periods where the population decreases, for example, February 2019, May 2022, and August 2024 (Figure 5). These population fluctuations are observed at the camp, state, and national scales (Vanderduys et al. 2024). The number of flying-foxes in an area is determined by the availability of food locally and across the species distribution.

We note that data is missing for parts of 2020 and 2021 due to Covid lockdowns (Vanderduys et al. 2024). Additional surveys were undertaken during 2023 and 2024; we have requested this data from DEW.

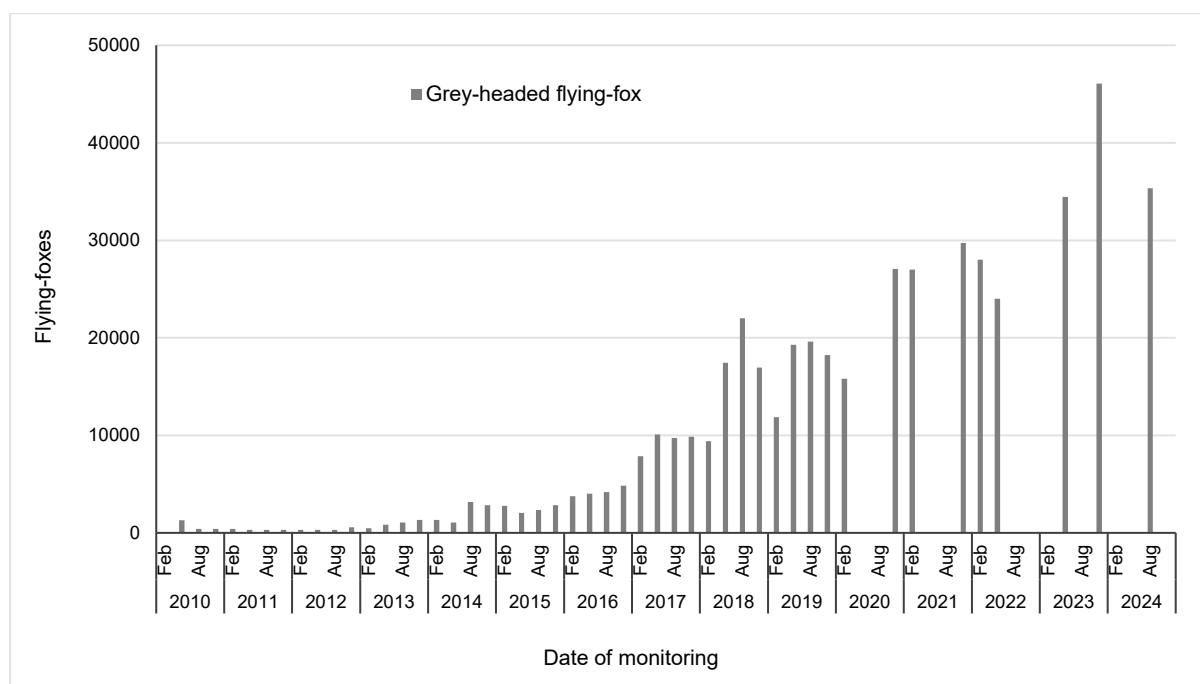


Figure 5 Grey-headed flying-fox population estimates at the Adelaide Botanic Park camp. Counts conducted by the Department of Environment and Water. Four surveys are missing due to Covid lockdown in 2020 and 2021. Additional data has been requested for 2022-2024.

#### 3.1.1 Flying-foxes in South Australia

Prior to 2010 no flying-fox camps had been observed in SA (Figure 6; Figure 7). In April 2010 the first observation of a temporary camp in SA was documented, with 30 GHFF observed in Naracoorte. The number grew quickly to approximately 600 roosting GHFF. Later that April, 20 GHFF were observed in a temporary camp in Toorak Gardens, in Adelaide. This site was

abandoned and in May over 300 were observed roosting in a temporary camp in Fullarton, in Adelaide. Later that May 2010, the number increased to approximately 1,300 GHFF.

During 2010 two observations were recorded of GHFF roosting at the Adelaide Botanic Garden. However, it wasn't until January 2011 that multiple GHFF roosted at this site, including female GHFF carrying pups. Incidentally, this is the first record of flying-foxes breeding in SA. Consistent roosting of approximately 150 GHFF was observed during April and May 2011, no other roosting was recorded in the Adelaide region or SA suggesting that over 1,000 GHFF had flown back to Victoria, although this is unknown. During 2011 a program was implemented to move the GHFF from Adelaide Botanic Garden to Adelaide Botanic Park, this management action is known as 'nudging'. The GHFF were moved to where the camp is currently located in Adelaide Botanic Park.

To learn more about GHFF movements in Adelaide and SA, and particularly their roosting behaviour, GPS tracking was conducted (see Yabsley et al. 2022). Tracking over a one year period identified GHFF movements from Adelaide to Victoria and back (Figure 3), with camps identified at Wangolina, Mount Burr, and Dismal Swamp (Figure 1; Figure 6). Subsequent surveys of these locations confirmed the presence of GHFF camps periodically at these sites, forming the stepping stones between Adelaide and Melbourne.

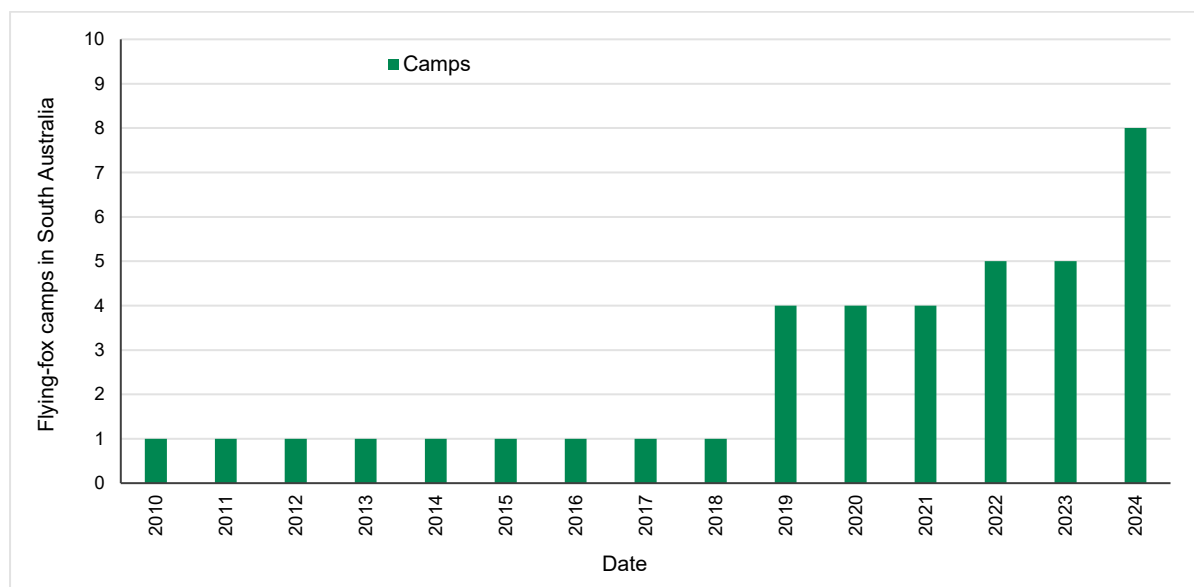
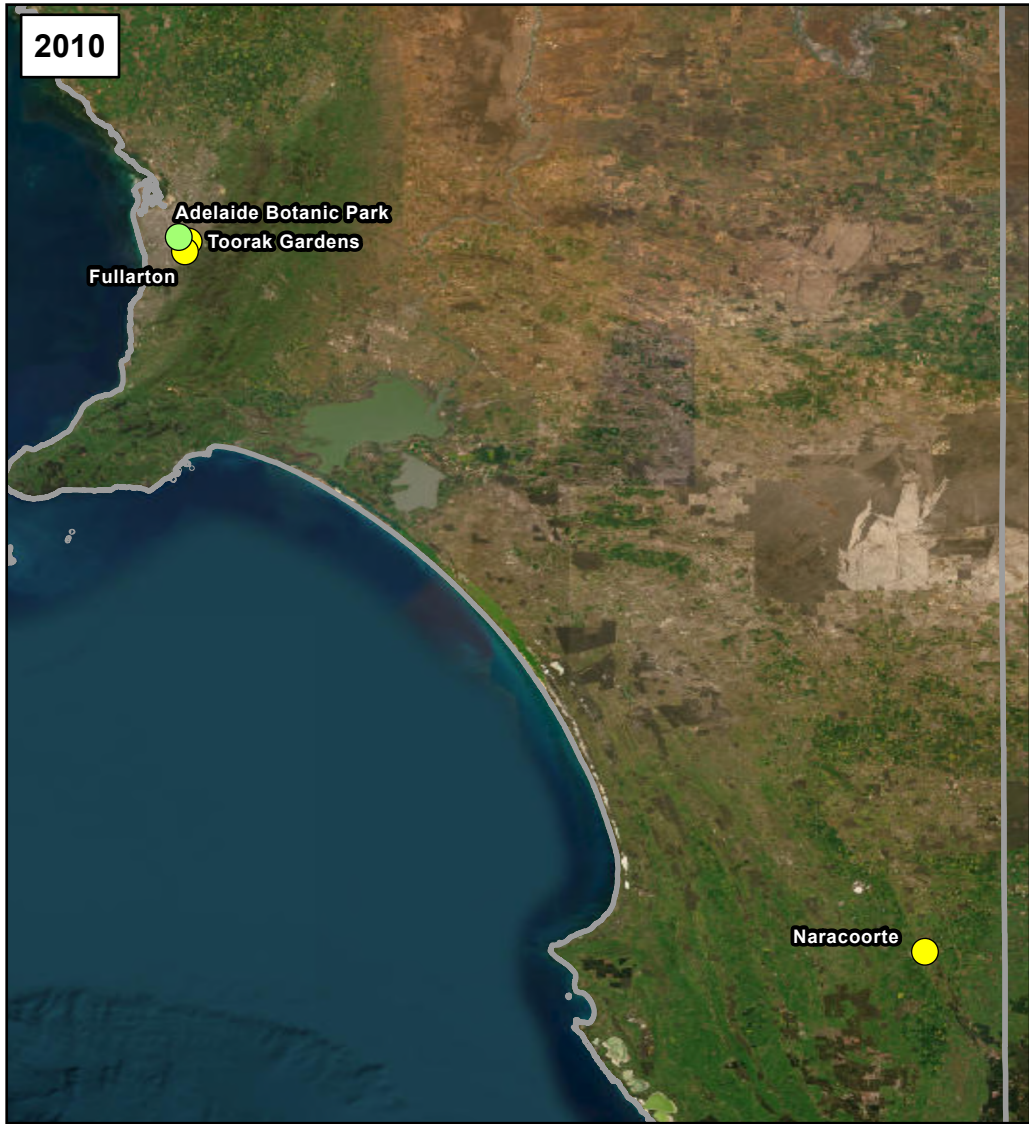


Figure 6 Increasing number of established grey-headed flying-fox camps in South Australia



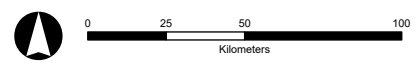
**Figure 7: Initial camp locations of grey-headed flying-fox within South Australia**

South Australia Power Networks  
 Flying-Fox population trend 2024

- Temporary camp 2010
- Established camp



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## 4 Discussion

A dramatic increase in the GHFF population in SA has been observed since the observation of the first camp in 2010. The majority of the GHFF have been observed in the Adelaide region. GPS tracking shows their nightly foraging movements predominantly occur in an area covering approximately 1,500 km<sup>2</sup>. GPS tracking also shows that their movements between Adelaide and Victoria covers an area of approximately 80,000 km<sup>2</sup>. Yet this species is increasingly being observed across new areas of SA. The current estimate is that GHFF are moving across approximately 120,000 km<sup>2</sup> of SA. It is likely that GHFF will increasingly use this larger part of SA and neighbouring areas.

In SA, GHFF are spreading into new areas, establishing temporary camps as they move. With time some of these camps are likely to support growing numbers of GHFF and may transition to permanent camps. Since 2010 the number of camps has grown to eight; additional temporary camps have and do exist.

Increased diversity of plant species in urban areas of SA provide attractive foraging resources that support increasing numbers of GHFF (see Yabsley et al. 2022). Many of the introduced species are native to eastern Australia and are known as flying-fox forage plants. An increase in the diversity of plant species suitable for flying-fox foraging was also noted as a likely driver of the establishment of a permanent camp in Melbourne (Williams et al. 2006). Over the past 40 years the Melbourne and Victorian flying-fox population has increased from a few hundred animals sporadically present during the 1980's (ALA 2024) to peaks of over 200,000 flying-fox across the state (Vanderduys et al. 2024). Based upon the observed flying-fox population increase across Victoria and the increased population and number of camps in SA, we can speculate that the number of flying-foxes and camps across SA will continue to increase.

We can anticipate continued GHFF population spread, with existing camps supporting larger numbers and the establishment of new camps. It is likely that the number of GHFF in South Australia will increase; the rate of increase is currently unknown. Critically, GHFF are highly mobile, forming a single national population. The number of GHFF in an area is dependent on the availability of food locally and nationally, as large aggregations of several hundred thousand GHFF have been temporarily observed in response to mass flowering events (Vanderduys et al. 2024).

### 4.1 Flying-fox urbanisation

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

#### 4.1.1 Flying-foxes in Adelaide

Over the past decade the flying-fox 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 flying-fox 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 camps we see a seasonal variation in the number of flying-fox present, this was documented for the Adelaide camp (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 camps (Welbergen et al. 2020), enables the rapid establishment of new camps when abundant foraging resources are available.

The number of flying-foxes in an area is determined by the availability of food locally and across the species distribution. The Adelaide camp count data clearly indicates an increasing population trend, and periods where the population decreases (Figure 5). In general, a seasonal pattern of population increase is observed, peaking around April-May, with the smallest number of GHFF often observed during winter (Vanderduys et al. 2024). Tracking data shows that GHFF may be roosting away from established camps or may be roosting at new or unknown camps (Welbergen et al. 2020). Given the mobility of this species, the population fluctuations observed occur at the camp, state, and national scales (Vanderduys et al. 2024) as determined by food availability.

#### 4.1.2 Flying-fox mobility

GHFF fitted with satellite transmitters at the Botanic Garden Sydney camp moved through New South Wales, Queensland, and Victoria (Welbergen et al. 2020). Critically, this tracking showed that the GHFF observed at a camp readily move to near-by and distant camps in response to food availability. This study recorded GHFF move to over 200 different camps over the first year, demonstrating that the population is connected across the species distribution and readily moves between camps. Each camp can be considered a node in a network or camps rather than an individual GHFF 'home'.

GHFF GPS tracked from Adelaide Botanic Park were recorded moving over 200 km in a single night (J. Martin unpub. data). GHFF have been recorded moving over 300 km in a single night (Welbergen et al. 2020), indicating they can readily move from Adelaide to Port Augusta, to Port Lincoln, to Streaky Bay. Our current understanding is that food availability drives GHFF movements, so a period of abundant flowering is likely to see an influx of GHFF to known or new areas across SA. Additional GPS tracking would provide valuable information, especially if GHFF were deployed with transmitters across SA.



## 5 Conclusion

The GHFF population has dramatically increased in SA, and specifically Adelaide, over the past decade. This increase represents a significant range expansion, driven by GHFF moving from Victoria and possibly New South Wales into SA. The population growth observed indicates that SA is an attractive region. The consistent large number of GHFF roosting in the Adelaide Botanic Park camp suggests that foraging resources in the Adelaide region are abundant, and likely to be able to support a larger number of flying-foxes than have been recorded to date. Increased numbers of GHFF in the Adelaide region is likely to lead to the establishment of new camp(s) in the Adelaide region. Increased numbers of GHFF in SA is also likely to lead to the establishment of new camps.

In addition to the movement of GHFF into SA, breeding has been recorded at the Adelaide Botanic Park camp, 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. Electrocutation on powerlines has emerged as a significant source of mortality, in addition to posing a threat to the nationally vulnerable GHFF there is also an impact to households and businesses when power outages occur. The electrocution of GHFF is expected to continue in association with the consistent large number of flying-fox roosting and breeding in SA. Based on the pattern observed in the Sydney and Melbourne regions (Ecosure 2023), it is likely that the GHFF population and number of camps will increase where suitable habitat occurs across SA.

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## Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	4/10/2024	South Australian Flying-fox Camp Trend Draft	Dr John Martin, Senior Ecologist	Mitch Horan, Senior Ecologist	Jess Bracks, Principal Wildlife Biologist
00	29/10/2024	South Australian Flying-fox Camp Trend.FI	Dr John Martin, Senior Ecologist	Heather Richards, Senior Environmental Scientist	

## Distribution List

Copy #	Date	Type	Issued to	Name
1	29/10/2024	Electronic	SA Power Networks	Eirin Lawton
2	29/10/2024	Electronic	Ecosure	Administration

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