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Subject: 2018 Winter Nest Box Monitoring – Newcastle Gas Storage Facility

This report outlines the 2018 findings of the annual nest box monitoring program on the Newcastle Gas Storage Facility (NGSF) site at Tomago, NSW.

Background

In August 2012, 100 nest boxes were installed on AGL owned land adjacent to the NGSF as a requirement under Section 75J of the *Environmental Planning & Assessment Act 1979*, Application No. MP 10_0133. Due to the low number of large trees in regenerating native forest at the site the Minister for Planning and Infrastructure required 80 boxes to be mounted on treated timber posts which were cemented into the ground. The remaining boxes were placed on trees in mature forest. Four different box types were installed to suit a variety of arboreal mammals including:

- Sugar/Squirrel Glider (40 boxes);
- Brushtail/Ringtail Possum (15 boxes);
- Pygmy-possum (15 boxes); and
- Microchiropteran bat (30 boxes).

The Fauna Hollow Management Plan (AGL, 2012) specified annual inspections of boxes over five years to evaluate native fauna usage, and to ensure they remain operational and available for use.

Following the 2014 monitoring surveys, nine nest boxes were found to be destroyed by fire. All nine boxes were replaced in September 2014.

Monitoring methods

Two Kleinfelder staff with experience and accreditation in handling animals and working at heights attended the site on the 4th and 14th of June 2018.

Nest boxes were monitored using a wireless GoPro™ camera mounted on an extension pole capable of reaching heights of over 6 m. A live video feed is transferred wirelessly from the camera to an iPhone device capable of capturing HD images or videos. Images were captured in the field and processed in the office.

A handheld Global Positioning System (GPS), pre-loaded with co-ordinates, was used to locate the boxes. Once a box was located, the pole camera was used to open the lid and to observe the contents.

Status of the boxes were recorded as either:

- A – Animal present;
- E1 – Fresh evidence of use (i.e. fresh nest or scats);
- E2 – Moderately fresh evidence of use (i.e. green leaves but beginning to age);
- E3 – Old signs of use (i.e. old leaf nest, old scats);
- N – No evidence of use;
- NA – Not available for use; and
- X – Missing.

If a box was found to be occupied, an attempt was made to capture the animal for positive identification and to evaluate the health of the animal.

Signs of use include the presence of hair, scats or nesting material.

Boxes which contained wasp nests or other pest species, had lids which were open or missing, or had fallen or were missing/destroyed were deemed to be not available for use by target animals.

Results

In 2018, the total number of boxes exhibiting any signs of use was 58% compared to 52% in 2017, 54% in 2016, 62% in 2015 and 40% in 2014 (**Figure 1**). A total of 93 boxes were available for use in 2018 compared to 84 in 2017, 95 in 2016, 97 in 2015 and 81 boxes in 2014.

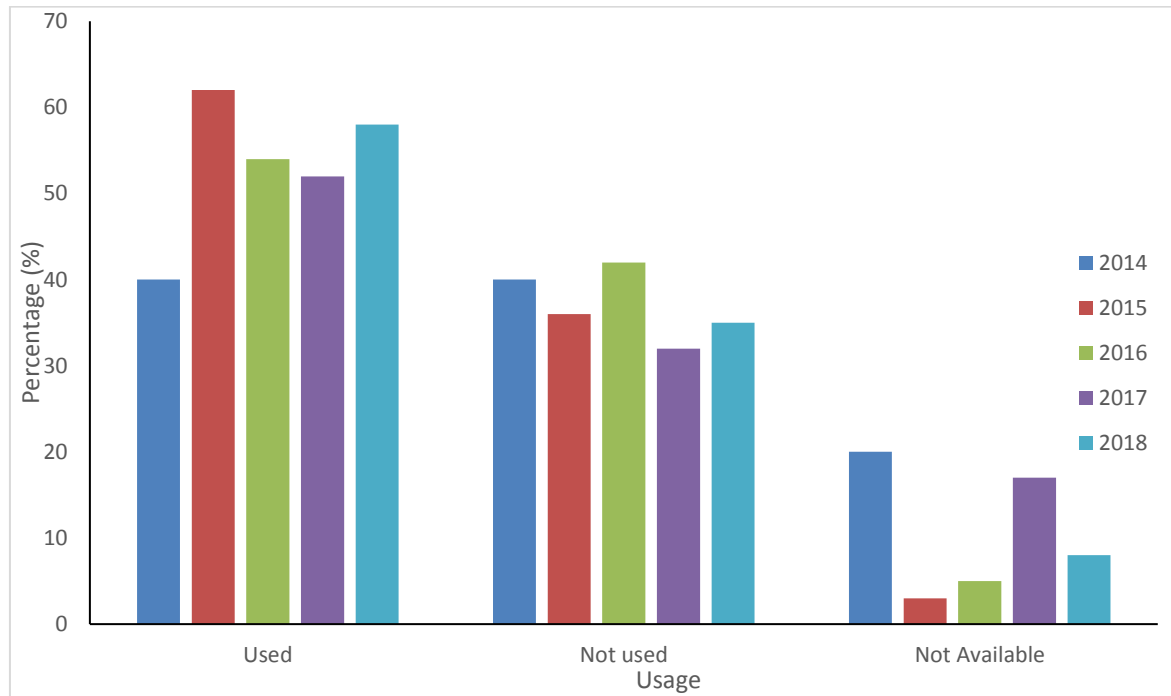


Figure 1: General usage rates of nest boxes

The number of animals present (A) declined in 2018, with three boxes containing animals, although one of these animals was a feral species (see **Table 1**). Five boxes contained animals in 2017, eight contained animals in 2016, nine boxes in 2015 and seven boxes in 2014. Recent evidence of use (E1 & E2) saw a small increase to 25% in 2018 rising from 21% in 2017. This value is still much greater than evidence obtained in the 2014 surveys, where only 7% showed recent evidence of use (**Figure 2**).

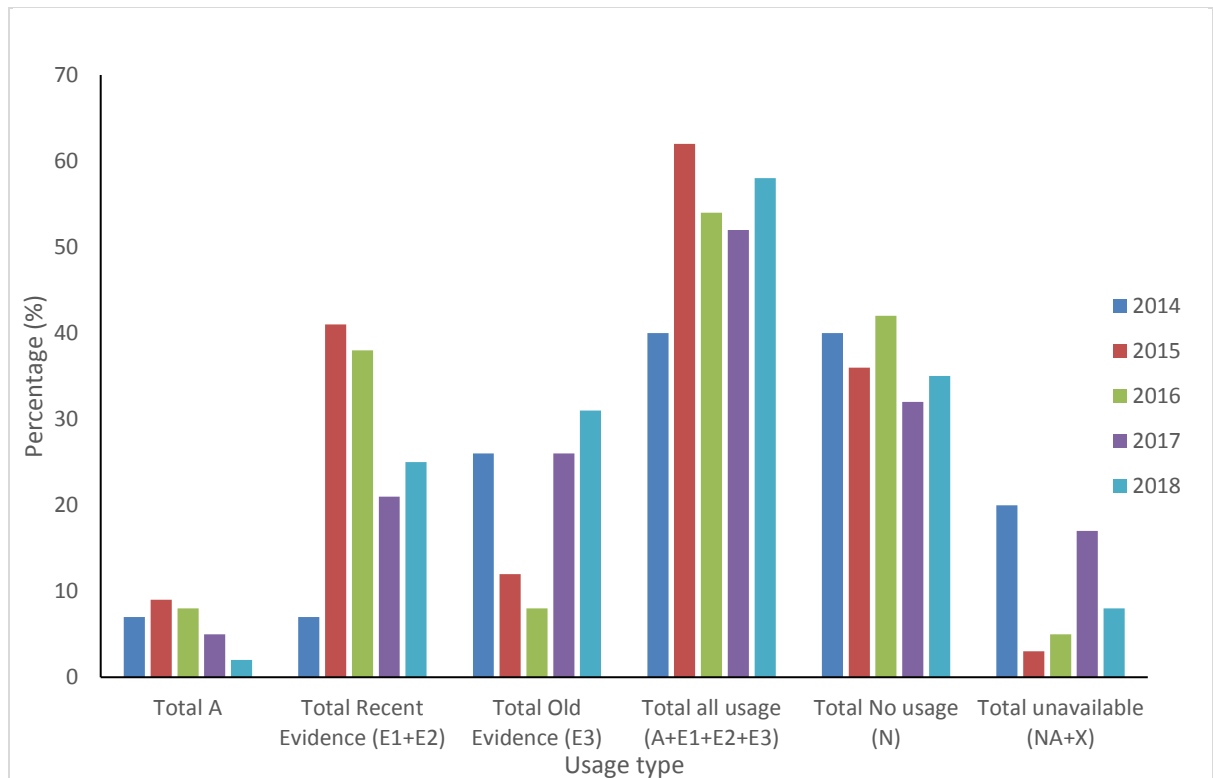


Figure 2: Detailed usage of nest boxes (n=100)

The total number of nest boxes with no signs of use in 2018 has increased from 32% in 2017 to 35%. However, total old evidence is higher in 2018 at 31%, compared to 26% in 2017.

Unavailable box numbers decreased considerably from 17% in 2017 to 8% in 2018, due to a number of nest box lids being fixed with clasps to prevent possums and wind from opening sugar glider box lids, and the decreased presence of mud wasp nests.

Usage per box type in 2018 remains relatively stable since the increase in usage observed in 2015 (**Figure 3**). Glider nest boxes saw a slight increase in use, most likely attributed to boxes

being affixed with clasps, and other box lids being re-attached so boxes were again available for use.

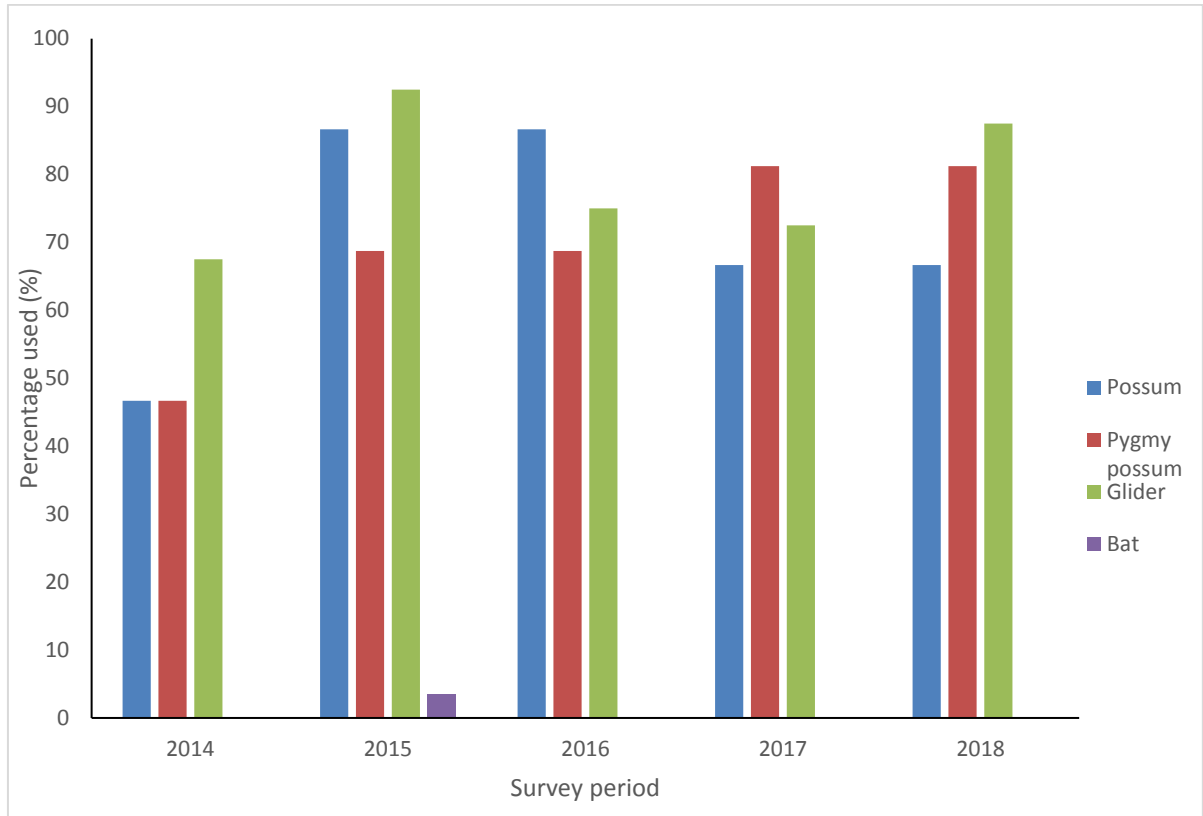


Figure 3: Usage per nest box type

Two native fauna species were occupying the boxes in 2018; Common Brushtail Possum (*Trichosurus vulpecula*) and Squirrel Glider (*Petaurus norfolcensis*). Also present in one box was a Black Rat (*Rattus rattus*) which is an introduced species. The Squirrel Glider is listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016*.

Evidence of use by one other species, Brown Antechinus (*Antechinus stuartii*) was also observed.

Four live animals in three nest boxes were physically present during the 2018 monitoring event (**Table 1**). All species observed were utilising glider boxes.

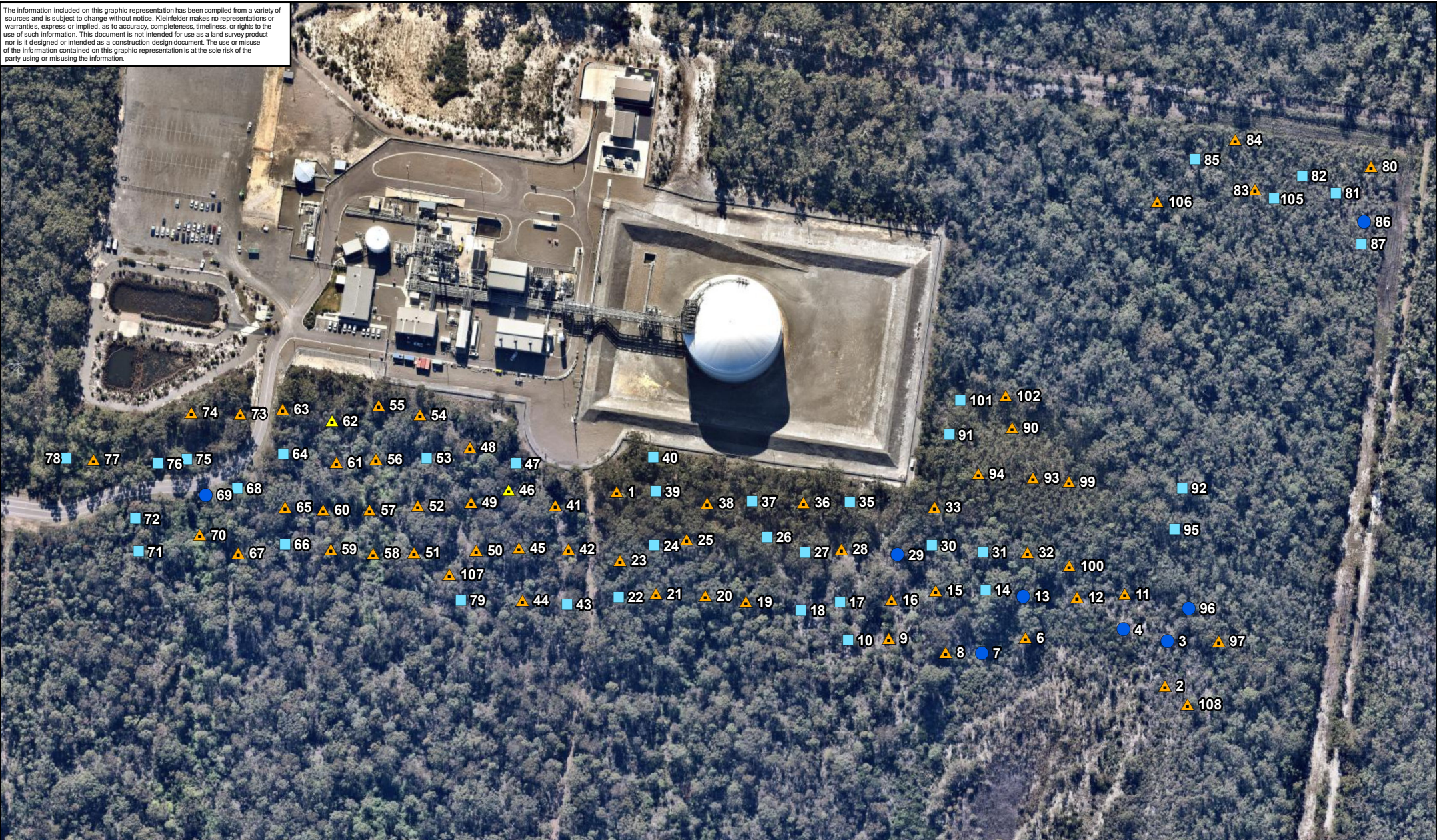
Table 1: Actual animals present in 2018

Species recorded occupying box	No. Individuals	Box Type	Mount Type	Box no.
Squirrel Glider (<i>Petaurus norfolcensis</i>)	2	Sugar/Squirrel Glider	Post	46
Black Rat (<i>Rattus rattus</i>)*	1	Sugar/Squirrel Glider	Post	69
Common Brushtail Possum (<i>Trichosurus vulpecula</i>)	1	Sugar/Squirrel Glider	Post	62
Total Live Animals	4			

*Feral/Non-native Species**

An overview of nest box locations and the results of the 2018 monitoring is shown in **Figure 4**. A selection of photographs taken during the 2018 survey are provided in **Appendix 1**.

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Legend	
	Occupied
	Signs of use
	No signs of use
	Unavailable

Metres

0 25 50 100 150

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Nest Box Monitoring Results 2018
AGL Energy Ltd Nest Box Monitoring - Winter 2018 Newcastle Gas Storage Facility Old Punt Road Tomago

FIGURE:
4

Discussion

The 2018 monitoring surveys recorded a combined usage rate (incorporating animals present, recent and old evidence of use) of 58%, a slight increase of 6% from the 2017 survey. This rate of use is likely to be underestimated due to the difficulty of gauging use in current microbat nest box designs. Bat boxes contain an opening on the underside of the box, which means that scats and hair left by visiting microbats or other fauna are rarely retained within the box.

The high rate of nest box usage in young forest is consistent with other studies such as that conducted by Lindenmayer *et al.* (2009) who recorded an occupancy rate of 58% of boxes in 20 year old regrowth. Boxes placed in mature forest are not thought to be as well used by fauna due to the availability of natural hollows. This is consistent with the 2018 monitoring results where the usage or evidence of usage of nest boxes in the more mature forest in the east of the site was far lower than those boxes in the western portion of the site.

The 2018 surveys once again identified a higher rate of recent evidence compared to the 2014 survey, being 25% in 2018 and 7% in 2014. This is an increase from 21% in 2017 and may be attributed to the addition of clasps on boxes limiting unavailable nest boxes, which helped to decrease the number of open lids compared to previous years and increased the availability of usable boxes.

The species recorded in boxes in this study are consistent with arboreal species detected during baseline fauna surveys for the NGSF in 2009 and 2010 (ecobiological 2010). Although the threatened Squirrel Glider was detected from only one capture during baseline surveys, it was recorded three times using both glider (n=2) and pygmy-possum (n=1) boxes at the site in 2014 surveys, again in 2015 solely using glider boxes (n=6), in 2016 (n=4), in 2017 (n=4) and in 2018 (n=2).

In the 2015 surveys (Kleinfelder 2015) it was observed that Squirrel Glider adults were detected in nest box 50 in both 2014 and 2015 and juveniles were recorded in another box only 20 m north of box 50, thus indicating a successful breeding event. In 2016, a very fresh glider bowl was observed in box 50, and Squirrel Glider individuals were recorded in boxes 21, 45 and 51. In 2017 a Squirrel Glider female was observed in box 46 carrying a joey, confirming successful breeding. The 2018 surveys found Squirrel Gliders again in box 46 (one male and one female indicating another possible breeding event may occur). Signs of feeding on preferred feed tree species (*Eucalyptus gummifera*) was once again noted.

Fifteen Pygmy-possum boxes were installed at the site, as the area was thought to provide suitable habitat for this species. Eastern Pygmy-possum are difficult to survey for using conventional trapping and spotlighting techniques and it has been suggested that nest boxes may provide greater opportunities to detect this species through indirect evidence such as characteristic nests or hairs (Beyer and Goldingay 2006). No Eastern Pygmy-possum or associated signs have been detected in the five monitoring events. These boxes are however frequented by Gliders, with some fresh bowls and also evidence of use from *Antechinus stuartii* observed in these boxes in 2018.

Nest boxes at the site were installed consistently on warmer north-easterly aspects and it is assumed that this would make them more likely to be occupied in winter. Other factors such as the presence of canopy shade may also influence the microclimate within the boxes.

Summary

The 2018 nest box monitoring program at the NGSF site found that the nest boxes installed continue to provide hollow dependent fauna with a den resource. The observation of the threatened Squirrel Glider and successful breeding events in both 2016 and 2017 is a positive sign for this species in the area.

Ongoing annual monitoring and maintenance of nest boxes is essential for the continued success of the program.

References

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Lindenmayer, D, Welsh, A, Donnelly, C *et al* 2009. Are nest boxes a viable alternative source of cavities for hollow-dependent animals? Long-term monitoring of nest box occupancy, pest use and attrition, *Biological Conservation*, 142(1), 33-42.

APPENDIX 1 – 2018 FIELD PHOTOGRAPHS



Plate 1: Common Brushtail Possum using box 62



Plate 2: Squirrel Gliders using Box 46



Plate 3: Squirrel Gliders in Box 46



Plate 4: Feeding signs (sap feed scars made by Glider sp.) on a *Eucalyptus gummifera*



Plate 5: *Rattus rattus* (Black Rat) in box 69.