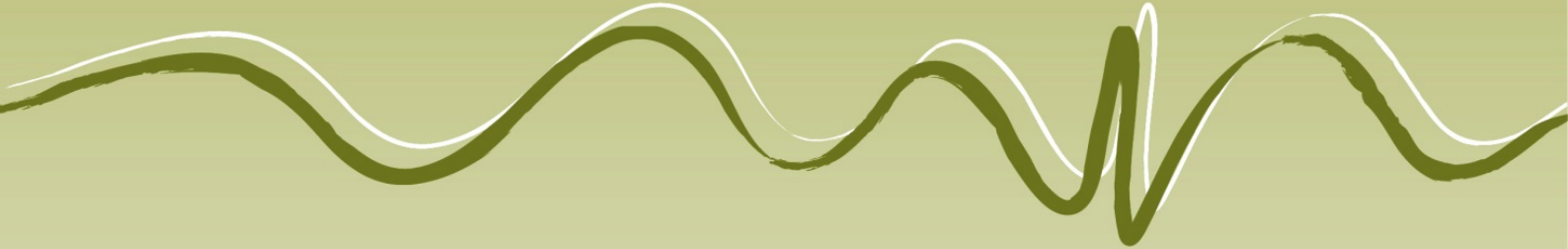


Flying-fox Monitoring January 2016

Warrell Creek to Nambucca Heads Pacific Highway Upgrade



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1. Introduction

1.1 Introduction

NSW Roads and Maritime Services (RMS) are working to resolve issues relating to a Grey-headed Flying-fox (*Pteropus poliocephalus*) (GHFF) camp that has intermittently been present within the approved alignment of the Warrell Creek to Nambucca Heads (WC2NH) Pacific Highway upgrade project near Macksville. The camp is located in a patch of Swamp Sclerophyll Forest vegetation north of Bald Hill Road (henceforth referred to as 'the site').

GeoLINK has undertaken monitoring at the site on at least a monthly basis since July 2013. Prior to this, irregular monitoring of flying-foxes at the site has been undertaken since the initial establishment of the camp in December 2011 (Eby 2012).

This report details the January 2016 seasonal flying-fox monitoring results.



2. Flying-fox Survey

2.1 Methodology

The following personnel undertook fieldwork for the January 2016 seasonal flying-fox monitoring:

- Frank Makin (GeoLINK ecologist).
- Jess O’Leary (GeoLINK ecologist).
- Dr Peggy Eby (sub-consultant flying-fox expert).
- Kale Hardie-Porter (GeoLINK environmental scientist).
- Jeremy Clifford (GeoLINK environmental scientist).
- Terry Tweedy (Sub-consultant ecologist)

The fieldwork followed the methodology developed by Dr Eby for this roost (Eby 2013). Refer to that document for full details of the methodology. A summary of the main procedures used for the monitoring is provided below.

On 27 January 2016 the presence of flying-foxes at the site was assessed by undertaking a traverse of the area previously known to support flying-foxes in conjunction with a few sharp handclaps aimed at eliciting a vocal response from any flying-foxes roosting at the site.

When flying-fox are present at the site, the following data is collected:


- The area of the roost footprint (mapped by GPS).
- Species composition.
- Demographics.
- Reproductive status.
- Behaviour.

However, as the initial traverse indicated that no flying-foxes were present at the site this data was not collected.

In light of the continued absence of flying-foxes at the site (since early April 2014) and the seasonal occupation of a flying-fox camp within two kilometres of the site adjacent to Macksville cemetery (first observed early in the summer of 2015), this data has recently been collected from the Macksville cemetery camp instead of at the site to provide some information relating to flying-foxes currently camping in the local area. Information for the Macksville cemetery camp was collected on 20 and 27 January 2016.

The water level at the site was also measured (approximate GPS location 492866, 6600756 [GDA 94, Zone 56]). The water level at this location is representative of the average level at the site and was collected on 27 January 2016.

Following the site traverse, a dusk exit count survey was undertaken at the site on the evening of 27 January 2016 to provide an estimate of the number of flying-foxes currently roosting at the camp. Two observers were strategically located for the count on a northern and southern ridge overlooking the camp. In addition to this three observers were also located in proximity to the Macksville cemetery camp to undertake an exit count of this camp.



Two observers were located at the following vantage points for the site:

- In a paddock to the north of the swamp sclerophyll forest (off Wedgewood Drive).
- On a ridge south of the camp (41 Bald Hill Road).

Three observers were located at the following vantage points for the Macksville cemetery camp:

- At the southern end of Nancy Roberts Drive (north of the camp).
- At the entrance to Macksville cemetery on Wallace Street (west of the camp).
- In the car park of the Macksville country club (south of the camp).

Recent observations had shown that the vast majority of flying-foxes are currently exiting the Macksville cemetery camp in a westerly and north-westerly direction and therefore the usual vantage point to the east of the camp adjacent to the Pacific Highway at the edge of the Macksville country club was not used in this exit count. Three observers (rather than two) were employed to more comprehensively capture the north, west and southern streams anticipated to be exiting the Macksville cemetery camp.

The exit count extended over approximately 45 minutes from sunset until dark (approximately 7:30 pm to 8:17 pm).

Other regional flying-fox camps at Gordon Park, Nambucca Heads (approximately 12 kilometres north-east of the Macksville camp), Bowraville and Bellingen Island were visited on 20 and 21 January 2016 and observational comments made. Refer to **Illustration 2.1** for the location of the subject regional camps.

2.2 Results

2.2.1 Roost Footprint

No flying-foxes were observed to be roosting at the site in the camp traverse. Flying-foxes were also absent from Bowraville and Wheatley Street in Bellingen.

Regionally, flying-foxes were observed to be roosting at Macksville Cemetery, Bellingen Island, and Gordon Park (Nambucca Heads). The roost footprint recorded at Macksville Cemetery has increased from approximately 4 ha in December 2015 to approximately 6 ha during the current monitoring event and is shown in **Illustration 2.2**.

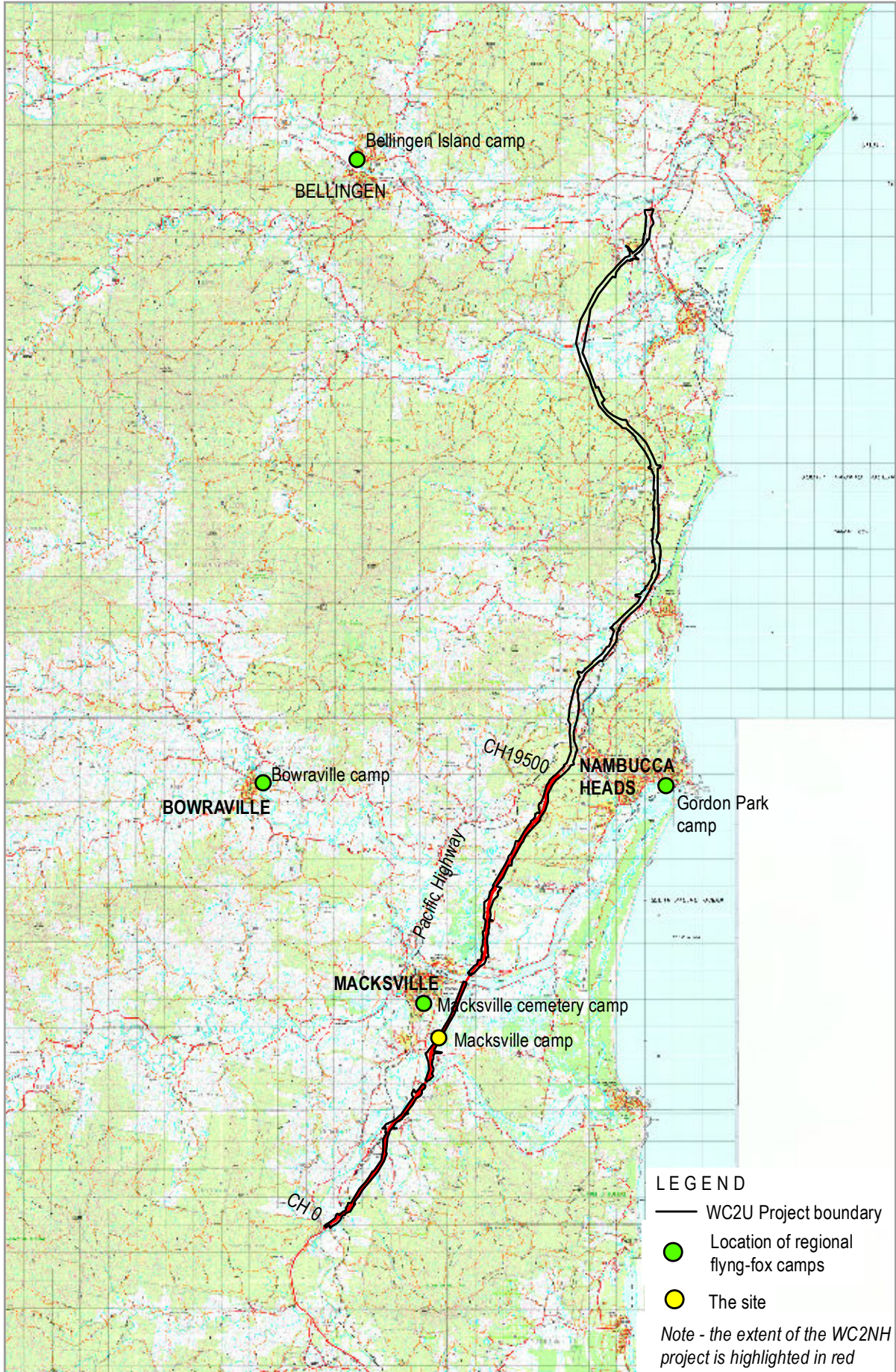
2.2.2 Population Estimates

2.2.2.1 Exit Count

No flying-foxes were observed flying from the site in the exit count. The exit count at the Macksville Cemetery camp recorded over 40,000 flying-foxes. It was not possible to accurately estimate the number of animals as:

- The flying-foxes were utilising four broad fly-out 'streams' to the west, north-west, south-east and north-east. The north-east stream was not present during the previous (December 2015) flying-fox monitoring event.
- Approximately 10% of animals changed direction during the fly-out.

Information shown is for illustrative purposes only



0 4 km

Location of Regional Flying-fox Camps



0 150



GeoLINK
environmental management and design

Macksville Cemetery Flying-fox Roost Footprint

2.2.2.2 Direct Counts

No exit counts were conducted at any of the regional camps (excluding the Macksville Cemetery camp). However, rough population estimates for these camps based on extrapolation of counts in individual trees and the roost footprint are as follows:

- Gordon Park: approximately 15,000 individuals (increased from 10,000 in the previous monitoring event).
- Bowraville: no individuals recorded (same as the previous monitoring event).
- Bellingen Island: >20,000 individuals (same as the previous monitoring event).
- Wheatley Street, Bellingen: no individuals recorded (same as the previous monitoring event).

2.2.3 Detailed Data

2.2.3.1 Species Composition

The species composition and proportions at occupied camps were as follows:

- Macksville Cemetery – GHFF >95%, Black Flying-fox <5%.
- Gordon Park – GHFF 90%, Black Flying-fox 10%.
- Bellingen Island – GHFF >95%, Black Flying-fox <5%.

2.2.3.2 Habitat Characteristics and Demographic Composition

As mentioned previously, no flying-foxes were recorded at the site and therefore, no detailed species composition data was collected. Instead, this data was collected at the nearby Macksville Cemetery camp for the current monitoring event.

Results of the demographic counts at the Macksville Cemetery camp indicated that females dominated the counts, making up between 43% and 77% (average 63%) of all individuals present at count locations (which excluded male 'bachelor' trees). Dependent young were observed with the female GHFF at a high level, with the proportion of females with young ranging between 80% and 100% (average 92%) (refer to **Table 2.1**).

Table 2.1 Demographic Data of GHFF at the Macksville Cemetery Camp

Tree Code	Tree Species	Height (m); DBH (cm)	Demographic Ratio (female:male)	Presence of Dependant Young (yes/no)	% Females with Dependant Young
MC1	Broad-leaved Paperbark	15; 30	10:8	yes	90
MC2	Broad-leaved Paperbark	15; 30	10:13	yes	100
MC3	Broad-leaved Paperbark	15; 25	10:6	yes	100
MC4	Broad-leaved Paperbark	20; 30	10:4	yes	90
MC5	Broad-leaved Paperbark	15; 30	10:4	yes	100
MC6	Broad-leaved Paperbark	20; 30	10:3	yes	90
MC7	Broad-leaved Paperbark	15; 25	10:4	yes	80
MC8	Broad-leaved Paperbark	15; 30	10:5	yes	90
MC9	Broad-leaved Paperbark	25; 35	10:8	yes	90

Tree Code	Tree Species	Height (m); DBH (cm)	Demographic Ratio (female:male)	Presence of Dependant Young (yes/no)	% Females with Dependant Young
MC10	Broad-leaved Paperbark	20; 30	10:4	yes	90

To provide comparative information relating to flying-foxes occupying the broader region surrounding the site, data of habitat characteristics and demographic composition was collected at Bellingen Island camp (refer to **Table 2.2**).

Table 2.2 Demographic Data of GHFF at the Bellingen Island Camp

Tree Code	Tree Species	Height (m); DBH (cm)	Demographic Ratio (female:male)	Presence of Dependant Young (yes/no)	% Females with Dependant Young
BI1	White Booyong	10; 20	10:7	yes	90
BI2	Sandpaper Fig	10; 20	10:9	yes	90
BI3	Moreton Bay Fig	20; 20	10:9	yes	100
BI4	Giant Stinging Tree	10; 20	10:9	yes	100
BI5	Giant Stinging Tree	15; 30	10:4	yes	90
BI6	White Booyong	10; 20	10:6	yes	90
BI7	Sandpaper Fig	10; 15	10:7	yes	100
BI8	Giant Stinging Tree	20; 40	10:6	yes	90
BI9	Giant Stinging Tree	15; 30	10:5	yes	90
BI10	Giant Stinging Tree	15; 40	10:4	yes	100

Results of the demographic counts at the Bellingen Island camp indicated that females dominated the counts, making up between 53% and 71% (average 60%) of all individuals present at count locations (which excluded male 'bachelor' trees). Dependent young were observed with the female GHFF at a very high level, with the proportion of females with young ranging between 90% and 100% (average 94%) (refer to **Table 2.2**).

General observations of the flying-foxes present at Gordon Park camp indicated that both female and male GHFF were present and a moderate to high number of female flying-foxes with dependant young were observed.

2.2.3.3 Water Level at the Site

Water level at the site measured at the representative measurement location was approximately 70 cm in depth as is shown in **Figure 2.1**. Prior to the January monitoring the water level has been steadily decreasing since February 2015. This monitoring event recorded an increase of 60 cm since the previous monitoring event (December 2015).

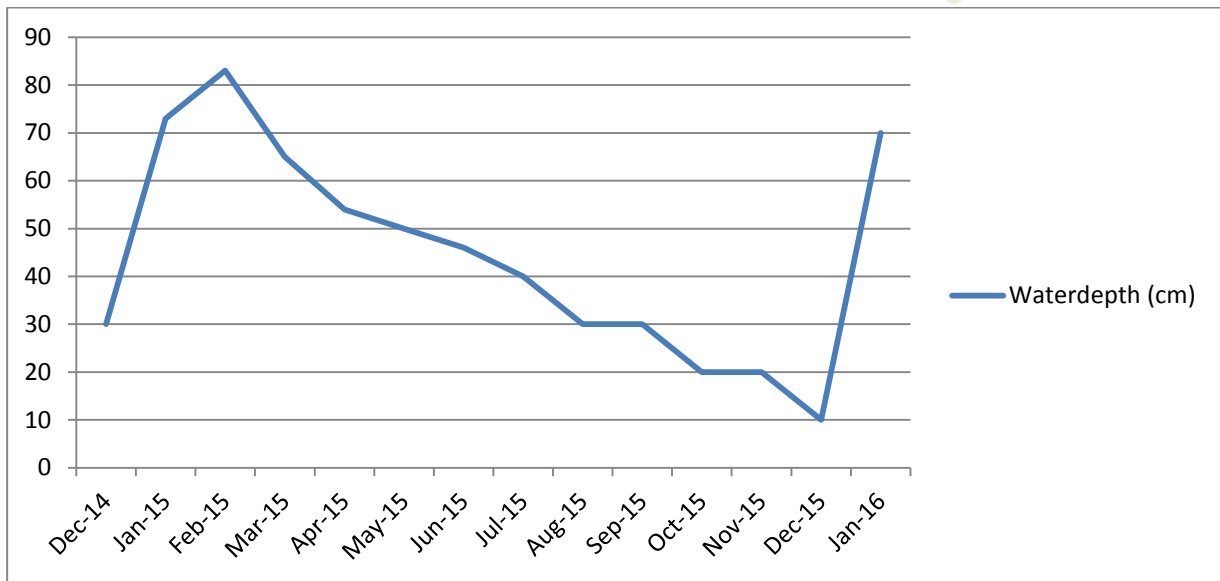


Figure 2.1 Water level measurements at the site

2.3 Discussion


2.3.1 Population Estimates

No flying-foxes were observed to be roosting at the site during the roost traverse undertaken for the current monitoring event. Nor were any flying-foxes observed to be flying from the site in the exit count. Flying-foxes have not been camped at the site (excluding a brief return in January 2015) since mid-April 2014.

Figure 2.2 shows the trend of flying-fox population at the site and other regional sites between January 2015 and January 2016. The number of flying-foxes roosting at the Macksville Cemetery camp has increased substantially over the last three months, from around 4,500 in October to an estimated >40,000 during the current monitoring event. This is the largest number of individuals recorded at the camp since the camp was detected in February 2015. This camp has been occupied for eight of the 12 months since detected. Flying-foxes were absent from the camp over the winter-early spring period (July-September) of 2015. The Macksville Cemetery camp appears to be used as a replacement camp to the site.

Flying-foxes continue to be absent from the Bowraville camp. No flying-foxes have been recorded roosting at Bowraville since mid-April 2015. For comparison, in January 2015 approximately 3,000-5,000 flying-foxes were roosting at the Bowraville camp (GeoLINK 2015).

The number of flying-foxes roosting at Bellingen Island has remained high with >20,000 individuals during the current monitoring event. In January 2015, approximately 10,000 flying-foxes were recorded (GeoLINK 2015). Bellingen Island was occupied for nine of the last 12 months, with a brief absence between April and June 2015. Small numbers of flying-foxes roosted at the Bellingen Wheatley Street camp that was established over this period and though has largely been vacant since the flying-foxes returned to Bellingen Island.



An estimated 15,000 flying-foxes were recorded at the Gordon Park camp (increase of approximately 5,000 individuals since last month). Of the camps monitored as part of this project, the Gordon Park camp has been the only continuously occupied flying-fox camp (July 2013 to January 2016). Flying-fox numbers are also generally stable and range between 10,000 and 20,000 individuals, with 10,000 and 15,000 individuals occupying the camp over the last 12 months).

2.3.2 Species Composition and Demographic Data

Both GHFF and Black Flying-foxes were present at all occupied camps. GHFF dominated the species composition comprising between 90-95% of all individuals present. Black Flying-fox accounted for a relatively small proportion (5-10%) of all individuals present.

The proportion of female GHFF with dependent young recorded in demographic counts in the current monitoring event was higher than was recorded in the previous month for the third month in a row. This is likely to be from:

- the birthing period now being finished (i.e. all of this year's young are now born);
- the young being larger and consequently easier to observe; and
- the weather conditions being warm, causing enhanced daytime flying-fox activity.

The proportion of GHFF females with dependent young at the Macksville cemetery camp and Bellingen Island were very high with 92% and 94% respectively, indicative of a breeding season with high reproductive output.

2.3.3 Phenology of Trees in Region

Nectar comprises a key foraging resource for flying-foxes in the region. During the December/ January period, a number of key diet nectar source trees in the upper North Coast region of NSW typically flower, including Black Bean (*Castanospermum australe*), **Red Bloodwood (*Corymbia gummifera*)**, **Pink Bloodwood (*Corymbia intermedia*)**, **Spotted Gum (*Corymbia maculata*)**, **Northern Spotted Gum (*Corymbia variegata*)**, New England Blackbutt (*Eucalyptus andrewsii*), River Red Gum (*Eucalyptus camaldulensis*), **Blackbutt (*Eucalyptus pilularis* – foothills and ranges)**, **Grey Ironbark (*Eucalyptus siderophloia* – foothills and ranges)** and **Forest Red Gum (*Eucalyptus tereticornis* – high altitude)** (Eby and Law 2008) (*Note: those in bold occur within a 50 kilometre radius of the site – Eby 2012*). Other flying-fox nectar and pollen diet tree species that occur within a 50 kilometre radius of the site and flower during the December/ January period include Smooth-barked Apple (*Angophora costata*), Rough-barked Apple (*Angophora floribunda*), Small-fruited Grey Gum (*Eucalyptus propinqua*) and Red Mahogany (*Eucalyptus resinifera*) (Eby 2012).

Red Bloodwood (*Corymbia gummifera*) and Pink Bloodwood (*Corymbia intermedia*) were observed exhibiting heavy flowering over the period surveyed.

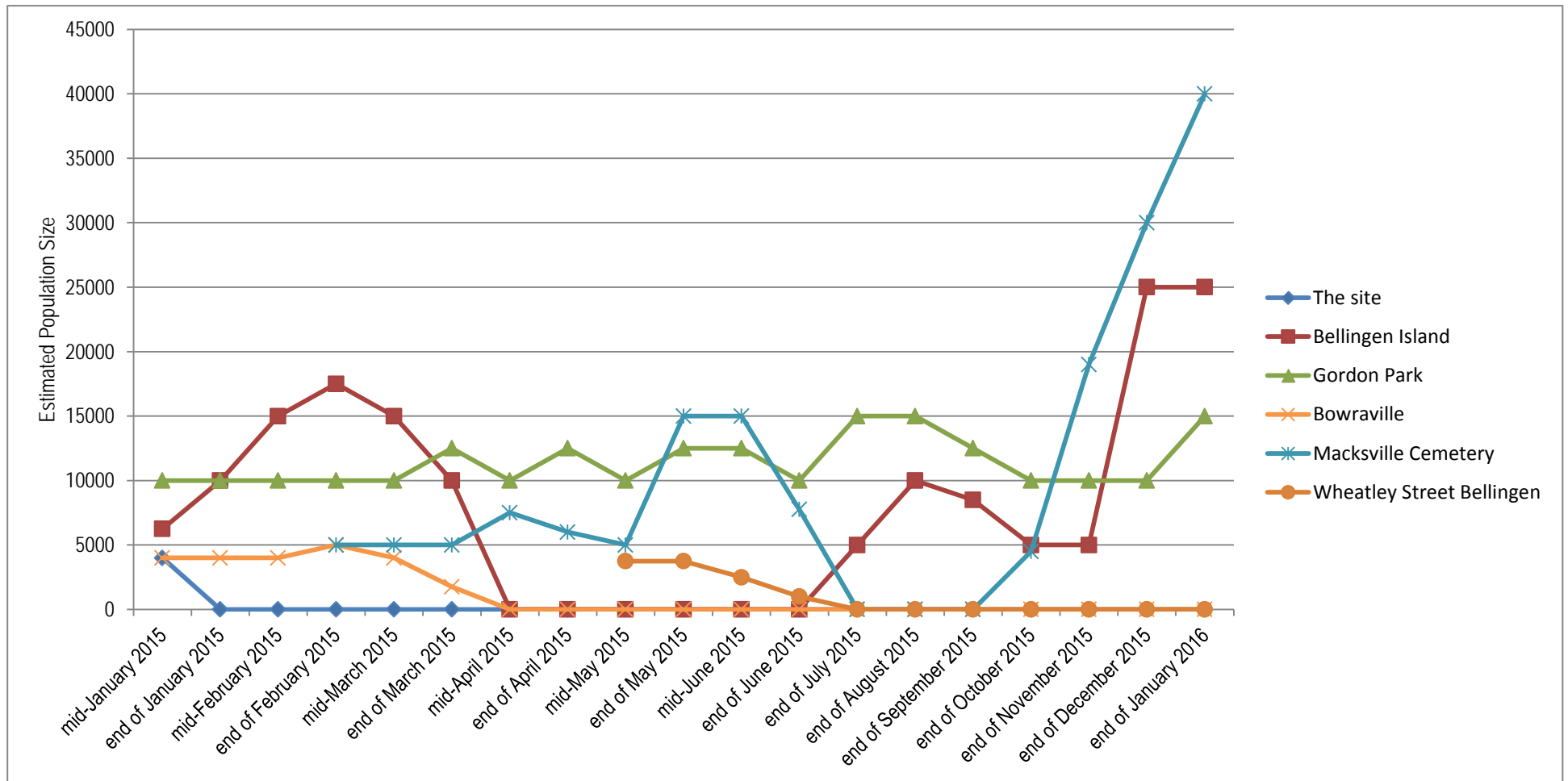


Figure 2.2 Population trends at the site and regional camps between January 2015 and January 2016

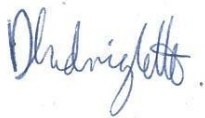


2.4 Conclusion

The results of the January 2016 monthly flying-fox monitoring indicate that excluding a brief stopover at the site observed in mid-January 2015, flying-foxes have been absent from the site now since mid-April 2014. The nearby Macksville Cemetery camp which was detected in February 2015 and has supported flying-foxes for most months since (excluding three months from July to September 2015), supported large numbers of flying-foxes during the January monitoring event (estimated >40,000). The Macksville Cemetery camp appears to be used as a replacement camp to the site.

Flying-foxes have remained at the Bellingen Island camp following a brief late autumn-winter absence, with substantial number of animals present (>20,000) during the current monitoring event (the largest numbers since the camp returned). Since departing Bowraville in late autumn flying-foxes have not returned yet for the usual occupation of this camp over the warmer period of the year. All regional camps have displayed seasonal absences in the 2015 winter period except for the Gordon Park camp, which has retained a generally steady population of flying-foxes over the past 12 months.

Dependent young GHFF are currently present at all occupied camps. So far this season a greater number of adult females are supporting dependant young at the Bellingen Island camp compared to the 2014/2015 breeding season.



David Andrighetto

Ecologist



References

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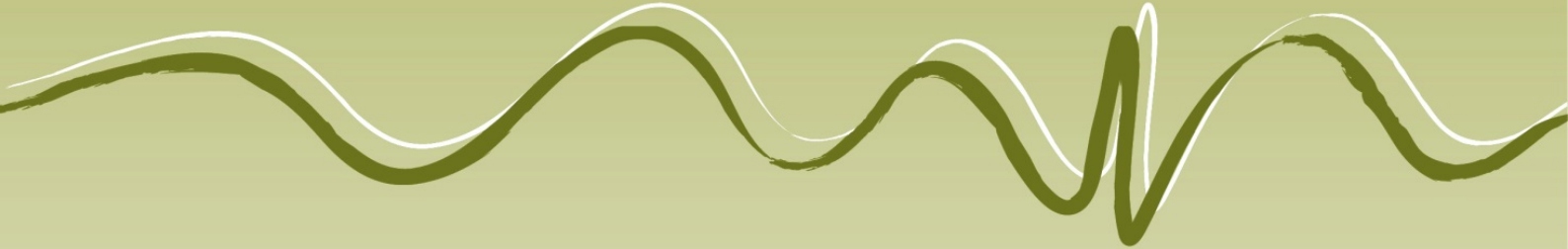
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Flying-fox Monitoring February 2016

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1. Introduction

1.1 Introduction

NSW Roads and Maritime Services (RMS) are working to resolve issues relating to a Grey-headed Flying-fox (*Pteropus poliocephalus*) (GHFF) camp that has intermittently been present within the approved alignment of the Warrell Creek to Nambucca Heads (WC2NH) Pacific Highway upgrade project near Macksville. The camp is located in a patch of Swamp Sclerophyll Forest vegetation north of Bald Hill Road (henceforth referred to as 'the site').

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This report details the January 2016 seasonal flying-fox monitoring results.



2. Flying-fox Survey

2.1 Methodology

The following personnel undertook fieldwork for the January 2016 seasonal flying-fox monitoring:

- Frank Makin (GeoLINK ecologist).
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The fieldwork followed the methodology developed by Dr Eby for this roost (Eby 2013). Refer to that document for full details of the methodology. A summary of the main procedures used for the monitoring is provided below.

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When flying-fox are present at the site, the following data is collected:


- The area of the roost footprint (mapped by GPS).
- Species composition.
- Demographics.
- Reproductive status.
- Behaviour.

However, as the initial traverse indicated that no flying-foxes were present at the site this data was not collected.

In light of the continued absence of flying-foxes at the site (since early April 2014) and the seasonal occupation of a flying-fox camp within two kilometres of the site adjacent to Macksville cemetery (first observed early in the summer of 2015), this data has recently been collected from the Macksville cemetery camp instead of at the site to provide some information relating to flying-foxes currently camping in the local area. Information for the Macksville cemetery camp was collected on 20 and 27 January 2016.

The water level at the site was also measured (approximate GPS location 492866, 6600756 [GDA 94, Zone 56]). The water level at this location is representative of the average level at the site and was collected on 25 February 2016.

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Two observers were located at the following vantage points for the site:

- In a paddock to the north of the swamp sclerophyll forest (off Wedgewood Drive).
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- At the southern end of Nancy Roberts Drive (north of the camp).
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- In the car park of the Macksville country club (south of the camp).

Recent observations had shown that the vast majority of flying-foxes are currently exiting the Macksville cemetery camp in a westerly and north-westerly direction and therefore the usual vantage point to the east of the camp adjacent to the Pacific Highway at the edge of the Macksville country club was not used in this exit count. Three observers (rather than two) were employed to more comprehensively capture the north, west and southern streams anticipated to be exiting the Macksville cemetery camp.

The exit count extended over approximately 45 minutes from sunset until dark (approximately 7:15 pm to 8:00 pm).

Other regional flying-fox camps at Gordon Park, Nambucca Heads (approximately 12 kilometres north-east of the Macksville camp), Bowraville and Bellingen Island were also visited on the 25 February 2016 and observational comments made. Refer to **Illustration 2.1** for the location of the subject regional camps.

2.2 Results

2.2.1 Roost Footprint

No flying-foxes were observed to be roosting at the site in the camp traverse. Flying-foxes were also absent from Bowraville and Wheatley Street in Bellingen.

Regionally, flying-foxes were observed to be roosting at Macksville Cemetery, Bellingen Island, and Gordon Park (Nambucca Heads). The roost footprint recorded at Macksville Cemetery was similar to last month (January 2016), occupying approximately 6 hectares during the current monitoring event (refer to **Illustration 2.2**).

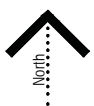
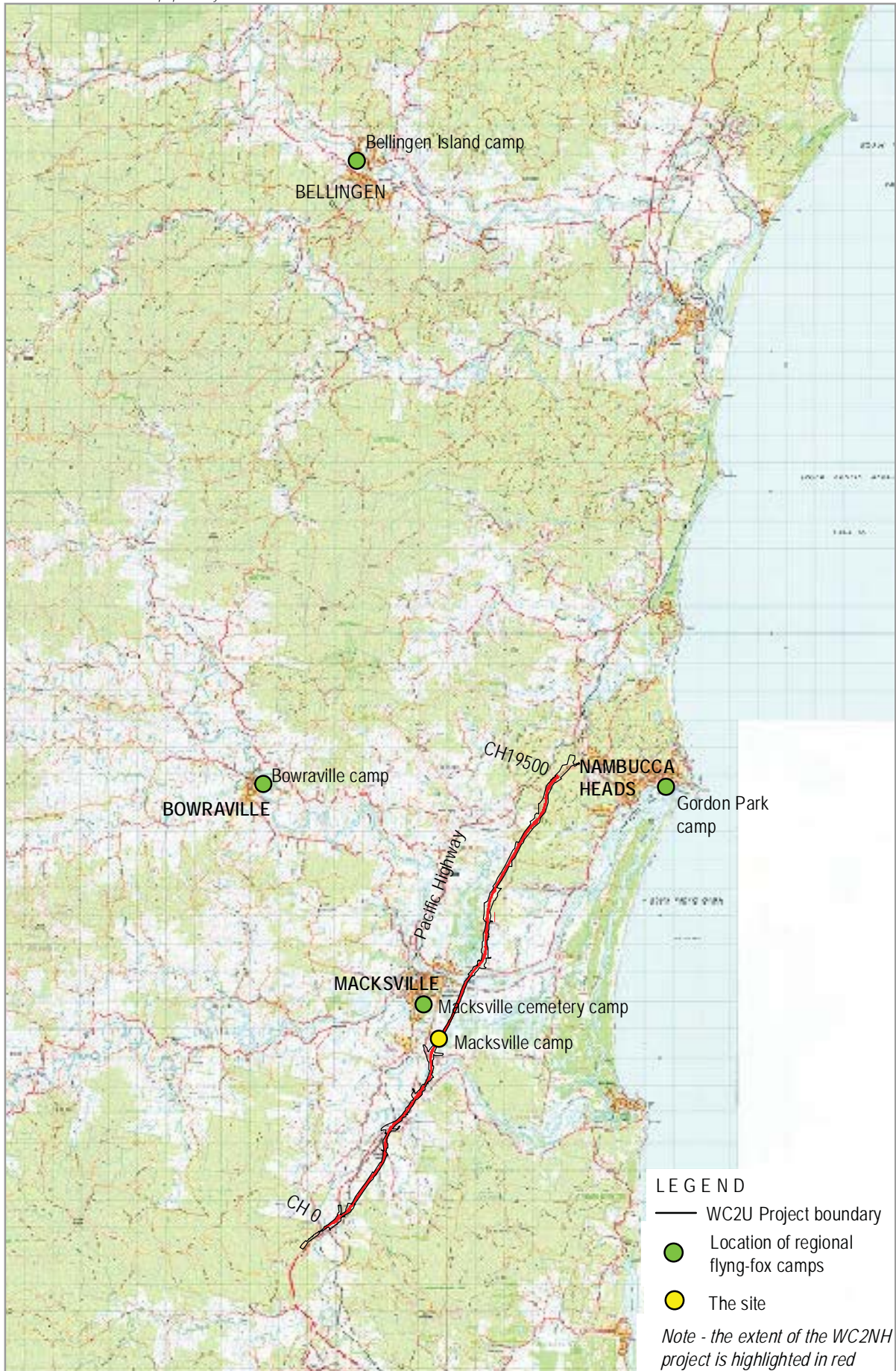
2.2.2 Population Estimates

2.2.2.1 Exit Count

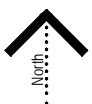
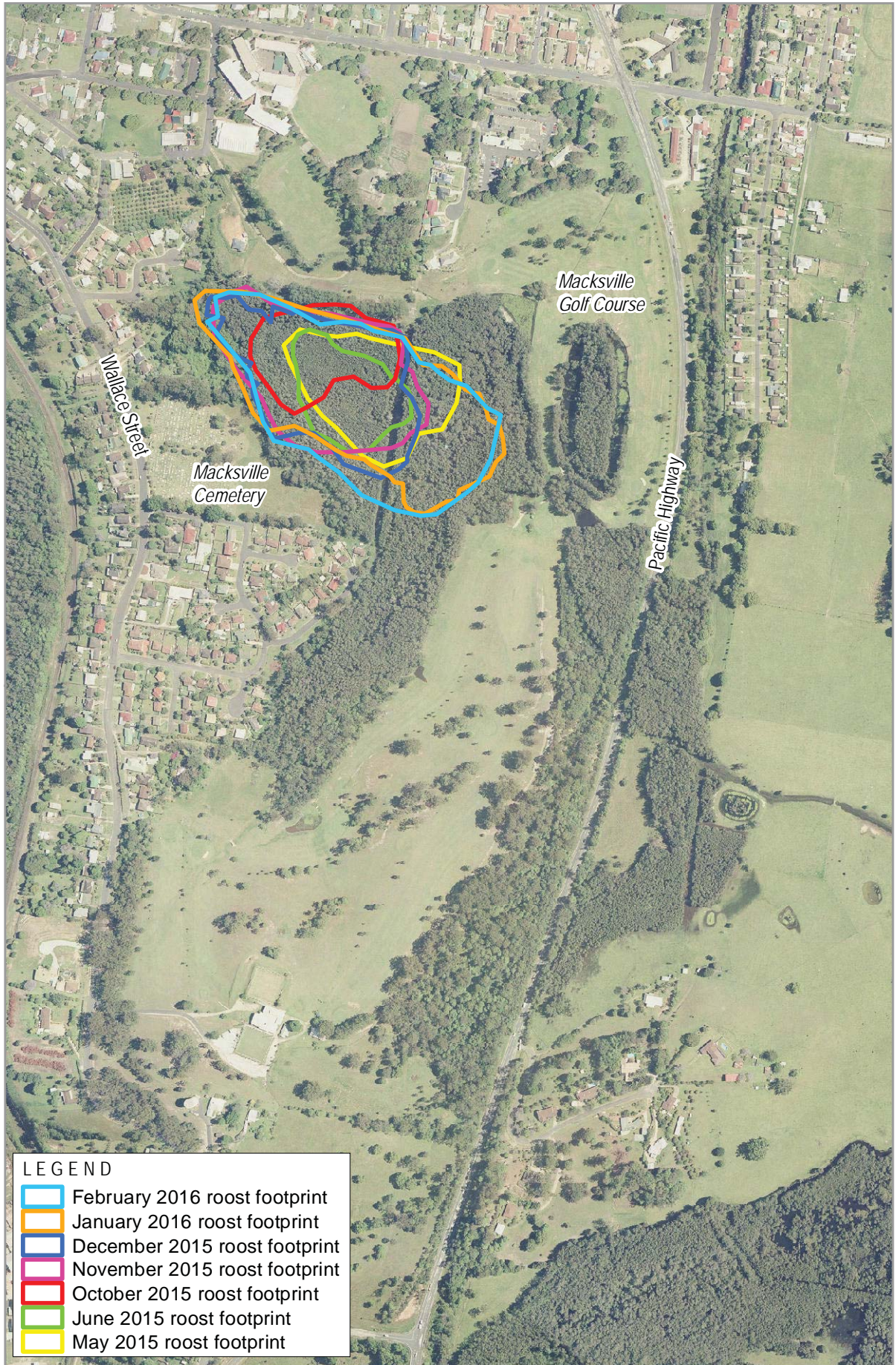
No flying-foxes were observed flying from the site in the exit count. The exit count at the Macksville Cemetery camp recorded over 50,000 flying-foxes (slight increase to last month). It was not possible to accurately estimate the number of animals as:

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- Approximately 10% of animals changed direction during the fly-out.

Information shown is for illustrative purposes only



0 4 km



0 150



Macksville Cemetery Flying-fox Roost Footprint



2.2.2.2 Direct Counts

No exit counts were conducted at any of the regional camps (excluding the Macksville Cemetery camp). However, rough population estimates for these camps based on extrapolation of counts in individual trees and the roost footprint are as follows:

- Gordon Park: approximately 10,000 individuals (decreased from 15,000 in the previous monitoring event).
- Bowraville: no individuals recorded (same as the previous monitoring event).
- Bellingen Island: >20,000 individuals (same as the previous monitoring event).
- Wheatley Street, Bellingen: no individuals recorded (same as the previous monitoring event).

2.2.3 Detailed Data

2.2.3.1 Species Composition

The species composition and proportions at occupied camps were the same as last month, as follows:

- Macksville Cemetery – GHFF >95%, Black Flying-fox <5%.
- Gordon Park – GHFF 90%, Black Flying-fox 10%.
- Bellingen Island – GHFF >95%, Black Flying-fox <5%.

2.2.3.2 Habitat Characteristics and Demographic Composition

As mentioned previously, no flying-foxes were recorded at the site and therefore, no detailed species composition data was collected. Instead, this data was collected at the nearby Macksville Cemetery camp for the current monitoring event.

The results of this month's demographic counts (including sex ratios and percentage of females with dependant young), should be considered indicative only. In late February weaning commences and some young become independent. Some may temporarily roost independently from their mother despite being dependant. The seasons young are also almost the same size as adults. These factors make it difficult to determine whether some flying-foxes are dependant or not. Dependant young also often roost on the edges of camps to avoiding (or are pushed out) by breeding adult males (Churchill 2008). This influences the results, particularly at the Macksville Cemetery camp, as it is not possible to go into the camp without causing significant disturbance. Demographic counts are therefore undertaken on the edge of the camp, and are more likely to encounter non-breeding groups.

Results of the demographic counts at the Macksville Cemetery camp indicated that females dominated the counts, making up between 77% and 100% (average 85%) of all individuals present at count locations (which excluded male 'bachelor' trees). Dependant young were observed with the female GHFF at a variable levels, with the proportion of females with young ranging between 30% and 100% (average 74%) (refer to **Table 2.1**).

Table 2.1 Demographic Data of GHFF at the Macksville Cemetery Camp

Tree Code	Tree Species	Height (m); DBH (cm)	Demographic Ratio (female:male)	Presence of Dependant Young (yes/no)	% Females with Dependant Young
MC1	Broad-leaved Paperbark	10; 30	10:2	yes	60
MC2	Broad-leaved Paperbark	10; 25	10:1	yes	100
MC3	Broad-leaved Paperbark	10; 25	10:1	yes	50
MC4	Broad-leaved Paperbark	10; 30	10:2	yes	60
MC5	Broad-leaved Paperbark	10; 25	10:2	yes	30
MC6	Broad-leaved Paperbark	10; 30	10:3	yes	80
MC7	Broad-leaved Paperbark	10; 15	10:3	yes	90
MC8	Broad-leaved Paperbark	10; 15	10:2	yes	70
MC9	Broad-leaved Paperbark	10; 25	10:1	yes	100
MC10	Broad-leaved Paperbark	10; 30	10:0	yes	100

To provide comparative information relating to flying-foxes occupying the broader region surrounding the site, data of habitat characteristics and demographic composition was collected at Bellingen Island camp (refer to **Table 2.2**).

Table 2.2 Demographic Data of GHFF at the Bellingen Island Camp

Tree Code	Tree Species	Height (m); DBH (cm)	Demographic Ratio (female:male)	Presence of Dependant Young (yes/no)	% Females with Dependant Young
BI1	Sandpaper Fig	9; 15	10:4	yes	20
BI2	Sandpaper Fig	10; 50	10:3	yes	30
BI3	Giant Stinging Tree	13; 20	10:6	no	0
BI4	Giant Stinging Tree	15; 30	10:2	no	0
BI5	Giant Stinging Tree	13; 30	10:2	yes	10
BI6	Giant Stinging Tree	13; 20	10:3	yes	50
BI7	Giant Stinging Tree	13; 40	10:4	yes	30
BI8	Moreton Bay Fig	10; 30	10:2	yes	60
BI9	Giant Stinging Tree	12; 40	10:4	yes	10
BI10	Giant Stinging Tree	8; 40	10:4	yes	20

Results of the demographic counts at the Bellingen Island camp indicated that females dominated the counts, making up between 63% and 83% (average 75%) of all individuals present at count locations (which excluded male 'bachelor' trees). Female GHFF with dependant young were observed at considerably lower numbers than last month with the proportion of females with young ranging between 0% and 60% (average 23% down from 94 % last month)(refer to **Table 2.2**). This is attributed to weaning behaviour exhibited at this time of year and associated issues/ influences on data collection, as discussed previously.

General observations of the flying-foxes present at Gordon Park camp indicated that both female and male GHFF were present and a moderate number of female flying-foxes with dependant young were observed.

2.2.3.3 Water Level at the Site

Water level at the site measured at the representative measurement location was approximately 67 cm in depth as is shown in **Figure 2.1**. This represents a slight decrease since last month, following a significant rise in water level in January 2016.

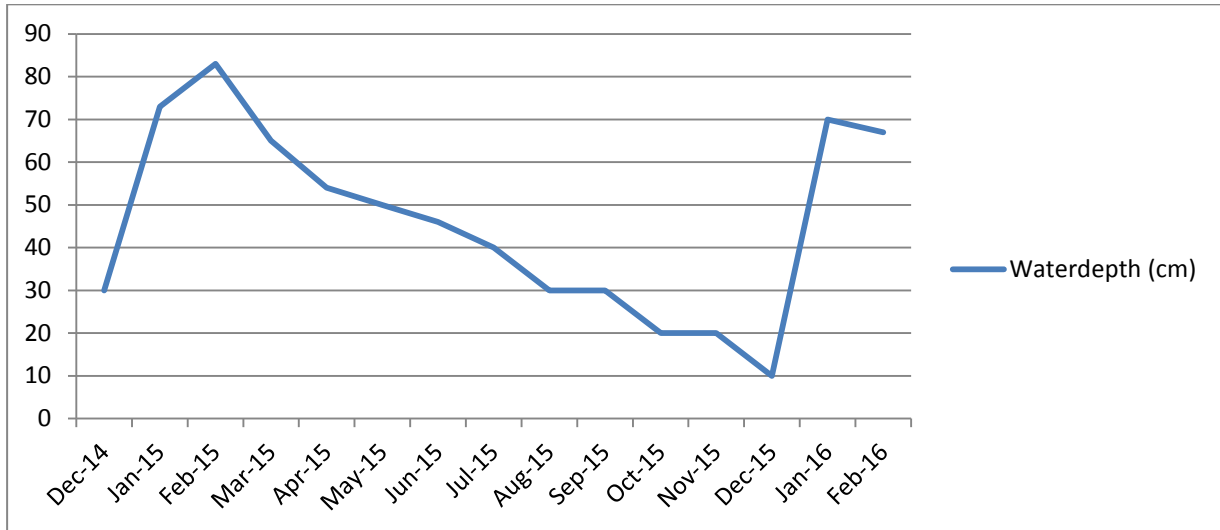


Figure 2.1 Water level measurements at the site

2.3 Discussion


2.3.1 Population Estimates

No flying-foxes were observed to be roosting at the site during the roost traverse undertaken for the current monitoring event. Nor were any flying-foxes observed to be flying from the site in the exit count. Flying-foxes have not been camped at the site (excluding a brief return in January 2015) since mid-April 2014.

Figure 2.2 shows the trend of flying-fox population at the site and other regional sites between January 2015 and February 2016. The number of flying-foxes roosting at the Macksville Cemetery camp has increased substantially over the last four months, from around 4,500 in October to an estimated >50,000 during the current monitoring event. This is the largest number of individuals recorded at the camp since the camp was detected in February 2015. In addition to flying-foxes following food resources, recent increases in flying-fox numbers are likely to be associated with this seasons young joining the flyout.

Flying-foxes continue to be absent from the Bowraville camp. No flying-foxes have been recorded roosting at Bowraville since mid-April 2015. For comparison, in February 2015 approximately 5,000 flying-foxes were roosting at the Bowraville camp (GeoLINK 2015).

The number of flying-foxes roosting at Bellingen Island has remained high with over 20,000 individuals recorded during the current monitoring event. In February 2015, between 15,000 and 20,000 flying-foxes were recorded at this camp (GeoLINK 2015). Bellingen Island was occupied for 11 of the last 14 months, with a brief absence between April and June 2015. The Bellingen Wheatley Street camp which supported small numbers of flying-foxes mainly when the Bellingen Island was vacant, has



remained vacant since July 2015 (shortly after the flying-foxes returned to Bellingen Island).

An estimated 10,000 flying-foxes were recorded at the Gordon Park camp (a decrease of approximately 5,000 individuals since last month). Of the camps monitored as part of this project, the Gordon Park camp has been the only continuously occupied flying-fox camp (July 2013 to February 2016). Flying-fox numbers are also generally stable and range between 10,000 and 20,000 individuals, with 10,000 and 15,000 individuals occupying the camp over the last 12 months.

2.3.2 Species Composition and Demographic Data

Both GHFF and Black Flying-foxes were present at all occupied camps. GHFF dominated the species composition comprising between 90-95% of all individuals present. Black Flying-fox accounted for a relatively small proportion (5-10%) of all individuals present.

Small numbers of Little-red Flying-foxes (*Pteropus scapulatus*) have recently been observed in the north-east NSW region. Although not detected, it is possible that small numbers of Little-red Flying-foxes (*Pteropus scapulatus*) may be roosting locally, including at the Macksville Cemetery camp and contributing to the large numbers of flying-foxes recorded at the camp. Due to the large footprint of this camp, high density that Little-red Flying-foxes roost and inability to traverse the centre of the camp during monitoring (which would generate significant disturbance), it is possible for modest numbers of Little-red Flying-foxes (*Pteropus scapulatus*) to be present and avoid detection. The other currently occupied camps (Bellingen Island and Gordon Park) are reasonably easy to inspect comprehensively and no Little-red Flying-foxes (*Pteropus scapulatus*) were detected.

The proportion of female GHFF with dependent young recorded in demographic counts in the current monitoring event was lower than was recorded in the previous month. This is likely to be a result of dependent young transitioning to independence and is supported by the observation of many juvenile/sub-adult individuals.

2.3.3 Phenology of Trees in the Region

Flower nectar and pollen sources comprise a key foraging resource for flying-foxes in the region. During the February/ March period, a number of key diet nectar source trees in the upper North Coast region of NSW typically flower, including Red Bloodwood (*Corymbia gummifera*), Pink Bloodwood (*Corymbia intermedia*), Spotted Gum (*Corymbia maculata*), Northern Spotted Gum (*Corymbia variegata*), New England Blackbutt (*Eucalyptus andrewsii*), River Red Gum (*Eucalyptus camaldulensis*), Mountain Blue Gum (*Eucalyptus deani*), Grey Box (*Eucalyptus molucana*), Blackbutt (*Eucalyptus pilularis* – foothills and ranges), Sydney Blue Gum (*Eucalyptus saligna*), Forest Red Gum (*Eucalyptus tereticornis*) and Broad-leaved Paperbark (*Melaleuca quinquinervia*) (Eby and Law 2008).

Key diet species within 50km of the Maclean camp that may flower this time of the year include Spotted Gum (*Corymbia maculata*), Northern Spotted Gum (*Corymbia variegata*), Red Bloodwood (*Corymbia gummifera*), Blackbutt (*Eucalyptus pilularis*), Forest Red Gum (*Eucalyptus tereticornis*) and Broad-leaved Paperbark (*Melaleuca quinquinervia*) (Eby, 2012). Pink Bloodwood and Broad-leaved Paperbark were observed flowering in the area during the monitoring.

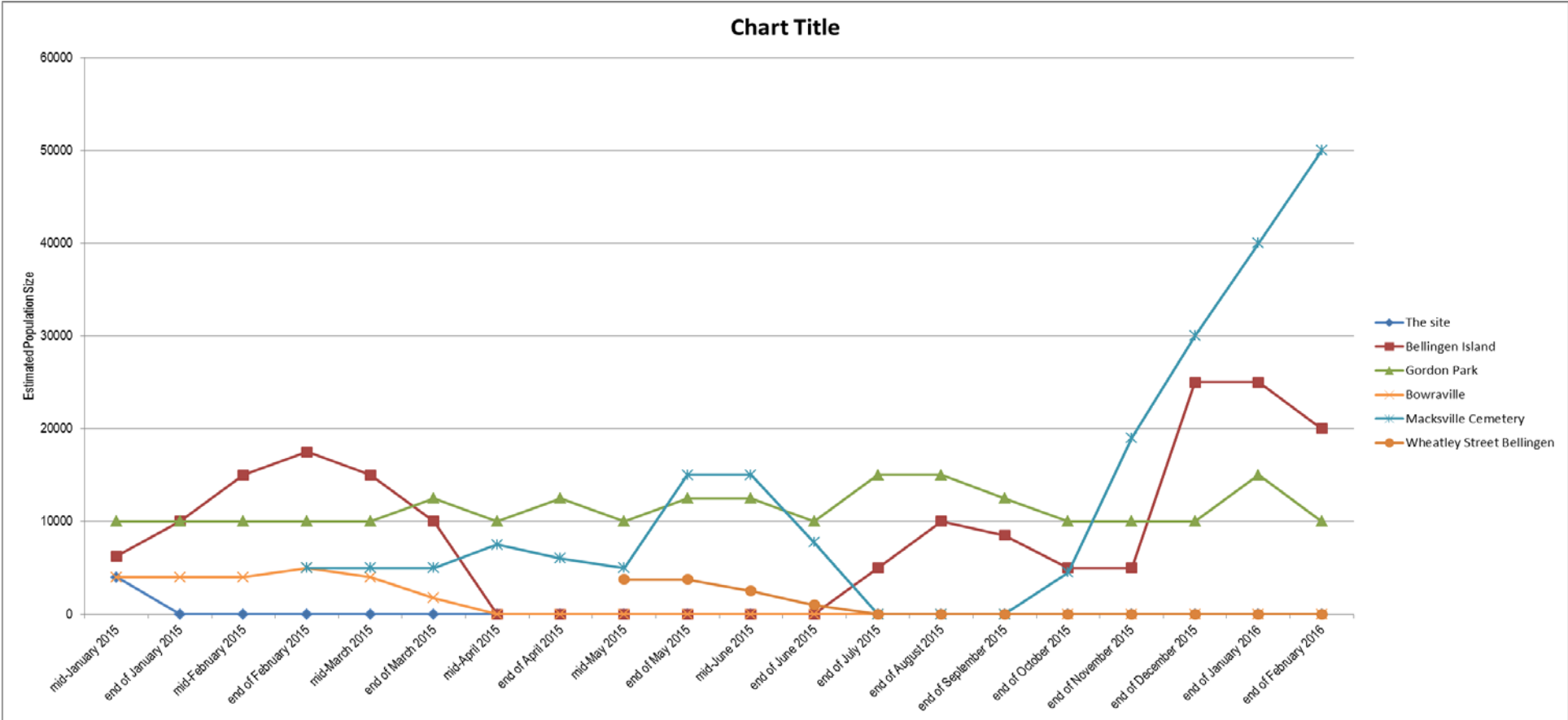


Figure 2.2 Population trends at the site and regional camps between January 2015 and February 2016



2.4 Conclusion

The results of the February 2016 monthly flying-fox monitoring indicate that excluding a brief stopover at the site observed in mid-January 2015, flying-foxes have been absent from the site now since mid-April 2014. The nearby Macksville Cemetery camp which was detected in February 2015 and has supported flying-foxes for most months since (excluding three months from July to September 2015), supported large numbers of flying-foxes during the February monitoring event (estimated >50,000). The Macksville Cemetery camp appears to be used as a replacement camp to the site.

Flying-foxes have remained at the Bellingen Island camp following a brief late autumn-winter absence, with substantial number of animals present (> 20,000) during the current monitoring event. Since departing Bowraville in late autumn flying-foxes have not returned yet for the usual occupation of this camp over the warmer period of the year. All regional camps have displayed seasonal absences in the 2015 winter period except for the Gordon Park camp, which has retained a generally steady population of flying-foxes over the past 12 months.

Dependent young GHFF are present at all occupied camps however they are in lesser densities than the previous months monitoring as begin to transition to independence.



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