



## Summary of ecological surveys and monitoring at North Byron Parklands 2007 – 2016

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## Abbreviations

Abbreviation	Description
Parklands	North Byron Parklands
OEH	NSW Office of Environment and Heritage
EIM	Event Impact Monitoring
SITG	Splendour in the Grass
FF	Falls Festival
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>

# 1 Introduction

The North Byron Parklands site (Parklands) was acquired by the current owners in late 2006. Since then, eight major music festival events have been held between 2013 and 2017 (four Splendour in the Grass and four Falls Festival events).

Over the last 10 years, numerous ecological surveys and flora and fauna monitoring has been undertaken at the Parklands and in the adjacent Billinudgel Nature Reserve. This work has been primarily to support the environmental approvals for operation of the site (pre-2012) and to comply with regulatory requirements (post-2012) associated with Event Impact Monitoring (EIM). The results of these surveys are reported across numerous documents.

## 1.1 Purpose and scope

The purpose of this report is to provide a consolidated summary of the ecological surveys and flora and fauna monitoring that has occurred at the Parklands and adjacent sites. It provides a summary of the methods and results of each survey conducted by Dr. Mark Fitzgerald (with support from Biolink Consultants, EarthProcess Ecological Services, Sandpiper Ecological Surveys and Wildlife Services). It also analyses trends over time for key datasets to assess any cumulative impacts, which is a task that has not been undertaken to date.

The report is focused on two key types of survey:

- EIM – flora and fauna monitoring undertaken before, during and after each of the eight events held to-date; and
- Other ecology surveys – the collection of other ecological surveys that have been undertaken at the Parklands since 2007, including biennial fauna surveys.

This report has been prepared via review of the individual reports prepared for each survey and monitoring event, and includes an analysis of the data reported therein. Data for the most recent EIM undertaken for Falls Festival 2016-17 is not yet available and has therefore not been included in this summary. No analysis of primary data has been undertaken.

## 1.2 Background to event impact monitoring (EIM)

The NSW Department of Planning and Environment's approval conditions for the Parklands requires preparation and implementation of a Flora and Fauna Monitoring Program under Consent Condition C20, to monitor and assess the impact of the project on flora and fauna within and adjacent to the site. This program was developed by Billinudgel Property Trust and finalised in 2013. It has been implemented as required.

A key component of the Flora and Fauna Monitoring Program is the EIM. The EIM focuses on key groups of flora and fauna with the intention of identifying:

- Any ecological impacts as a results of events particularly on fauna within the site and Billinudgel Nature Reserve
- Requirements to ensure there are no significant impacts on the function of the Marshall's Ridge Wildlife Corridor
- Measures to ensure there are no significant impacts on threatened species and communities
- Presence of Eastern Grass Owl (*Tyto longimembris*)

Additional survey requirements for the Flora and Fauna Monitoring Program under Consent Condition C20 include biennial fauna monitoring. This has been undertaken in 2014 and was scheduled in 2016, however these surveys have been deferred until 2017.

## 2 Methods

### 2.1 Development of this report

This report has been developed using results provided in the following individual survey and/or monitoring reports:

- Performance Report #1 – #4 Appendices B1 Environmental Performance Report and B2 Results and Analyses of Event Impact Monitoring Data (North Byron Parklands 2014a, 2014b, 2015, 2016)
- August 2007 Fauna Survey of (Fitzgerald 2007)
- February 2009 Fauna Survey of North Byron Parklands (Fitzgerald 2009)
- North Byron Parklands Biennial Fauna Survey (Fitzgerald 2014)
- North Byron Parklands Flora and Fauna Rehabilitation Program (Fitzgerald 2016)
- Yelgun Koala Survey and Koala Plan of Management (Biolink 2007)
- Yelgun Koala Survey Koala Habitat Reassessment (Biolink 2008)
- North Byron Parklands SEPP No. 44 Koala Survey and Habitat Reassessment (Biolink 2013)
- North Byron Parklands SEPP No. 44 Koala Monitoring Report (Biolink 2016)

Data review has been undertaken using reported data only, and therefore statistical analyses were not possible. No review or analysis of primary data has been undertaken.

The primary focus of this report has been on the EIM results. These surveys were specifically designed to detect any impact of events on the target flora and fauna groups. Each survey has employed a consistent methodology, therefore allowing a comparison of data over time. Results of other surveys are also reviewed, although in less detail.

### 2.2 Survey and monitoring method summary

Numerous surveys have been undertaken within the study area from 2007 to 2016, including eight EIM events and seven other surveys. Sampling methods for EIM and other surveys are summarised below, with full details available in the documents listed above. Monitoring locations are presented in Figure 1 and Figure 2.

#### 2.2.1 Event impact monitoring (EIM)

The monitoring methods for EIM were developed and approved as part of the Flora and Fauna Monitoring Program (2013) and are summarised in Table 1 below. This program has been implemented during the eight events listed in Table 2.

**Table 1: Summary of survey and monitoring methodology across the study area (2007 – 2016)**

Target Group	Sampling Methodology
Vegetation	Vegetation condition and changes before and after each event recorded at 27 permanent photo-points across the Parklands
Forest Birds	Monthly samples (ten X 20 minute / 200m transects) taken before, during and after each event over three consecutive days between December 2015 to January 2016, and from June to August 2016. Sampling events are undertaken by three experienced observers. Impact sites within the Parklands; control sites within Billinudgel Nature Reserve
Forest Birds – plantings	Birds monitored at two sites in established (~9 year old) native plantings in the Marshall's Ridges area – commenced 2015
Waterbirds	20-minute point counts of waterbirds around the 2 ha constructed dam on-site recording species and abundance since 2007
Eastern Grass Owl	Targeted survey and call playback each July during event years – 2013, 2014, 2015, 2016
Terrestrial Mammals	Ten hair funnels deployed at each of 5 locations at 20 m intervals along a bird transect. The sampling for four nights before, during and after each event.
Terrestrial Fauna	Two sand traps deployed (within an area of 20 m <sup>2</sup> ) on three nights before, during and after each event at eight locations along tracks. Traps raked the night before sampling and checked each morning.  Two motion sensor wildlife cameras deployed in the Marshall's Ridges area to monitor fauna presence – commenced 2015.
Microchiropteran Bats	Three locations sampled by Anabat call detectors. Anabats deployed for three nights before, during and after each event. Two locations are within the event area (dam and flyway) and the third nearby within Billinudgel Nature Reserve.
Flying-foxes	Incidental survey whilst ecologist on site during events
General Fauna	Incidental road kill observations
Koala	Targeted searches (KSAT) and habitat assessments – 2007, 2008, 2013, 2016

Note: Minor methodology changes have been made during the life of the project.

**Table 2: List of events monitored, including number of patrons**

Event	Monitoring dates	Number of patrons per day
Splendour in the Grass 2013	Before: June; During: July; After: August	25,000
Splendour in the Grass 2014		27,500
Splendour in the Grass 2015		30,000
Splendour in the Grass 2016		32,500
Falls Festival 2013-14	Before: December; During: January; After: February	15,000
Falls Festival 2014-15		17,500
Falls Festival 2015-16		20,000
Falls Festival 2016-17		22,500

### 2.2.2 Other surveys

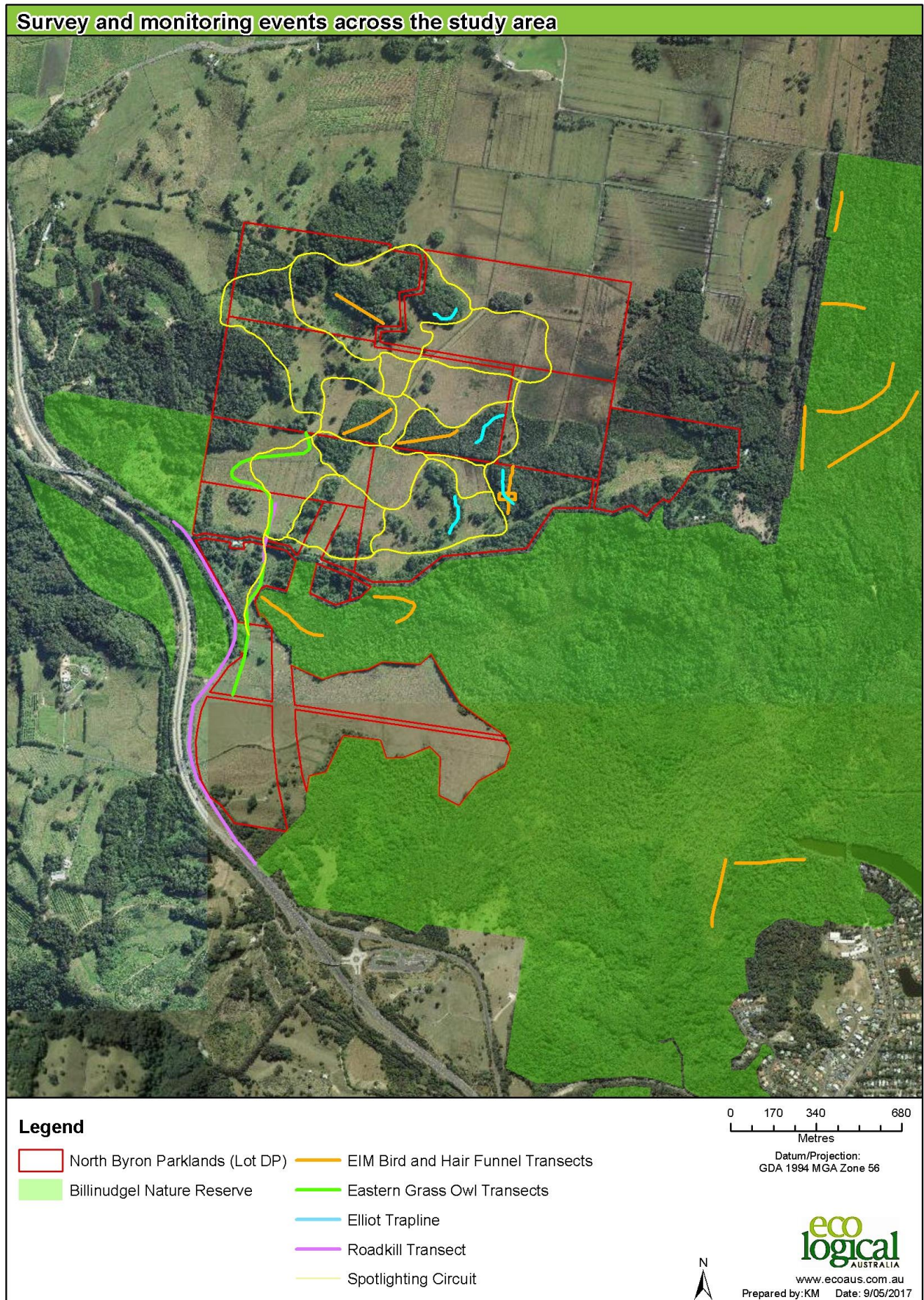
A number of other surveys have been undertaken at the Parklands. Prior to 2013, these were to support the environmental approvals process. Subsequent surveys have been undertaken as part of the approvals requirements. This is primarily the 2014 biennial fauna survey. A summary of these surveys and the method employed is provided in Table 3.

**Table 3: Summary of other surveys undertaken at the Parklands**

Survey type	Year	Methods employed	Reference
Fauna survey	2007	Anabat detection Bird survey (incl. call playback) Drift fence and pitfall traps Elliot traps Flying-fox census Frog survey Harp trapping Incidental observations incl. of tracks, scats, diggings and remains Reptile survey Spotlighting	Fitzgerald 2007
Fauna survey	2009	As per 2007 fauna survey above	Fitzgerald 2009
Fauna survey	2014	Anabat detection Bird survey incl. call playback Elliot traps Frog survey Harp traps Sand traps Spotlighting	Fitzgerald 2014



		Waterbird surveys Incidental observations incl. of tracks, scats, diggings and remains	
Koala survey	2007	Analysis of historical records Site assessment – habitat quality and koala searches (KSAT)	Biolink 2007
Koala survey	2008	Site assessment – habitat quality and koala searches (KSAT)	Biolink 2008
Koala survey	2013	Site assessment – habitat quality and koala searches (KSAT)	Biolink 2013
Koala survey	2016	Site assessment – habitat quality and koala searches (KSAT)	Biolink 2016



**Figure 1: Transect survey and monitoring locations within the Parkland and surrounds**





**Figure 2: Survey and monitoring locations within the Parklands and surrounds**

## 3 Results

The following section provides a summary of the main ecological results from the various surveys and monitoring events conducted within the study area from 2007 to 2016.

### 3.1 Event impact monitoring (EIM) 2013 – 2016

EIM has been undertaken for each of the seven events held at the Parklands to date (2013 – 2016). The consistent conclusion across all EIM surveys has been that there were no significant adverse effects on any flora or fauna group as a consequence of events held at the Parklands. Minor negative ecological effects observed during and immediately after events included limited sediment movement, littering and trampling of grasses within the event area and avoidance of illuminated areas by mobile fauna. These impacts were temporary and reversible at the conclusion of events.

Overall, EIM data highlight the natural variability of the fauna assemblages (particularly bird and microbat). The main driver of this variability appears to be seasonal movements of species and local patterns of food resource abundance, primarily blossom in swamp sclerophyll forest and fruit crops in both native and exotic species (e.g. Camphor Laurel).

Table 4 provides a summary of the results of the EIM at each event. Results and trends for birds, microbats and flying foxes are presented and discussed in more detail in the subsequent sections. These groups have been focused on because they:

- Are the most prevalent on site
- Contain threatened species
- Have the greatest potential to be impacted by events.

Table 4: Summary of EIM results for each event

Group	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016
Vegetation	No impact to remnant forest vegetation; improvements in specific areas due to bush regeneration activities; minor tramping of grass within event area (areas recovered soon after)						
Threatened flora species	Individuals retained and condition maintained; Rough-shelled Bush Nut ( <i>Macadamia tetraphylla</i> ) experiencing some impact from historical competition from Camphor Laurel and Mango Trees, though this is unrelated to the SITG and FF events and has been addressed by Parklands' bush regeneration team						
Forest birds	No difference in abundance or diversity across before-during-after events						
Water birds (@ dam)	No difference in abundance or diversity across before-during-after events; low abundance during SITG 2013 due to patrons swimming in the dam (this practise has ceased in subsequent events)						
Microbats	No difference in abundance or diversity across before-during-after events						
Flying foxes (within event areas)	Absent	Present (5 – 7 individuals)	Absent	Present (2 individuals)	Present (2 – 5 individuals)	Absent	Present (3 – 5 individuals)
Mammals (hairtube results)	No difference in abundance or diversity across before-during-after events; species detected include Dog, Rat, House Mouse, Northern Brown Bandicoot, Antechinus, Possum						
Mobile fauna (sand trap, motion camera)	Technique had limited effectiveness; demonstrated connectivity within and across the site maintained; species detected include Dog, Rat, Cane Toad, Fox, Water Dragon, Brushtail Possum, Northern Brown Bandicoot, Swamp Wallaby, Scrub Turkey, Lace Monitor						
Road kill (incidental obs)	Primarily cane toad						
Threatened fauna species	2 microbat spp. 2 bird spp.	7 microbat spp. 1 – 3 bird spp. (report unclear)	5 microbat spp. 3 bird spp.	8 microbat spp. 1 bird spp.	3 microbat spp. 2 bird spp.	5 microbat spp. 3 bird spp.	4 microbat spp. 0 bird spp.

### 3.1.1 Birds

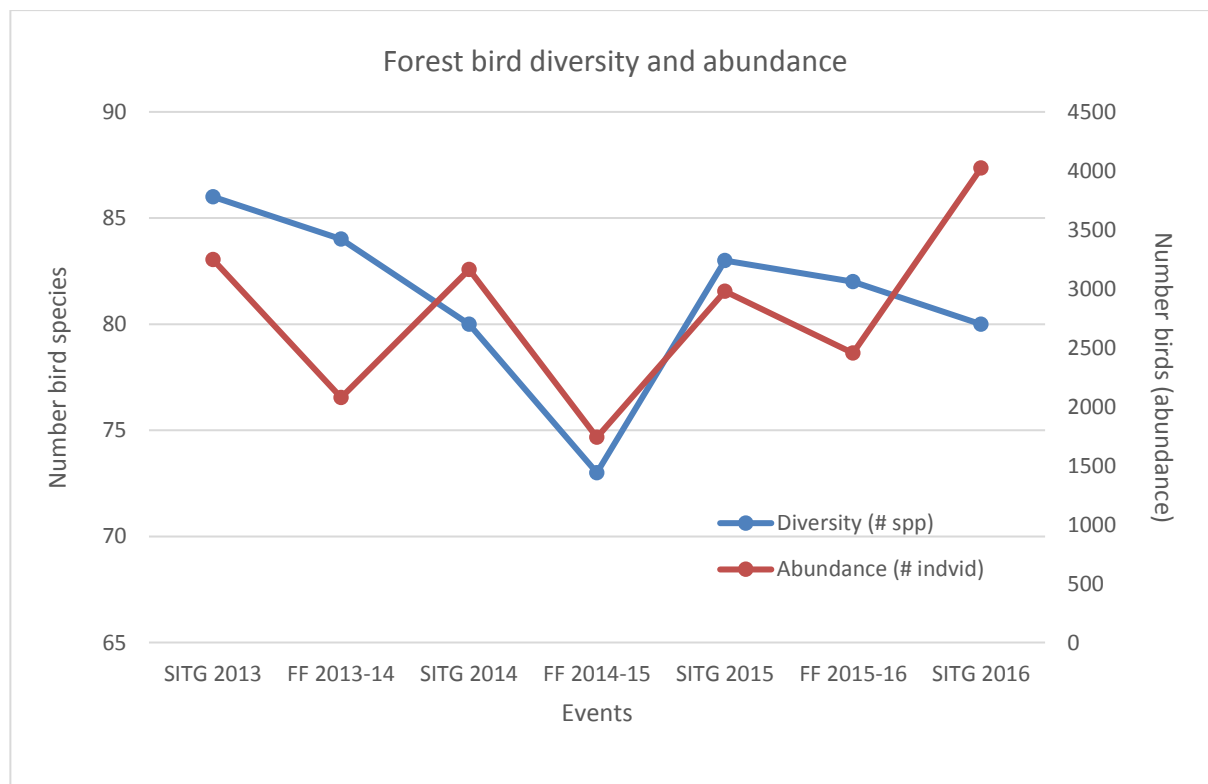
#### Forest birds

The forest bird assemblage at the Parklands and adjacent monitoring areas is diverse and has been monitored consistently across all eight events. The monitoring sites are within the Parklands event areas and in the adjacent areas of Billinudgel Nature Reserve. Bird communities at the sites within the event area have the potential to be disturbed during events. Each EIM survey result demonstrated no differences in bird diversity, abundance or community structure before, during or after events (North Byron Parklands 2014a, 2014b, 2015, 2016).

Across all EIM surveys there were between 73 and 86 species and up to 4023 individuals recorded (sum across all survey transects, Table 5). The most recent surveys associated with SITG 2016 recorded the highest number of individuals to date. While overall diversity and abundance has fluctuated over time, there is no consistent trend of decline in either parameter (Figure 3). This result suggests the combined program of events since 2013 has not impacted regional forest bird communities over time.

**Table 5: Summary of forest bird diversity and abundance at each event**

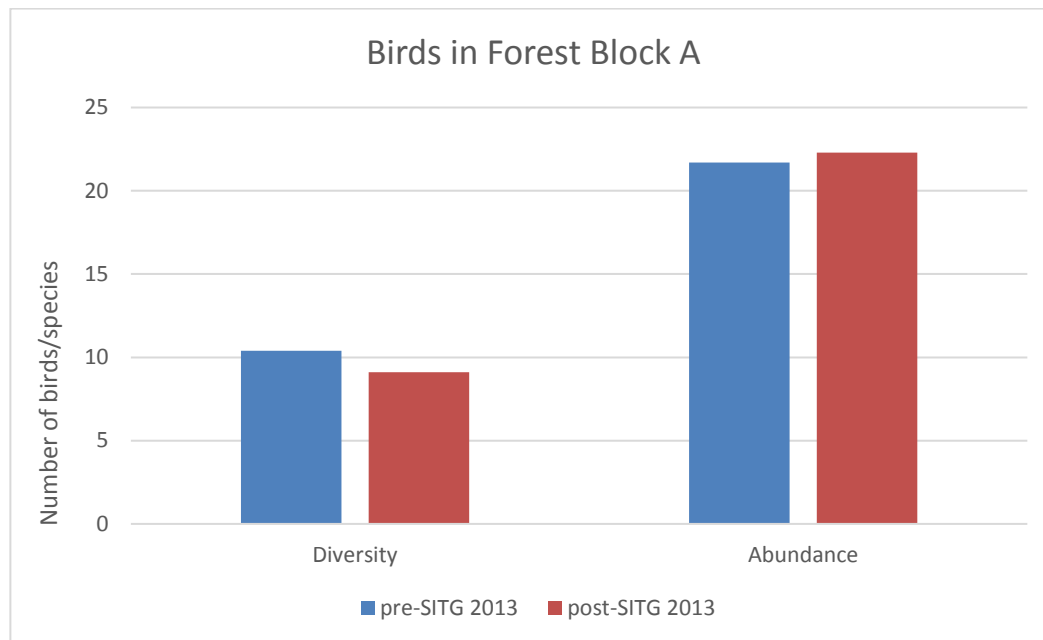
Index	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016
Diversity (# species)	86	84	80	73	83	82	80
Abundance (# individuals)	3246	2077	3164	1740	2979	2455	4023



**Figure 3: Forest bird diversity and abundance trends over time (2013 – 2016)**



There is data available to directly compare bird monitoring data before and after events commenced at the Parklands. Species and abundance data from forest block A (native vegetation block surrounded by event area) was collected over 12 samples prior to SITG 2013 and 44 samples subsequent to this first event. Data show no differences in either the number of birds (abundance) or the number of species (diversity) over time (Figure 4).

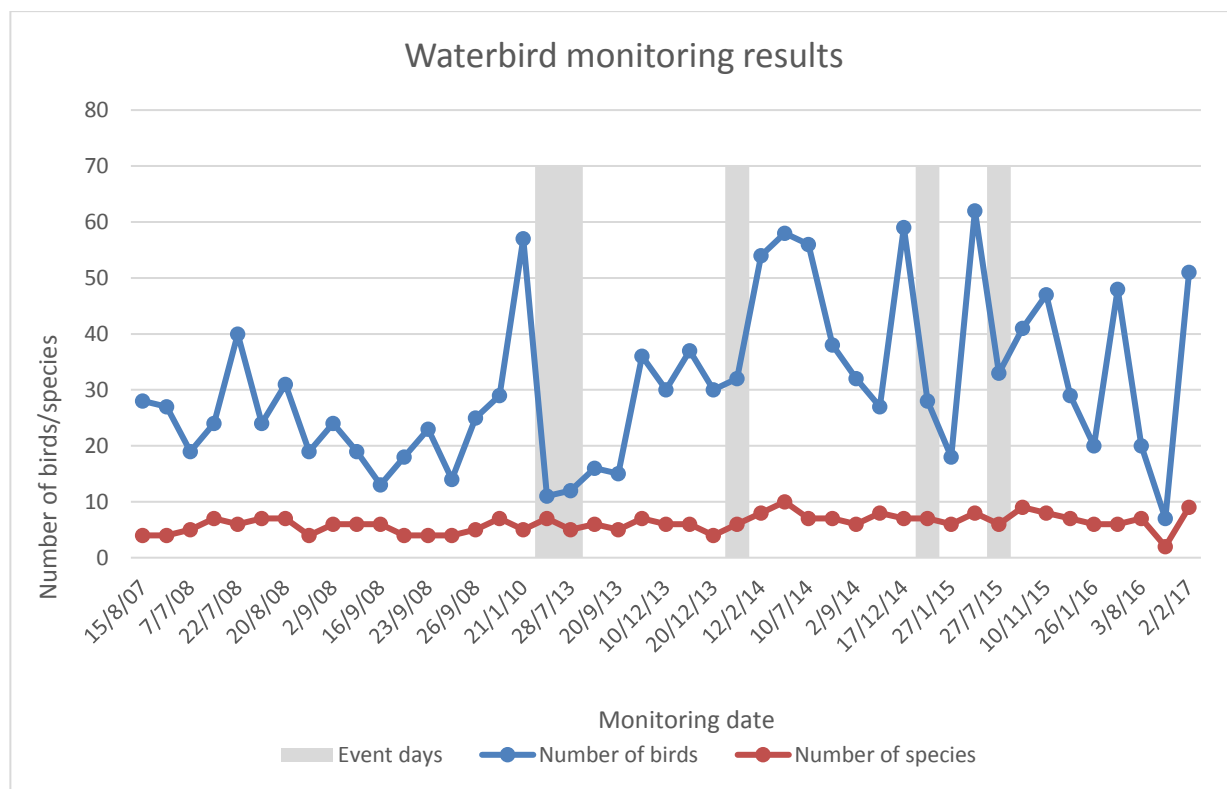


**Figure 4: Forest bird species and abundance in Forest Block A before and after the commencement of events**

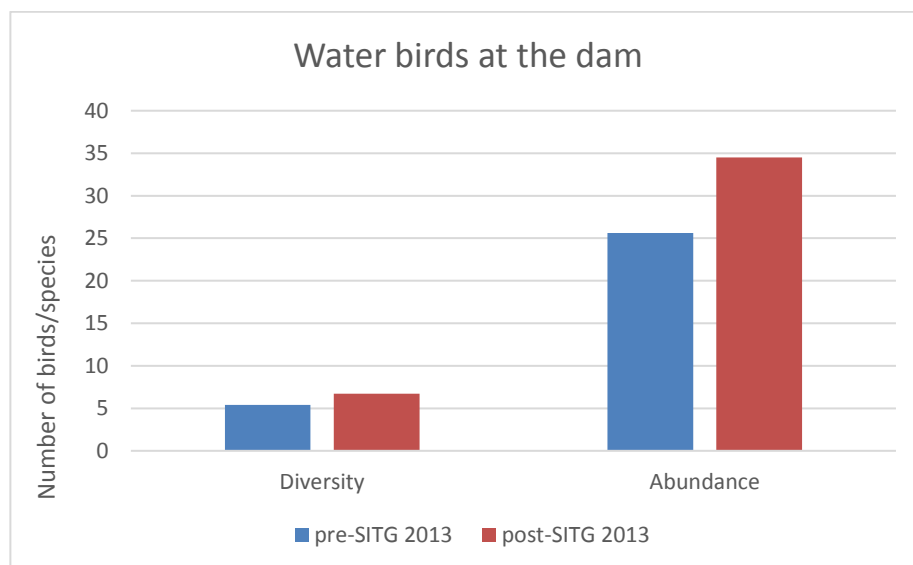
#### *Water birds*

The water bird assemblage at the Parklands dam has been monitored over time since 2007. The dam is within the event area and the waterbird population has the potential to be disturbed during events. Monitoring over time, include during EIM surveys has demonstrated no impact on the waterbird population that is attributable to individual events (North Bryon Parklands 2014a, 2014b, 2015, 2016; Fitzgerald 2016).

Across all surveys there were between 2 and 10 species and up to 62 individuals recorded (per survey, Figure 5). While overall diversity and abundance has fluctuated over time, there is no consistent trend of decline in either diversity or abundance (Figure 5). Additionally, when aggregated across surveys from before and after the commencement of events at the Parklands, the data show both higher diversity and abundance of waterbirds since commencement of events in 2013 (Figure 6). These results suggest the combined program of events since 2013 has not impacted water bird communities over time. It should be noted that the low abundance coincident with SITG 2013 (first grey block on Figure 5) was a direct result of patrons swimming in the dam, and this practise that has since ceased.



**Figure 5: Water bird diversity and abundance over time (grey bars are monitoring data from during events)**



**Figure 6: Water bird diversity and abundance before and after the commencement of events**

#### *Threatened bird species*

Threatened bird species have not been specifically targeted during the EIM, rather their presence recorded along with that of all other species (with the exception of the Eastern Grass Owl – see below).

Five threatened species have been recorded during EIM surveys. All are listed as vulnerable on the NSW Threatened Species Conservation Act (TSC Act) and include:



- Eastern Osprey (*Pandion cristatus*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Rose-crowned Fruit Dove (*Ptilinopus regina*)
- White-eared Monarch (*Carterornis leucotis*)
- Wompoo Fruit Dove (*Ptilinopus magnificus*)

There is insufficient data at an individual event level to undertake an analysis of whether threatened birds are impacted during single events. However, given that the majority of records are from outside the event area, and there is no evidence that events are impacting the general bird communities, it seems reasonable to conclude individual events are not impacting on these species.

A longer-term analysis of the threatened bird data supports this conclusion. Both the Rose-crowned Fruit Dove and the White-eared Monarch have been recorded during multiple EIM surveys, with the most recent being the Falls Festival 2015-16 (Table 6). Furthermore, both species have been recorded within 'the plantings' i.e. areas of active regeneration inside the Parklands (see below). This demonstrates ongoing use of the Parklands and surrounds during 2013 – 2016, and the improvements in habitat value within the Parklands site.

**Table 6: Summary of threatened bird species abundance at each event**

Species	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016	Total count	# events present
Rose-crowned Fruit Dove	42	–	6	18	15	21	–	102	5
White-eared Monarch	2	–	2	–	1	1	–	6	4
Eastern Osprey	–	1	–	–	–	–	–	1	1
Wompoo Fruit Dove	–	–	1	–	–	–	–	1	1
Little Lorikeet	–	–	–	–	–	1	–	1	1

#### *Eastern Grass Owl*

Targeted surveys for the Eastern Grass Owl (*Tyto longimembris*, listed as vulnerable on the TSC Act) were undertaken in July each year for four years (2013 – 2016) and in September 2014 as part of the biennial fauna survey. This species was not present in the main event area (north of Jones Rd) in any year. A pair of Eastern Grass Owls responded to call play back in July 2016 in the exotic grassland in the south of the Parklands. This was the first observation of these species within the site since 2007.

### **3.1.2 Microbats**

#### *All microbat species*

The microbat assemblage at the Parklands and adjacent monitoring areas is diverse and has been monitored consistently across all seven events. Microbat assemblages are monitored via bioacoustic recordings (i.e. anabats), with the number of calls recorded providing a proxy for abundance. The microbat monitoring sites are within the Parklands event areas (primarily the dam) and in the adjacent areas of Billinudgel Nature Reserve. Microbats at the dam within the event area have the potential to be disturbed during events, primarily due to lighting impacts. Each EIM survey result demonstrated no

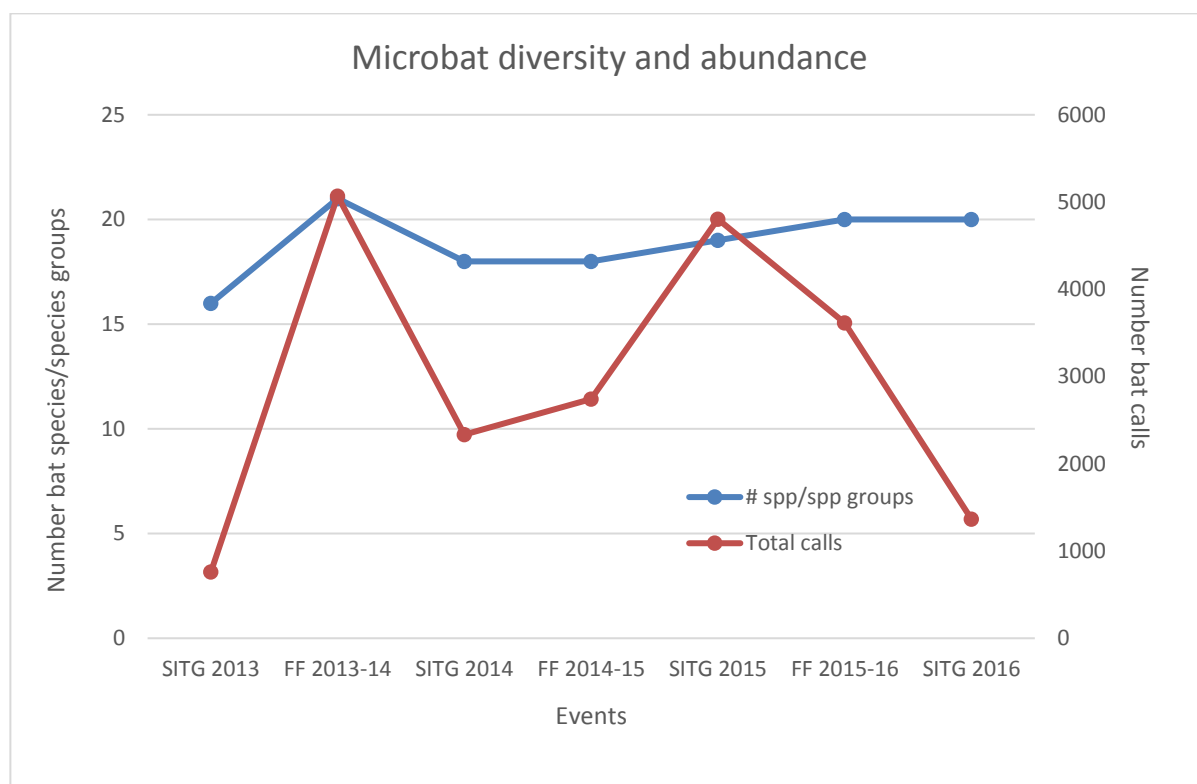
differences in microbat diversity, abundance or assemblage structure before, during or after events (North Byron Parklands 2014a, 2014b, 2015, 2016).

Across all EIM surveys there were between 16 and 21 species<sup>1</sup> and up to 5070 individual calls recorded (sum across transects, Table 7). The most recent surveys associated with SITG 2016 recorded fewer calls than previous surveys, however, this was attributed to equipment malfunction rather than an ecological effect.

While overall diversity and abundance has fluctuated over time, there is no consistent trend of decline in either the number of species recorded or the total number of calls (Figure 3). This result suggests the combined program of events since 2013 has not impacted microbat assemblages over time.

**Table 7: Summary of microbat diversity and abundance at each event**

Index	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016
Diversity (# species)	16	21	18	18	19	20	20
Abundance (# calls)	762	5070	2336	2743	4805	3614	1367



**Figure 7: Microbat diversity and abundance (using calls as a proxy) trends over time (2013 – 2016)**

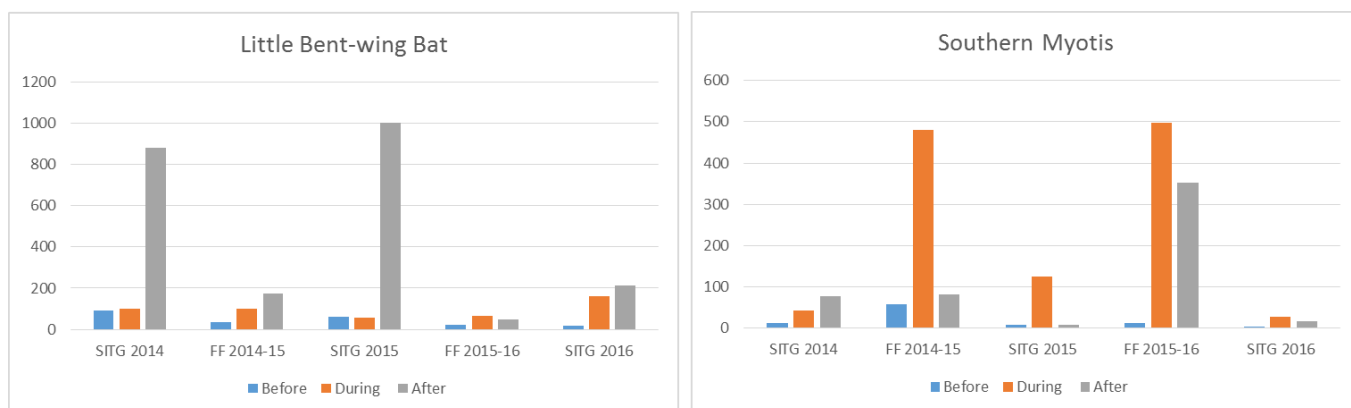
<sup>1</sup> Or species groups if calls could not be attributed to only one species, as commonly occurs in microbat call analysis

### Threatened microbats

Threatened microbat species have not been specifically targeted during the EIM, rather their presence recorded along with that of all other species. Eight threatened species have been recorded during EIM surveys. All are listed as vulnerable within the NSW TSC Act and one is also listed as vulnerable on the EPBC Act. The species include:

- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Golden-tipped Bat (*Kerivoula papuensis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*) – EPBC Act vulnerable species
- Little Bent-wing Bat (*Miniopterus australis*)
- Southern Myotis (*Myotis macropus*)
- Yellow-bellied Sheathtailed Bat (*Saccolaimus flaviventris*)

There is sufficient data for the two most common species (Little Bent-wing Bat and Southern Myotis) at an individual event level to undertake analysis of whether threatened microbats are impacted during events. Figure 8 shows the numbers of calls from each of these species recorded before, during and after five events. These data come from anabats located at the dam wall, the site most likely to be impacted by event-related disturbances. Results for the Little Bent-wing Bat show higher numbers of calls recorded in the month after most events, with similar numbers of calls before and during. Conversely, results for the Southern Myotis show higher numbers of call during most events, with similar numbers of calls before and after. This later result suggests increased predation on insects that are attracted to event lighting in and around the dam, which is key foraging habitat for this species (OEH 2017). Collectively, the results demonstrate no adverse impact associated with events and are consistent with those from the broader microbat assemblage data (as discussed above).

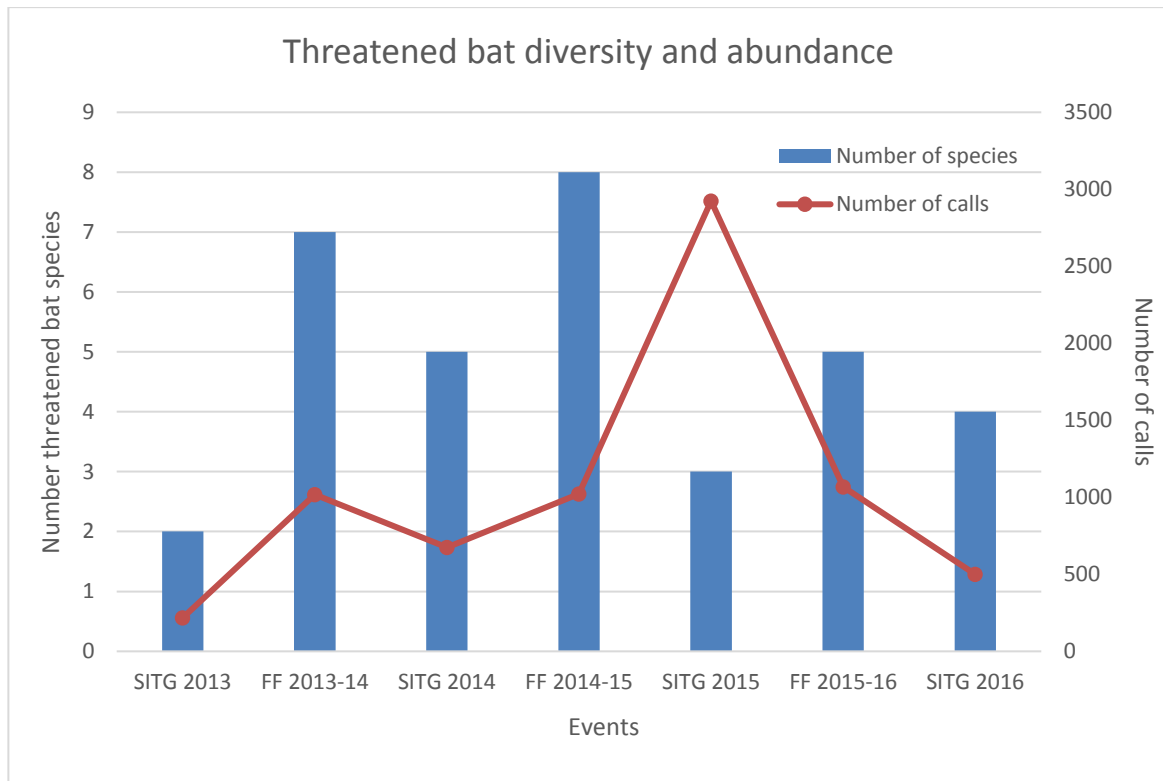


**Figure 8: Before, during and after event call data for Little Bent-wing Bat and Southern Myotis at the dam (note – there were 2572 calls from Little Bent-wing Bat during SITG 2015, however this has been reduced on the figure for scaling purposes)**

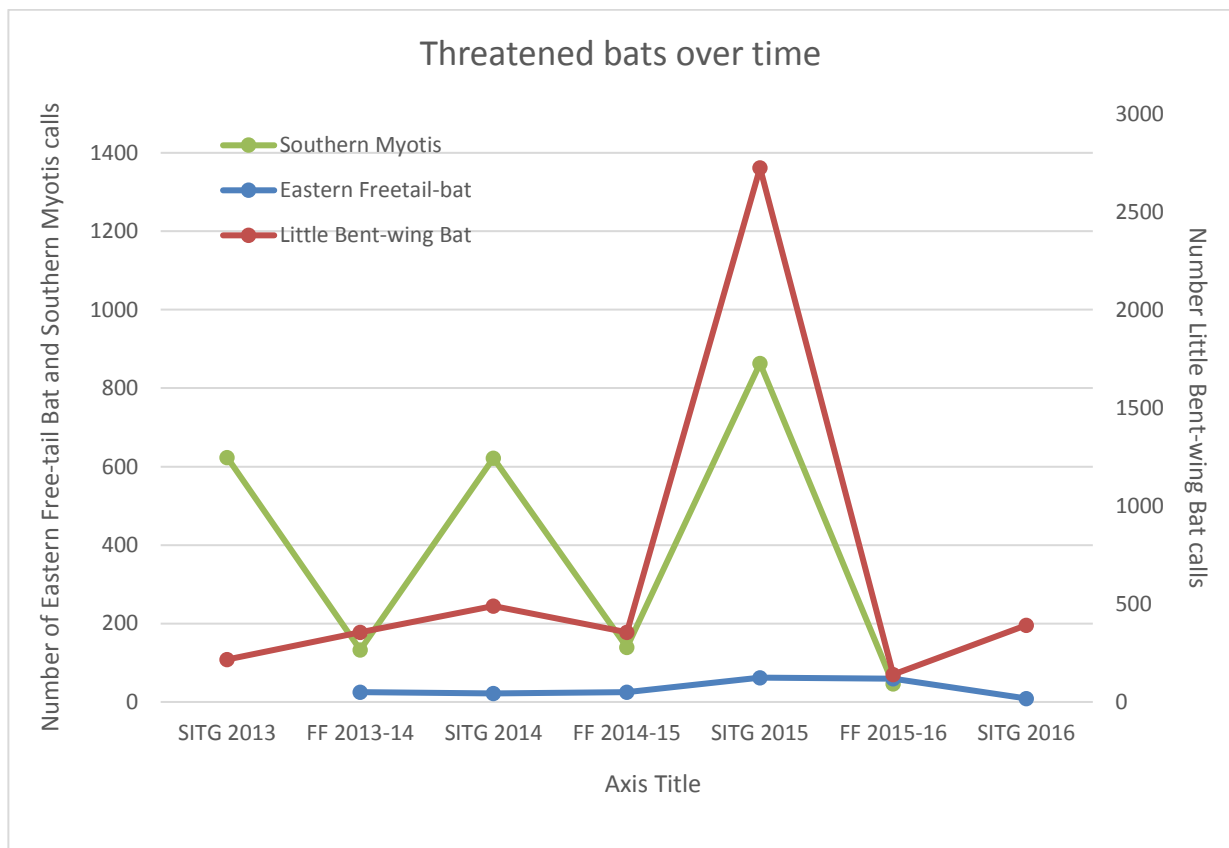
A longer-term analysis of the collective dataset of threatened microbats further supports the conclusion that events have not negatively impacted microbat assemblages. Several microbat species have been recorded during multiple EIM surveys and while call abundance has fluctuated over time, there are no evident trends on an ongoing decline (Table 8, Figure 9, Figure 10). This demonstrates the ongoing use of the Parklands and surrounds during 2013 – 2016 and over the course of the events held to date.

Table 8: Summary of threatened microbat abundance (calls) during each event

Species	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016	Total count	# events present
Little Bent-wing Bat	217	356	489	356	2723	140	392	4673	7
Large-eared Pied Bat	-	1	10	1	-	-	-	12	3
Eastern Freetail-bat	-	25	22	25	62	59	9	202	6
Southern Myotis	-	623	133	622	139	863	46	2426	6
Eastern False Pipistrelle	1	4	-	4	-	1	-	10	4
Yellow-bellied Sheathtailed Bat	-	4	-	4	-	-	-	8	2
Golden-tipped Bat	-	5	-	5	-	4	-	14	3
Eastern Bent-wing Bat	-	-	21	6	-	-	53	80	3
Total calls	218	1018	675	1023	2924	1067	500	7425	
Total spp	2	7	5	8	3	5	4	8	



**Figure 9: Diversity and abundance (number of calls) of threatened microbat species over time**



**Figure 10: Abundance (number of calls) of three most common threatened microbat species over time (note – Little Bent-wing Bat data on secondary axis)**

### 3.1.3 Flying foxes

Flying fox observations have been largely incidental sightings from during event monitoring. Flying foxes have been observed on site during four of the eight events held to date and numbers observed at the site during each event has been low (Table 9). Event abundances are consistent with numbers observed during fauna surveys in 2009 and 2014 (Mark Fitzgerald, pers comm. 2017). Events at the Parklands have not coincided with any large blossom events (i.e. times of highly abundant food resources) and the closest maternity camp (at Brunswick Heads Nature Reserve) for Black and Grey-headed Flying Foxes was abandoned in 2011. Both these factors are likely to be the drivers behind low flying fox numbers of site.

**Table 9: Summary of flying fox abundance at each event**

Index	SITG 2013	FF 2013-14	SITG 2014	FF 2014-15	SITG 2015	FF 2015-16	SITG 2016	FF 2016-17
Flying fox numbers	0	5 – 7	0	2	2 – 5	0	3 – 5	0

### 3.2 Other surveys 2007 – 2016

Numerous other surveys have been undertaken at the Parklands between 2007 and 2014. Most have been associated with fauna. The results of these surveys are discussed by fauna group below (Table 10), with particular focus on comparisons over time. Surveys prior to 2013 provide a pre-event baseline, while surveys after this time were undertaken to detect any impact of events on local fauna communities (specifically the 2014 biennial fauna survey).

**Table 10: Summary of fauna surveys 2007 – 2014**

Fauna group	Summary of results
Forest birds	Bird species diversity was similar across all fauna survey years. When summed across all transects at all sites diversity was 70 species in 2007; 63 species in 2009 and 68 species in 2014.
Water birds	Water bird diversity (8 species) and abundance (27 individuals) was within the range of variability recorded during EIM. Water bird surveys were not undertaken in 2007 and 2009.
Threatened bird species	Three threatened bird species were recorded prior to events commencing – Comb-crested Jacana ( <i>Irediparra gallinacea</i> , TSC Act vulnerable), Eastern Grass Owl and Rose-crowned Fruit Dove. None of these species were recorded in the 2014 fauna surveys, however both the Eastern Grass Owl and Rose-crowned Fruit Dove have been recorded during EIM. The Comb-crested Jacana has not been recorded on site since 2007. The reason for this is unclear, however it is unlikely to be related to events as events began in 2013. The species was absent well before the first event was held and suitable habitat remains on site at the dam that continues to be well utilised by a range of other water bird species.

Frogs	Frog species diversity has varied over time with records of 8 species in 2007; 12 species in 2009 and 6 species in 2014. No threatened frogs have been recorded on site.
Reptiles	Reptile species diversity has varied over time with records of 4 species in 2007 (winter); 0 species in 2009 (summer) and 5 species in 2014 (winter). No threatened reptiles have been recorded on site.
Mammals (general)	<p>Mammal species diversity has varied over time with records of 17 species in 2007; 15 species in 2009 and 13 species in 2014. The lower diversity in 2014 was due to an absence of possum and bandicoot in this survey. Both species were regularly detected during EIM.</p> <p>One threatened mammal (Grey-headed Flying Fox) has been recorded on site.</p> <p>Mammals recorded on site include exotic species: Black Rat, House Mouse, Dog and Red Fox.</p>
Microbats	<p>Nine species of microbat were captured during harp trapping in 2007, 2009, 2014. This included four threatened species (Common Blossom Bat, Eastern Long-eared Bat, Eastern Bent-wing Bat and Little Bent-wing Bat. Both Bent-wing Bats were also regularly detected in EIM surveys, whilst the Common Blossom Bat (<i>Syconycteris australis</i>) and Eastern Long-eared Bat (<i>Nyctophilus bifax</i>) detected only during harp trapping (2007 and 2014). There were fewer bats capture in 2014, however this is attributed to poor trap placement rather than a true reflection of decreased abundance.</p> <p>Anabat survey was different in the pre-event (2007, 2009) surveys versus the 2014 surveys and data cannot therefore be compared. Bat assemblages during all surveys were comprised of similar species to those detected during EIM, with Little Bent-wing Bat being the most commonly recorded species.</p>
Flying foxes	Flying fox numbers declined over time, with numerous Grey-headed and Black Flying Foxes observed in 2007, with only single number of individuals observed subsequently. This decline is attributed to the abandonment of the maternity camp in Brunswick Heads Nature Reserve, as well as a lack of foraging resources (blossom) on site during survey periods.
Koala	<p>Targeted Koala surveys of the site were undertaken by Biolink in 2007, 2008, 2013 and 2016.</p> <p>2007 – small area of core Koala habitat (3 ha) mapped on site; koala scats observed at four locations within the Parklands; results suggest use of the site by 1 – 2 Koalas</p> <p>2008 – significantly reduce evidence of activity, such that activity level does not reach the threshold that indicates active, ongoing use by resident animals</p> <p>2013 – no evidence of Koala within the Parklands</p> <p>2016 – evidence of Koala (scats and scratches) at 7 sites, primarily in the north-west corner of the Parklands and within Billindugel Nature Reserve. Mixed age scats suggest repeat use of sites by Koala individuals with home ranges that encompass the north-west corner of the Parklands</p> <p>EIM – no evidence of Koala within the Parklands or surrounds (based on general observations, not targeted survey)</p>

### **3.2.1 Birds of the plantings**

Planting of local native forest flora species has been ongoing at the Parklands since 2007. Plantings have taken place within degraded farmland areas across the site and in areas adjacent to Billinudgel Nature Reserve. The total area of replanting is 10.7 ha. These areas have filling in gaps in vegetation and have joined previously fragmented areas. Plantings now support a range of native fauna.

Forest birds have been specifically surveyed in two established planting locations. Over four surveys, 161 birds across 31 species have been recorded. This includes two threatened species (NSW TSC Act) – Rose-crowned Fruit Dove (1 sighting) and White-eared Monarch (4 sightings) – which were observed in ~9 year old stands of native plantings located south of Jones Road.

## **4 Discussion and conclusion**

The overall survey and monitoring results to date indicate that the cultural events at the North Byron Parklands site and adjacent Billinudgel Nature Reserve have caused only very minor, temporary and reversible impacts on the ecological attributes of this locality, including threatened species, populations and communities. Increased light and noise levels are an inevitable occurrence associated with event, and these factors will impact on local fauna movements and site usage during the period of each event. However comprehensive EIM has shown that once these factors cease to operate and the site returns to pre-event conditions, fauna presence and habitat values return to baseline conditions. Moreover, there are no evidence of declines in any environmental values at the Parklands, indicating no cumulative effects of holding multiple events.



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