COMMUNITIES LISTENING FOR NATURE

Citizen science in Brisbane Ranges National Park 2018–2019

Australian Owlet-nightjar. Photo: Damian Kelly

A REPORT ON A COMMUNITY PARTNERSHIP IN ECO-ACOUSTIC MONITORING IN BRISBANE RANGES NATIONAL PARK, VICTORIA

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VICTORIAN NATIONAL PARKS ASSOCIATION
Be part of nature

Victorian National Parks Association

The Victorian National Parks Association (VNPA) helps to shape the agenda for creating and managing national parks, conservation reserves and other important natural areas across land and sea. We work with all levels of government, the scientific community and the general community to achieve long term, best practice environmental outcomes.
The VNPA is also Victoria's largest bush walking club and provides a range of information, education and activity programs to encourage Victorians to get active for nature.

NatureWatch

NatureWatch is a citizen science program which engages the community in collecting scientific data on Victorian native plants and animals. The program builds links between community members, scientists and land managers to develop scientific, practical projects that contribute to a better understanding of species and ecosystems, and contributes to improved management of natural areas.

Project Partners

Museums Victoria

Museums Victoria has been trusted with the collection and curation of Victoria's natural history for over 160 years and serves as a key international research institute and experts in data archiving and long-term data protection. Responding to changing intellectual issues, studying subjects of relevance to the community, providing training and professional development, and working closely with schools, communities, and online visitors, Museums Victoria works to disseminate our collective knowledge through online resources and image, audio and video databases.

Friends of Brisbane Ranges

Since 1982, this group has been bringing together the community to learn about and care for Brisbane Ranges National Park. Regular events engage the community in activities like wildlife monitoring, weed control and tree planting. Special projects include monitoring endangered Brush-tailed Phascogales and promoting the park's spectacular wildflowers. www.fobr.org.au

Moorabool Landcare Network Inc.

Bringing together eleven Landcare groups and five friends' groups, this network is tackling landscape scale challenges of native vegetation fragmentation, weed control and pest animal management in the Werribee Catchment. www.mln.org.au

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Helen Macpherson Smith Trust

Summary

In 2018 and 2019, the Victorian National Parks Association (VNPA) partnered with Museums Victoria and local community groups Friends of Brisbane Ranges and Moorabool Landcare Network to monitor bird populations in the Brisbane Ranges National Park and nearby farmland. The community groups provided local expertise and collected bird song data using exciting new eco-acoustic technology with the support of VNPA while experts at Museums Victoria analysed the data. Together this partnership delivered a current snapshot of the health and distribution of bird populations across many different habitat types in the Brisbane Ranges National Park.

- 2589 hours of recordings were collected across 14 sites.
- 26 bird species were identified.
- Powerful Owls were verified at five sites.
- Volunteers contributed 46 days of fieldwork, 44 hours of project planning and numerous hours of equipment management.

Monitoring bird populations is an effective way to evaluate local biodiversity, and corresponding habitat condition. However, it is time-consuming to both collect and analyse bird sightings or bird call data. The study of eco-acoustics allows for the collection of bird call data across large areas of land and over an extended period with a minimal number of people in the field.

This information will help the local community and land managers, Parks Victoria, with their land management planning including the management of threats and the protection of threatened species. In addition, this project has been an excellent way to increase expertise in local bird species and their habitat requirements as well as increasing awareness of the value of protected areas in preserving local biodiversity.

This project has provided Museums Victoria with a new bird call data set to add to their online collections and to enhance their bird call recognition software to improve their ability to identify quickly and accurately assess bird populations in Victoria.

Birds identified in recordings
Australian Magpie
Australian Owlet-nightjar
Bronzewing species
Corella species
Crimson Rosella
Eastern Yellow Robin
Fan-tailed Cuckoo
Galah
Scarlet Robin
Southern Boobook
Spotted Pardalote
Sulphur-crested Cockatoo
Superb Fairy-wren
Tawny Frogmouth
White-throated Nightjar
White-throated Treecreeper
Yellow-tailed Black-cockatoo
Golden Whistler
Grey Fantail
Grey Shrike-thrush
Horsfield's Bronze Cuckoo
Laughing Kookaburra
Powerful Owl
Raven species
Red Wattlebird
Rufous Whistler

This research was conducted under DELWP research permit #10007964.

1. Introduction

Communities Listening for Nature

Communities Listening for Nature is an exciting citizen science project, run by the Victorian National Parks Association in partnership with Museums Victoria, and local community groups and land managers. It has been run at five sites across Victoria including Brisbane Ranges National Park (Friends of Brisbane Ranges, Moorabool Landcare Network), Wombat State Forest (Wombat Forestcare), Bunyip State Park (Friends of Bunyip State Park), Mount Worth State Park (Mount Worth & District Landcare & Friends of Mount Worth State Park) and around the Mount Alexander region (Connecting Country). The program involves collaborative research design and implementation utilising new acoustic technology to monitor native birds in Victoria.

The aim of Communities Listening for Nature is to engage, train and equip community groups and volunteers in Victoria as citizen scientists and to detect, record and study Victorian birds, including some of the State's threatened species. This program supports local community expertise in bird identification and habitat use, providing important knowledge of Victorian bird species to assist with active management and conservation planning.

Data collected by citizen scientists will contribute to answering the project research questions, be added to the Victorian Biodiversity Atlas, and contribute to Museums Victoria's curated sound reference library of Victorian birds. Scientists, land managers, conservation groups and the general public worldwide can use this reference library to investigate Australia's unique bird life.

The study of bioacoustics

Bioacoustics combines acoustic and biological principles to record and analyse sounds in nature. It goes beyond just species identification and can investigate how an animal relates to their environment.

Recording devices, such as Song Meters, are easy to install in the field to record bird sounds. They can be programmed to focus on recording at certain times of the day and the frequency of recording. Recordings can also be set up simultaneously at multiple locations and rotated regularly to new locations, to maximise data collection. This survey method can provide data on the presence of secretive species or species that vocalise infrequently which have a greater probability of being missed during human-based surveys.

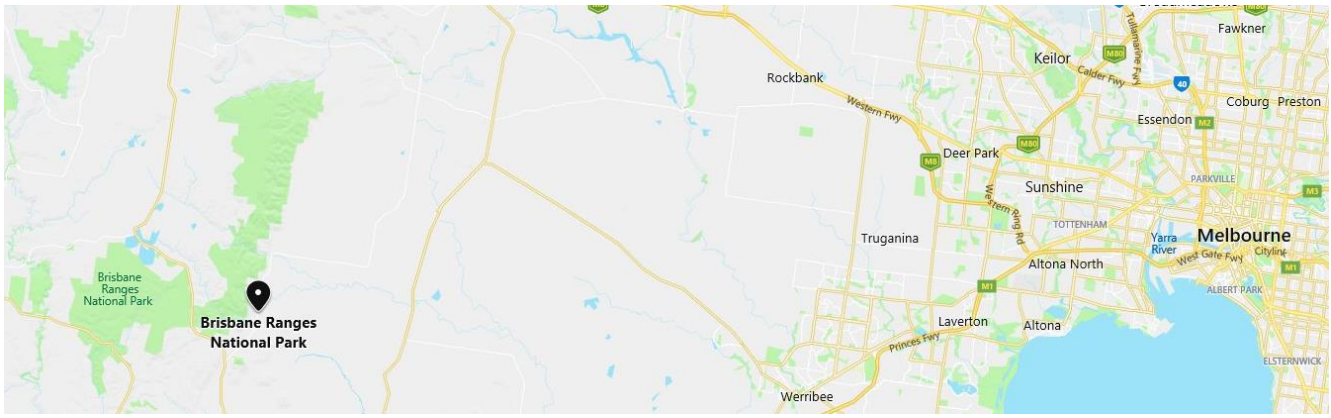
The recordings collected from the field are analysed using specialised software that interprets bioacoustic sound frequency as visual displays called spectrograms. Spectrograms essentially graph the sound and can be annotated by bird sound identification experts to identify the species. They can also be run through auto-detection software that can extract patterns for specific species against recognisers in models developed from previous identifications. However, whilst acoustic monitoring can provide clear evidence of the presence of particular species, and presence within different habitats, it cannot give comprehensive information about how many individuals there are in an area.

Acoustic monitoring also allows the assessment of the soundscape of a site, a reliable ecological monitoring tool for biodiversity (Fuller et al. 2015) that is an indicator of the natural calling activity of species across long periods of time that may not be possible in time-restricted, human-based surveys. One way to summarise soundscape data is to calculate an Acoustic Complexity Index (ACI) at each site (Pieretti et al. 2011). This

calculation measures the complexity of bird sounds in a soundscape as a way to indicate both singing activity and the diversity of birds present. Higher ACI values indicating more singing activity and greater bird diversity. ACI values can then be compared across sites to help understand how different sites compare with one another or are associated with different characteristics (e.g., do sites differ in their ACI in different Ecological Vegetation Classes).

Beyond drawing out ecological information from sound recordings, audio clips of local soundscapes and species are a great educational resource which can be presented back to the community. In this project, each recording is independently analysed by experts at Museums Victoria, archived digitally and stored in their collections into perpetuity. This makes them permanent, verifiable evidence of the presence of bird species at specific locations and serving as a valuable tool in monitoring threatened and other species.

Monitoring in Brisbane Ranges National Park



Located 80 km west of Melbourne, Brisbane Ranges National Park is known for its panoramic views, steep valleys, rocky gorges and wildflowers. The park is 7718 hectares in size and has a history of logging disturbance from the gold mining era of the 1850s. As a result, there are few remaining trees predating that period, with most current trees the result of coppice regrowth or regeneration since harvesting.

This park is located in the Central Victorian Uplands Bioregion. Predominant tree species include Messmate Stringybark, Red Stringybark, Broad-leaf Peppermint, Red Ironbark, Manna Gum, White Sallee, and Swamp Gum. The presence of *Phytophthora cinnamomi* is a serious threat to vegetation and overall ecology of the park and is therefore a management priority.

Photo: Nick McCaffrey

Koalas were re-introduced into the park between 1944 and 1977 and are now relatively common, although recent declines in sightings indicate that the species is under pressure in this region.

Threatened species found in the park and nearby landholdings include the Swift Parrot, Brush-tailed Phascogales, Common Bent-wing Bats, Powerful Owls, Barking Owls and Painted Honeyeaters. Additional significant species include the White-throated Nightjar and the Peregrine Falcon.

Project Design

An initial planning workshop was held in Bacchus Marsh on 20 August 2018. It was attended by members of the Friends of Brisbane Ranges, Moorabool Landcare Network, Parks Victoria, Museums Victoria and VNPA. This workshop discussed the research priorities for each group and developed a draft project design.

As the final location for 'Communities Listening for Nature', this project was limited in time for data collection. Therefore, a concise project plan was developed to focus on target species of nocturnal birds.

Target species:

Powerful owl (*Ninox strenua)*

Other species of interest:

- White-throated nightjar *(Eurostopodus mystacalis)*
- Australian Owlet-nightjar *(Aegotheles cristatus)*
- Diamond firetail *(Stagonopleura guttata)*

Southern Boobook. Photo: Damian Kelly

Research Questions:

1. What is the Acoustic Complexity Index for the different Ecological Vegetation Classes in the Brisbane Ranges National Park and adjacent private land?

2. How does the Acoustic Complexity Index compare across different Ecological Vegetation Classes in the Brisbane Ranges National Park?

3. Does the Acoustic Complexity Index change between sites in the Brisbane Ranges National Park and adjacent private land?

4. Where are Powerful Owls present in the Brisbane Ranges National Park and adjacent private land?

5. Are targeted management species (White-throated nightjars, Australian Owlet-nightjar, Diamond firetail) present in the Brisbane Ranges National Park and where are they located?

2. Methods

Song Meter Methodology

Communities Listening for Nature uses 'Song Meter SM4' devices from Wildlife Acoustics. Each Song Meter contains two built-in microphones for multidirectional recording and two 64 GB SD cards, all contained within a weatherproof protective case.

Field recording occurred from 24 September 2018 to 10 January 2019. Song Meters were in operation for three weeks at each site. At each site, volunteers located the centre of the site (using GPS coordinates and used the nearest suitable tree to set up the Song Meters. Song Meters were fixed to a tree trunk at approximately ear height (about 150 cm) above the ground with an elastic strap and secured with a cable-lock to prevent damage and theft. Locations were recorded with GPS. Recording began on the day they were set-up and stopped either when the SD cards were full or when the Song Meter was retrieved.

To increase the chances of detecting target nocturnal species, the Song Meters were programmed with a recording schedule of:

→ one hour before sunset, through to three hours after (4 hour block)

→ one hour before sunrise, through to two hours after (three hour block)

→ 10 minutes ON and 10 minutes OFF for all other times of the day

Song Meter SM4 acoustic recording device. Photo: Sera Blair

Site Selection:

Sites were selected both within the National Park and on private properties adjacent to the National Park. Private properties were owned by members of the Moorabool Landcare Network and selected based on access and for the best opportunities to engage local landholders in monitoring for threatened species such as Powerful Owls.

Within the National Park, sites were selected by the Friends of Brisbane Ranges to represent a variety of Ecological Vegetation Classes (EVCs) (Table 1). Sites were selected in areas of the park with different ages since last known fire occurrence and with or without Phytophthora. Sites were located a minimum of 2 km apart to ensure there would be no overlapping recordings of Powerful Owl, whose calls can travel over a kilometre. Song meters were rotated every three weeks to a new site.

Table 1: Ecological Vegetation Classes represented in this project and their conservation status (DELWP 2018).

Ecological Vegetation Class	EVC Number	Conservation Status
Sand Heathland	6	Least Concern
Lowland Forest	16	Least Concern
Heathy Dry Forest	20	Least Concern
Shrubby Dry Forest	21	Least Concern
Grassy Dry Forest	22	Depleted
Grassy Woodland	175	Endangered

Table 2: Sites monitored in this study and their ecosystem type. Ecological Vegetation Class (EVC) is the standard unit for classifying vegetation types in Victoria. * Private land sites.

Site	Ecological Vegetation Class	Site	Ecological Vegetation Class
*BROP1	Grassy dry forest	BRNP09	Heathy dry forest
*BROP2	Heathy dry forest	BRNP10	Lowland forest
*BROP3	Grassy woodland	BRNP11	Heathy dry forest
BRNP01	Heathy dry forest	BRNP12	Lowland forest
BRNP02	Heathy dry forest	BRNP13	Sand heathland
BRNP03	Heathy dry forest	BRNP14	Heathy dry forest
BRNP04	Grassy dry forest	BRNP15	Grassy dry forest
BRNP05	Shrubby dry forest	BRNP16	Heathy dry forest
BRNP06	Heathy dry forest		
BRNP07	Heathy dry forest		
BRNP08	Shrubby dry forest		

Data analysis

Acoustic field recordings were sent to Museums Victoria for analysis where species-specific recognisers were generated for commonly detected and threatened bird species previously recorded at different sites.

Recognisers are a type of model created based on available, pre-existing high quality vocalisations ('template vocalisations') for a species. Once created, recognisers were used in an automated process to scan the acoustic field recordings collected by Song Meters to detect vocalisations ('candidate vocalisations') that matched the template vocalisations. Candidate vocalisations were then manually checked to verify species presence.

Species-specific recognisers were used to produce a general species list for Brisbane Ranges National Park. Further analysis to produce site-level lists and detect further species is possible but requires a longer time period to process the data.

3. Results

Song meters were deployed in five rounds from 24 September 2018 to 10 January 2019. On the first round, song meters were deployed on three private properties adjacent to the National Park. The remaining four rounds deployed the song meters within the National Park at four locations each round.

Table 3: Number of times song meters were deployed in each EVC.

EVC Number	EVC Name	Deployments
6	Sand Heathland	1
16	Lowland Forest	2
20	Heathy Dry Forest	10
21	Shrubby Dry Forest	2
22	Grassy Dry Forest	3
175	Grassy Woodland	1

Acoustic recordings

Altogether, 5824 acoustic field recordings were collected from 111 days of monitoring for 14 sites. There were 178 audio files that were not readable, leaving 5646 usable files.

Most sites recorded around 185 hours of data.
Combined duration of field recordings equals 2589 hours, totalling 1.64 TB of data.

List of species recorded

Twenty-seven bird species have been identified in initial analysis from the acoustic field recording across all sites in Brisbane Ranges National Park (Table 4).

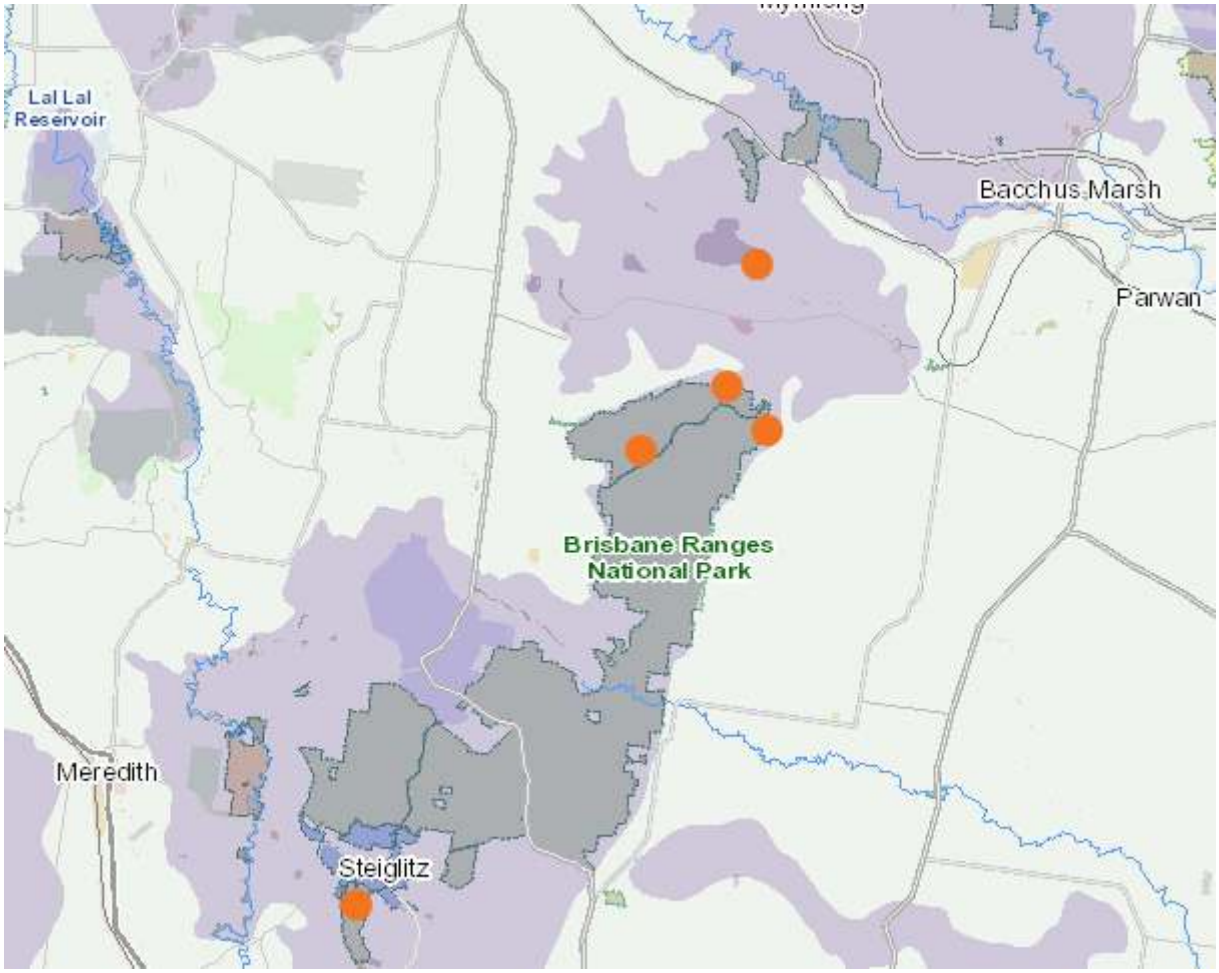
Table 4: List of all bird species identified in acoustic data in relation to the number of recordings in each Ecological Vegetation Class

Common Name	Ecological Vegetation Class					
	Grassy Dry Forest	Grassy Woodland	Heathy Dry Forest	Lowland Forest	Sand Heathland	Shrubby Dry Forest
Australian Magpie	1					
Australian Owlet-nightjar	**38**	**20**	**43**	**3**	**31**	**2**
Black-faced Cuckoo-shrike			1			
Bronzewing species			2			
Corella species			1	1		
Crimson Rosella				1		
Eastern Yellow Robin	1		2			1
Fan-tailed Cuckoo	1		2			
Galah			1			
Golden Whistler			1			
Grey Fantail	1		2			
Grey Shrike-thrush			1			
Horsfield's Bronze Cuckoo			2			
Laughing Kookaburra	1					1
Powerful Owl	**1**	**3**	**11**			
Raven species	1					
Red Wattlebird						1
Rufous Whistler		1	1			
Scarlet Robin			3			
Southern Boobook	8	13	25	4	1	5
Spotted Pardalote			1			
Sulphur-crested Cockatoo	1		1			
Superb Fairy-wren			1	1		
Tawny Frogmouth			5	1		
White-throated Nightjar		**1**	**16**			**1**
White-throated Treecreeper	1		1			
Yellow-tailed Black-cockatoo				1		
Total number of species	**11**	**5**	**21**	**7**	**2**	**6**

Threatened species:

Powerful Owls are the only listed threatened species identified in acoustic recordings from this project. They are listed as vulnerable on the Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013). In this study they were recorded in three EVCs – Grassy Dry Forest, Grassy Woodlands and more frequently in Heathy Dry Forest. This is an interesting finding as we generally find Powerful Owl in more wet habitats (Birdlife Australia 2019). Within EVCs, Powerful Owls were detected at five sites: BRNP01, BRNP16, and all three private land sites (BROP01-03)(Figure 2).

Figure 2: Map of sites where Powerful Owls were detected.



Of the four target species in this study, all were detected but the Diamond Firetail. White-throated Nightjar was detected in Grassy Woodland and Shrubby Dry Forest, but primarily in Heathy Dry Forest whereas Australian Owlet-nightjar was detected in all the surveyed EVCs.

Incidental, non-target species are primarily detected when verifying the results of running the target species recognisers. For example, when looking at the spectrogram of a potential target species the recogniser has identified, other species' vocalisations can often be seen in the background. In this case, non-target species may be disproportionately detected in habitats or times when the target species are calling. In this study, incidental species were primarily detected in Grassy Dry Forest and Heathy Dry Forest as these habitats were also where many of the target species were detected. Incidental detections of nocturnal species (including Southern Boobook and Tawny Frogmouth) may also be more likely than other species as three of the four target species in this study primarily call at night.

Powerful Owl and chick. Photo: Damian Kelly

Spectrograms for the audio recordings of the target birds detected in this study.

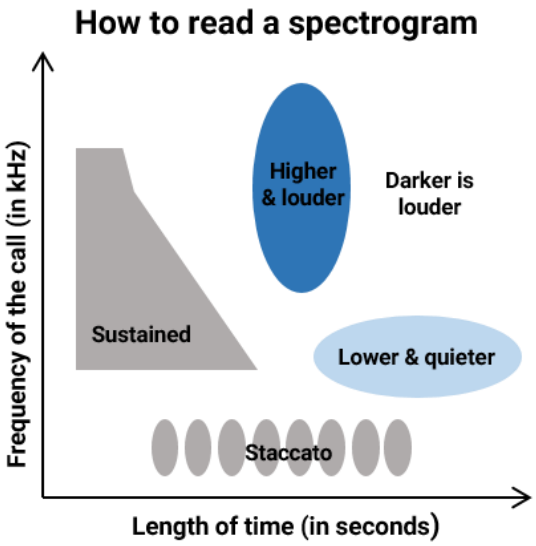


Figure 3: Spectrogram of Powerful Owl call

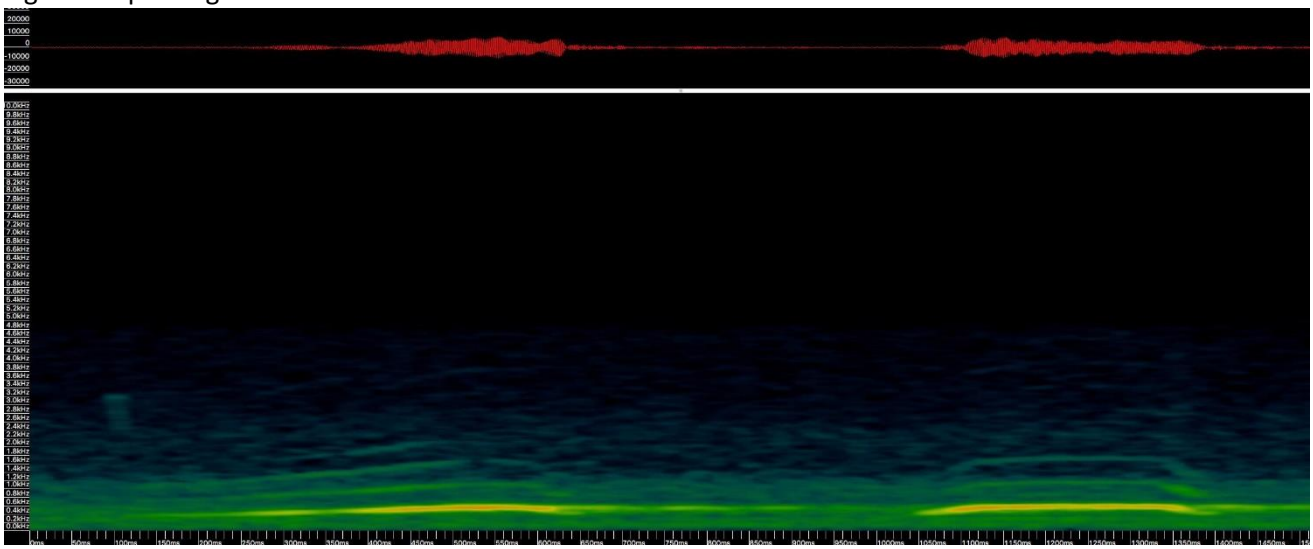


Figure 4: Spectrogram of White-throated Nightjar call

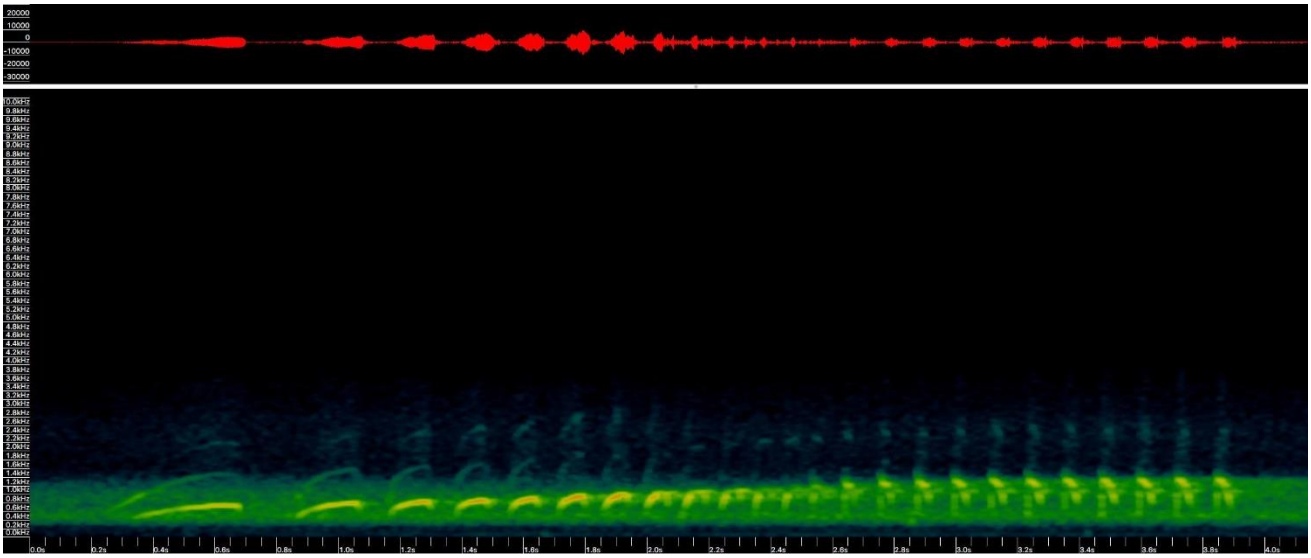
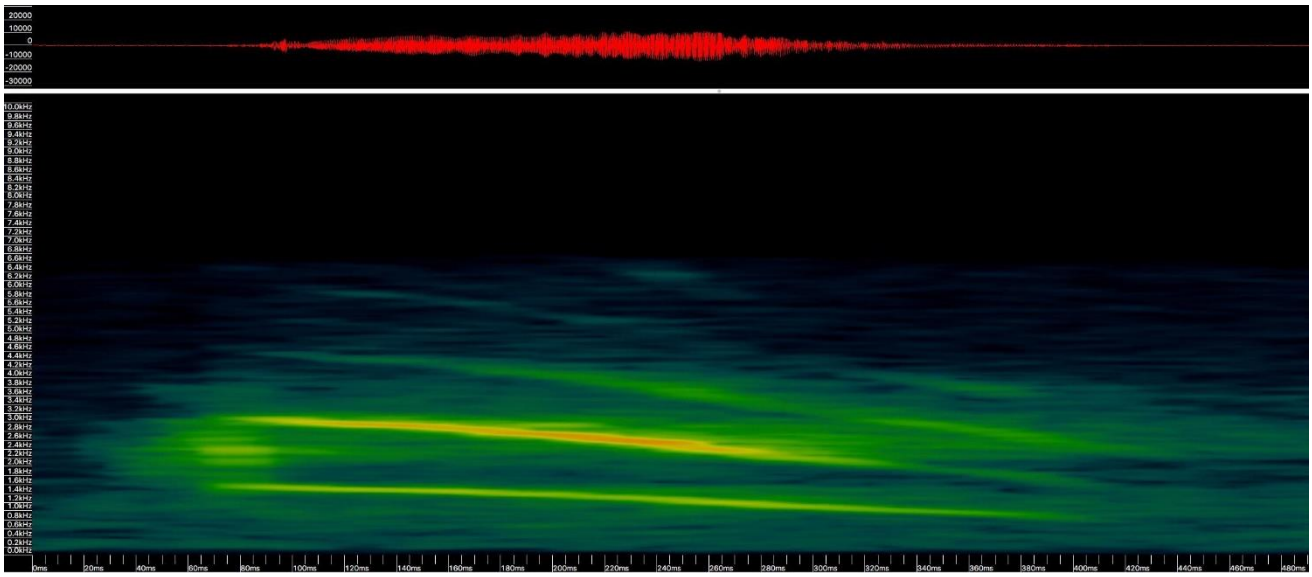


Figure 5: Spectrogram of Australian Owlet-nightjar call



Acoustic Complexity Index

Soundscape data for sites by EVC and land tenure were compared by calculating an Acoustic Complexity Index (ACI) for each site characteristic. Higher ACI values indicate a higher complexity of both singing activity and the diversity of birds present at a site.

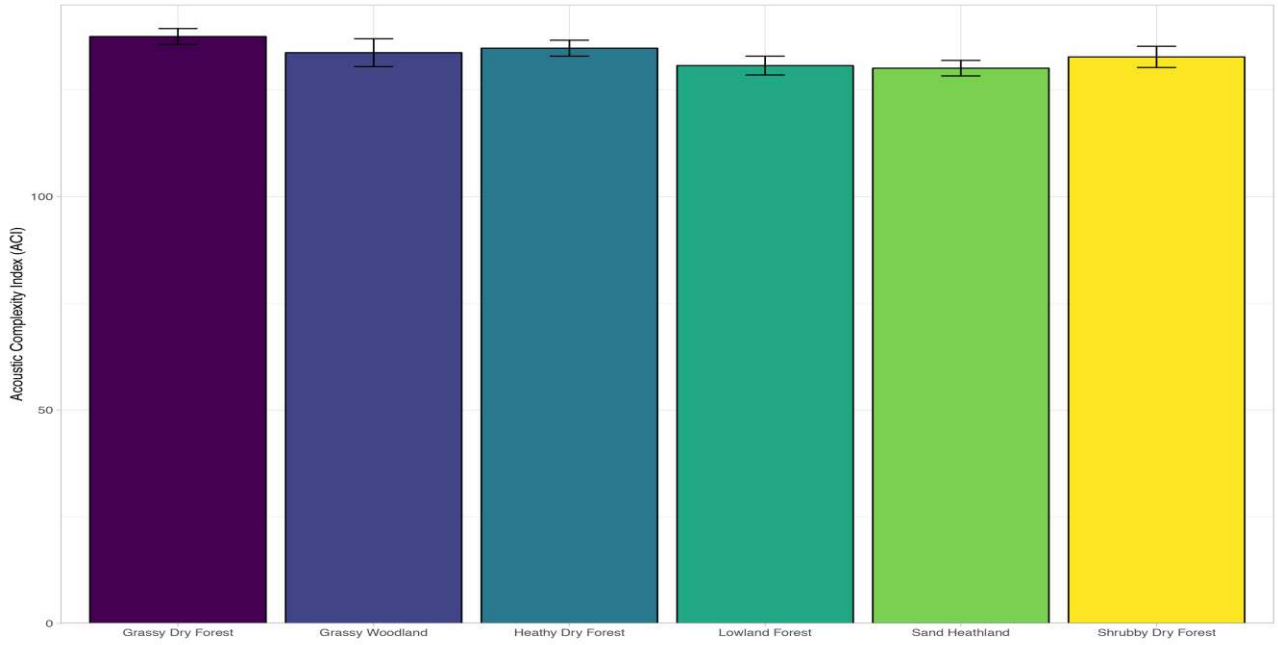
ACI by Ecological Vegetation Class

ACI values were calculated for each category of EVC. Sand Heathland had the lowest acoustic complexity value and Grassy Dry Forest the highest, however values were fairly similar across all EVCs (130.1 – 137.5; Table 5).

Table 5: ACI values by EVC (mean of 95th percentile daily values with 95% confidence intervals).

EVC	ACI Mean	ACI Range
Grassy Dry Forest	137.5	135.7 – 139.4
Grassy Woodland	133.7	130.5 – 137.0
Heathy Dry Forest	134.8	132.9 – 136.7
Lowland Forest	130.7	128.5 – 132.9
Sand Heathland	130.1	128.3 – 131.9
Shrubby Dry Forest	132.8	130.3 – 135.2

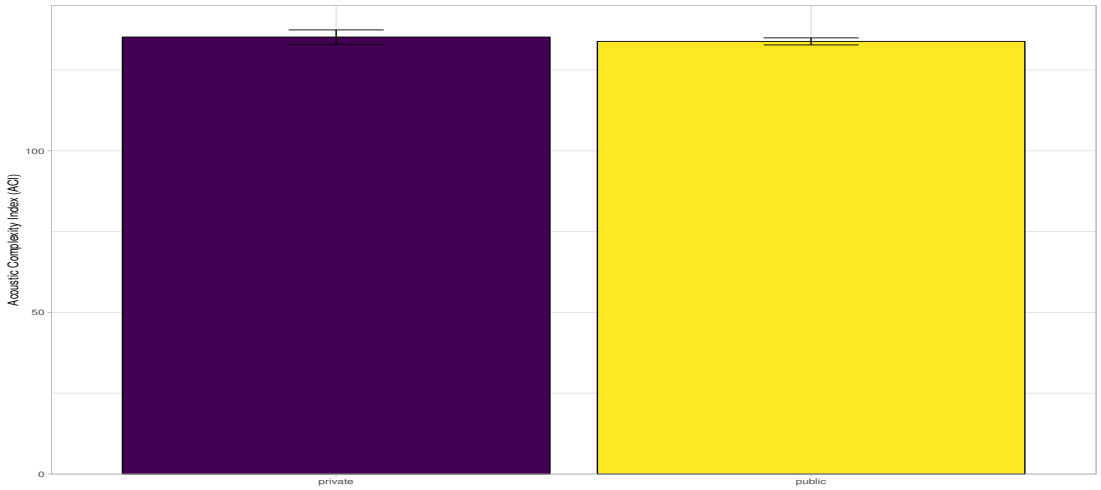
Figure 6: Comparison of the Acoustic Complexity index across EVCs within Brisbane Ranges National Park and adjacent private land.



ACI by land tenure

ACI values were calculated for land tenure to compare complexity on private land sites to those within the national park. ACI was virtually the same with it being only slightly lower on public land (135.2, range of 133.0 – 137.4) than on private (133.8, range of 132.8 – 134.9; Fig. 7). Both values were within the confidence intervals of each other suggesting similar acoustic activity, and likely species richness, between public and selected private lands adjacent to the Brisbane Ranges National Park. This result may be related to the quality of the private land under the guidance of the Moorabool Landcare Networks that is working to restore native vegetation to private land in the area. These results may not be indicative of all private land in the area.

Figure 7: Comparison of the Acoustic Complexity index within Brisbane Ranges National Park (yellow) and adjacent private land (purple).



4. Discussion

Overall, this Communities Listening for Nature project answers all of its research questions to add new information for community and land managers to more effectively protect habitat elements for native bird species in land management in the region.

The presence of Powerful Owls was confirmed within the Brisbane Ranges National Park and adjacent private land indicating the value of managing habitat elements across land tenures. This study indicates that Powerful Owl use drier ecological vegetation types as well as the more commonly considered wetter habitats. It should be noted that this research was conducted outside of the breeding season for the Powerful Owls and they were therefore likely to be calling less frequently than they would have in the winter months.

Copies of all bird call recordings, sample spectrograms and park soundscapes have been provided to the Friends of Brisbane Ranges and Moorabool Landcare Network for use in local education programs and to assist with future bird identification efforts.

The annotated data collected in this project will be incorporated into Museums Victoria's species recognizers and online collection of bird sounds. This data is freely available worldwide and will help scientists, land managers, conservation groups and the public connect with Australia's unique and charismatic bird life.

Along with the achievements of this project, the collection of terabytes of data from the sound recordings and their associated metadata proved to be challenging to store and to manually catalogue. It was estimated that one hour of mono recording resulted in half a gigabyte of data to be stored. Future projects should consider these challenges when estimating the timeline, funding, data storage and staffing requirements to complete a similar project.

This project provided an excellent example of the NatureWatch model bringing together the local community with scientists and land managers to improve our collective understanding of species and ecosystems and to inform management of natural areas. Because of this partnership, we now know more about the avian species and their distribution in Brisbane Ranges National Park and have a set of skilled citizen scientist who are now deeply embedded contributors to the development of bioacoustic monitoring and the on-going management of the park.

Recommendations

This project is a valuable start to understanding the current bird populations and distributions in Brisbane Ranges National Park and adjacent private land. We recommend this research be continued over a series of year and throughout all seasons to gain a more complete understanding of the distribution of threatened species, such as Powerful Owls, to ensure their habitat is being adequately managed and protected.

This research also indicated the habitat value of well-managed private land for a range of bird species. Efforts by private landholders to re-establish native vegetation and habitat values clearly has a positive correlation with a variety of native bird species and we would encourage the continued support and expansion of Landcare groups and community outreach to increase habitat restoration on private land. Future research could investigate different private land management strategies to increase habitat for the birds recorded in

this area to assist with targeted restoration activities across the landscape. By engaging private landholders in this project it shows the value of managing bird habitat on private land that can be used as a catalyst by restoration groups, such as Landcare, to educate and engage the wider community.

This project was a first step in introducing local community groups to new acoustic monitoring techniques for monitoring local bird populations that is less labour intensive that traditional methods. With recording equipment becoming more affordable, groups or individual land owners could continue collecting data on local bird populations. However, the analysis of the audio data is still time consuming and requires expertise. The Communities Listening for Nature program has helped to increase the capacity of Museums Victoria to analyse bird populations from audio data and we recommend projects continue to work with Dr Karen Rowe to continue to build species recognisers that assist with the analysis of audio data. In addition, efforts should be made to improve the ability of community groups to analyse data for themselves, through bird call identification training and use of digital bird call recognisers, to increase the speed of analysis to assist in local decision making for habitat protection and improvement.

Austral Grass-trees (*Xanthorrhoea australis*) in flower in Brisbane Ranges National Park.

5. References

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Pieretti, N., Farina, A. and Morri, D. 2011. A new methodology to infer the singing activity of an avian community: The Acoustic Complexity Index (ACI). *Ecological Indicators,* 11: 868-873.

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Appendix A:

Bird species list for Brisbane Ranges National Park generated from the Global Biodiversity Informatics Facility (www.gbif.org). Conservation status listed in the Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013): CE = Critically Endangered, E = Endangered, NT = Near Threatened, V= Vulnerable. **Species listed in bold were detected in this study at the genus or species level.**

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Botaurus poiciloptilus	Australasian Bittern	4	E	EN	L
Anhinga novaehollandiae	Australasian Darter	21			
Tachybaptus novaehollandiae	Australasian Grebe	192			
Anthus novaeseelandiae	Australasian Pipit	215			
Anas rhynchotis	Australasian Shoveler	21	V		
Ardeotis australis	Australian bustard	1	CE		L
Porzana fluminea	Australian Crake	1			
Falco longipennis	Australian Hobby	34			
Alisterus scapularis	Australian King Parrot	8			
Gymnorhina tibicen	**Australian Magpie**	**1132**			
Aegotheles cristatus	**Australian Owlet-nightjar**	**118**			
Pelecanus conspicillatus	Australian Pelican	46			
Phalacrocorax varius	Australian Pied Cormorant	21			
Corvus coronoides	**Australian Raven**	**770**			
Acrocephalus australis	Australian Reed Warbler	12			
Tadorna tadornoides	Australian Shelduck	235			
Threskiornis molucca	Australian White Ibis	117			
Chenonetta jubata	Australian Wood Duck	534			
Alcedo azurea	Azure Kingfisher	2	NT		
Vanellus tricolor	Banded Lapwing	19			
Ninox connivens	Barking Owl	15	E		L
Tyto alba	Barn Owl	11			
Zoothera lunulata	Bassian Thrush	41			
Stagonopleura bella	Beautiful Firetail	4			
Manorina melanophrys	Bell Miner	2			
Falco subniger	Black Falcon	19	V		
Milvus migrans	Black Kite	13			
Cygnus atratus	Black Swan	282			
Melithreptus gularis	Black-chinned Honeyeater	24	NT		
Chrysococcyx osculans	Black-eared Cuckoo	16	NT		
Coracina novaehollandiae	Black-faced Cuckoo-shrike	801			
Elseyornis melanops	Black-fronted Dotterel	63			
Elanus axillaris	Black-shouldered Kite	111			
Gallinula ventralis	Black-tailed Native-hen	3			
Himantopus himantopus	Black-winged Stilt	5			
Oxyura australis	Blue-billed Duck	63	E		L
Neophema chrysostoma	Blue-winged Parrot	100			
Grus rubicunda	Brolga	7	V		L
Falco berigora	Brown Falcon	367			

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Accipiter fasciatus	Brown Goshawk	230			
Coturnix ypsilophora	Brown Quail	11			
Megalurus cruralis	Brown Songlark	19			
Acanthiza pusilla	Brown Thornbill	1556			
Climacteris picumnus	Brown Treecreeper	461	NT		
Melithreptus brevirostris	Brown-headed Honeyeater	900			
Phaps elegans	**Brush Bronzewing**	**35**			
Cacomantis variolosus	Brush Cuckoo	19			
Melopsittacus undulatus	Budgerigar	3			
Rallus philippensis	Buff-banded Rail	5			
Acanthiza reguloides	Buff-rumped Thornbill	1124			
Bubulcus ibis	Cattle Egret	9			
Anas castanea	Chestnut Teal	86			
Calamanthus pyrrhopygius	Chestnut-rumped Heathwren	99	V		L
Coracina tenuirostris	Cicadabird	2			
Edolisoma tenuirostre	Cicadabird	1			
Accipiter cirrocephalus	Collared Sparrowhawk	71			
Turdus merula	Common Blackbird	555			
Phaps chalcoptera	**Common Bronzewing**	**580**			
Acridotheres tristis	Common Myna	98			
Sturnus vulgaris	Common Starling	376			
Phylidonyris pyrrhopterus	Crescent Honeyeater	20			
Ocyphaps lophotes	Crested Pigeon	171			
Falcunculus frontatus	Crested Shrike-tit	249			
Platycercus elegans	**Crimson Rosella**	**2310**			
Stagonopleura guttata	Diamond Firetail	180	NT		L
Gallinula tenebrosa	Dusky Moorhen	69			
Artamus cyanopterus	Dusky Woodswallow	501			
Ardea alba	Eastern Great Egret	33			
Ardea modesta	Eastern Great Egret	26	V		L
Platycercus eximius	Eastern Rosella	607			
Acanthorhynchus tenuirostris	Eastern Spinebill	1013			
Eopsaltria australis	**Eastern Yellow Robin**	**1148**			
Dromaius novaehollandiae	Emu	2	NT		
Fulica atra	Eurasian Coot	349			
Alauda arvensis	Eurasian Skylark	112			
Passer montanus	Eurasian Tree Sparrow	7			
Carduelis carduelis	European Goldfinch	421			
Chloris chloris	European Greenfinch	32			
Petrochelidon ariel	Fairy Martin	121			
Cacomantis flabelliformis	**Fan-tailed Cuckoo**	**790**			
Petroica phoenicea	Flame Robin	175			
Stictonetta naevosa	Freckled Duck	1	E		L
Lichenostomus fuscus	Fuscous Honeyeater	59			
Cacatua roseicapilla	**Galah**	**1197**			
Callocephalon fimbriatum	Gang-gang Cockatoo	3			

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Pachycephala pectoralis	**Golden Whistler**	**916**			
Cisticola exilis	Golden-headed Cisticola	8			
Phalacrocorax carbo	Great Cormorant	138			
Podiceps cristatus	Great Crested Grebe	110			
Tyto tenebricosa	Greater Sooty Owl	2			
Cracticus torquatus	Grey Butcherbird	21			
Strepera versicolor	Grey Currawong	1073			
Rhipidura albiscapa	**Grey Fantail**	**1853**			
Accipiter novaehollandiae	Grey Goshawk	11	V		L
Colluricincla harmonica	**Grey Shrike-thrush**	**2104**			
Anas gracilis	Grey Teal	149			
Pomatostomus temporalis	Grey-crowned Babbler	1	E		L
Aythya australis	Hardhead	97	V		
Poliocephalus poliocephalus	Hoary-headed Grebe	178			
Melanodryas cucullata	Hooded Robin	50	NT		L
Chrysococcyx basalis	**Horsfield's Bronze Cuckoo**	**383**			
Mirafra javanica	Horsfield's Bushlark	23			
Passer domesticus	House Sparrow	522			
Egretta intermedia	Intermediate Egret	3	CE		L
Microeca fascinans	Jacky Winter	456			
Sericornis magnirostra	Large-billed Scrubwren	1			
Gallinago hardwickii	Latham's Snipe	30	NT		N
Dacelo novaeguineae	**Laughing Kookaburra**	**1512**			
Myiagra rubecula	Leaden Flycatcher	41			
Lewinia pectoralis	Lewin's Rail	3	V		L
Phalacrocorax sulcirostris	Little Black Cormorant	162			
Turnix velox	Little Button-quail	5			
Cacatua sanguinea	**Little Corella**	**82**			
Hieraaetus morphnoides	Little Eagle	87			
Egretta garzetta	Little Egret	11	E		L
Megalurus gramineus	Little Grassbird	38			
Parvipsitta pusilla	Little Lorikeet	37			
Glossopsitta pusilla	Little Lorikeet	14			
Microcarbo melanoleucos	Little Pied Cormorant	329			
Corvus mellori	**Little Raven**	**980**			
Anthochaera chrysoptera	Little Wattlebird	8			
Cacatua tenuirostris	**Long-billed Corella**	**555**			
Grallina cyanoleuca	Magpie-lark	730			
Vanellus miles	Masked Lapwing	588			
Artamus personatus	Masked Woodswallow	11			
Dicaeum hirundinaceum	Mistletoebird	464			
Biziura lobata	Musk Duck	215	V		
Glossopsitta concinna	Musk Lorikeet	390			
Falco cenchroides	Nankeen Kestrel	153			
Nycticorax caledonicus	Nankeen Night-heron	20			

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Phylidonyris novaehollandiae	New Holland Honeyeater	1432			
Philemon corniculatus	Noisy Friarbird	3			
Manorina melanocephala	Noisy Miner	164			
Anas platyrhynchos	Northern Mallard	2			
Pachycephala olivacea	Olive Whistler	2			
Oriolus sagittatus	Olive-backed Oriole	343			
Anas superciliosa	Pacific Black Duck	423			
Apus pacificus	Pacific Swift	7			
Turnix varius	Painted Button-quail	106			
Grantiella picta	Painted Honeyeater	15	V		L
Platycercus adscitus	Pale-headed Rosella	5			
Cuculus pallidus	Pallid Cuckoo	365			
Geopelia placida	Peaceful Dove	4			
Falco peregrinus	Peregrine Falcon	141			
Cracticus nigrogularis	Pied Butcherbird	3			
Strepera graculina	Pied Currawong	104			
Himantopus leucocephalus	Pied Stilt	5			
Petroica rodinogaster	Pink Robin	72			
Malacorhynchus membranaceus	Pink-eared Duck	6			
Dendrocygna eytoni	Plumed Whistling Duck	2			
Ninox strenua	**Powerful Owl**	**118**	V		L
Porphyrio porphyrio	Purple Swamphen	103			
Porphyrio melanotus	Purple Swamphen	24			
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	72			
Parvipsitta porphyrocephala	Purple-crowned Lorikeet	59			
Merops ornatus	Rainbow Bee-eater	93			
Trichoglossus haematodus	Rainbow Lorikeet	36			
Anthochaera carunculata	**Red Wattlebird**	**1823**			
Neochmia temporalis	Red-browed Finch	823			
Petroica goodenovii	Red-capped Robin	20			
Erythrogonys cinctus	Red-kneed Dotterel	7			
Psephotus haematonotus	Red-rumped Parrot	287			
Xanthomyza phrygia	Regent Honeyeater	1	CE	EN	L
Myiagra inquieta	Restless Flycatcher	465			
Columba livia	Rock Dove	29			
Petroica rosea	Rose Robin	13			
Platalea regia	Royal Spoonbill	11	NT		
Rhipidura rufifrons	Rufous Fantail	22			
Megalurus mathewsi	Rufous Songlark	43			
Pachycephala rufiventris	**Rufous Whistler**	**1122**			
Todiramphus sanctus	Sacred Kingfisher	373			
Ptilonorhynchus violaceus	Satin Bowerbird	1			
Myiagra cyanoleuca	Satin Flycatcher	181			
Myzomela sanguinolenta	Scarlet Honeyeater	3			
Petroica boodang	**Scarlet Robin**	**1361**			
Chrysococcyx lucidus	Shining Bronze Cuckoo	458			

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Larus novaehollandiae	Silver Gull	47			
Zosterops lateralis	Silvereye	524			
Lichenostomus virescens	Singing Honeyeater	5			
Ninox novaeseelandiae	**Southern Boobook**	**193**			
Aphelocephala leucopsis	Southern Whiteface	16			
Pyrrholaemus sagittatus	Speckled Warbler	151	V		L
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	29			
Porzana tabuensis	Spotless Crake	4			
Streptopelia chinensis	Spotted Dove	43			
Circus assimilis	Spotted Harrier	16	NT		
Eurostopodus argus	Spotted Nightjar	2			
Pardalotus punctatus	**Spotted Pardalote**	**1537**			
Cinclosoma punctatum	Spotted Quail-thrush	283	NT		
Lophoictinia isura	Square-tailed Kite	2	V		L
Threskiornis spinicollis	Straw-necked Ibis	244			
Calamanthus fuliginosus	Striated Fieldwren	3			
Pardalotus striatus	Striated Pardalote	834			
Acanthiza lineata	Striated Thornbill	1097			
Coturnix pectoralis	Stubble Quail	28			
Cacatua galerita	**Sulphur-crested Cockatoo**	1871			
Malurus cyaneus	**Superb Fairy-wren**	2292			
Polytelis swainsonii	Superb Parrot	1	E	VU	L
Circus approximans	Swamp Harrier	122			
Lathamus discolor	Swift Parrot	54	E	EN	L
Podargus strigoides	**Tawny Frogmouth**	70			
Gliciphila melanops	Tawny-crowned Honeyeater	917			
Petrochelidon nigricans	Tree Martin	199			
Daphoenositta chrysoptera	Varied Sittella	463			
Aquila audax	Wedge-tailed Eagle	984			
Smicrornis brevirostris	Weebill	197			
Hirundo neoxena	Welcome Swallow	1262			
Gerygone fusca	Western Gerygone	6			
Haliastur sphenurus	Whistling Kite	311			
Cheramoeca leucosterna	White-backed Swallow	1			
Coracina papuensis	White-bellied Cuckoo-shrike	21			
Haliaeetus leucogaster	White-bellied Sea-eagle	7	V		L
Pachycephala lanioides	White-breasted Whistler	1			
Pomatostomus superciliosus	White-browed Babbler	1			
Sericornis frontalis	White-browed Scrubwren	1186			
Climacteris affinis	White-browed Treecreeper	6	V		L
Artamus superciliosus	White-browed Woodswallow	75			
Lichenostomus leucotis	White-eared Honeyeater	1438			
Egretta novaehollandiae	White-faced Heron	583			
Epthianura albifrons	White-fronted Chat	51			
Melithreptus lunatus	White-naped Honeyeater	1580			
Ardea pacifica	White-necked Heron	238			

Species name	Common name	# GBIF occurrences	Conservation Status		
			Advisory List	EPBC	FFG
Lichenostomus penicillatus	White-plumed Honeyeater	765			
Lalage sueurii	White-shouldered Triller	124			
Gerygone olivacea	White-throated Gerygone	8			
Hirundapus caudacutus	White-throated Needletail	51	V		
Eurostopodus mystacalis	**White-throated Nightjar**	76			
Cormobates leucophaea	**White-throated Treecreeper**	1983			
Corcorax melanoramphos	White-winged Chough	844			
Lalage tricolor	White-winged Triller	18			
Rhipidura leucophrys	Willie Wagtail	937			
Acanthiza nana	Yellow Thornbill	201			
Platalea flavipes	Yellow-billed Spoonbill	55			
Lichenostomus chrysops	Yellow-faced Honeyeater	961			
Lichenostomus ornatus	Yellow-plumed Honeyeater	16			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	777			
Calyptorhynchus funereus	**Yellow-tailed Black-cockatoo**	168			
Taeniopygia guttata	Zebra finch	12			

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