

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

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.

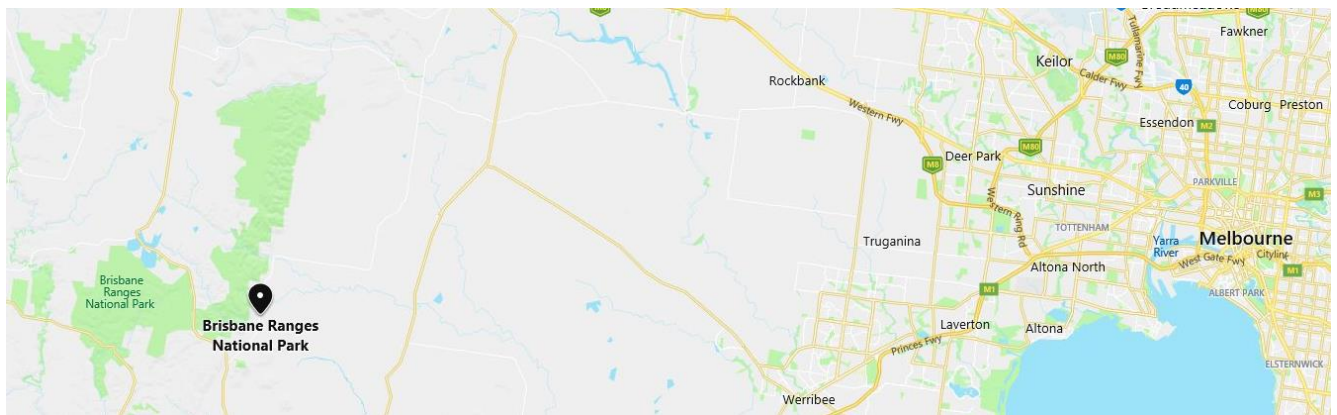
The recordings collected from the field are analysed using specialised software that interprets bioacoustic sound frequency as visual displays called spectrograms. Spectrograms essentially graph the sound and can be annotated by bird sound identification experts to identify the species. They can also 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).

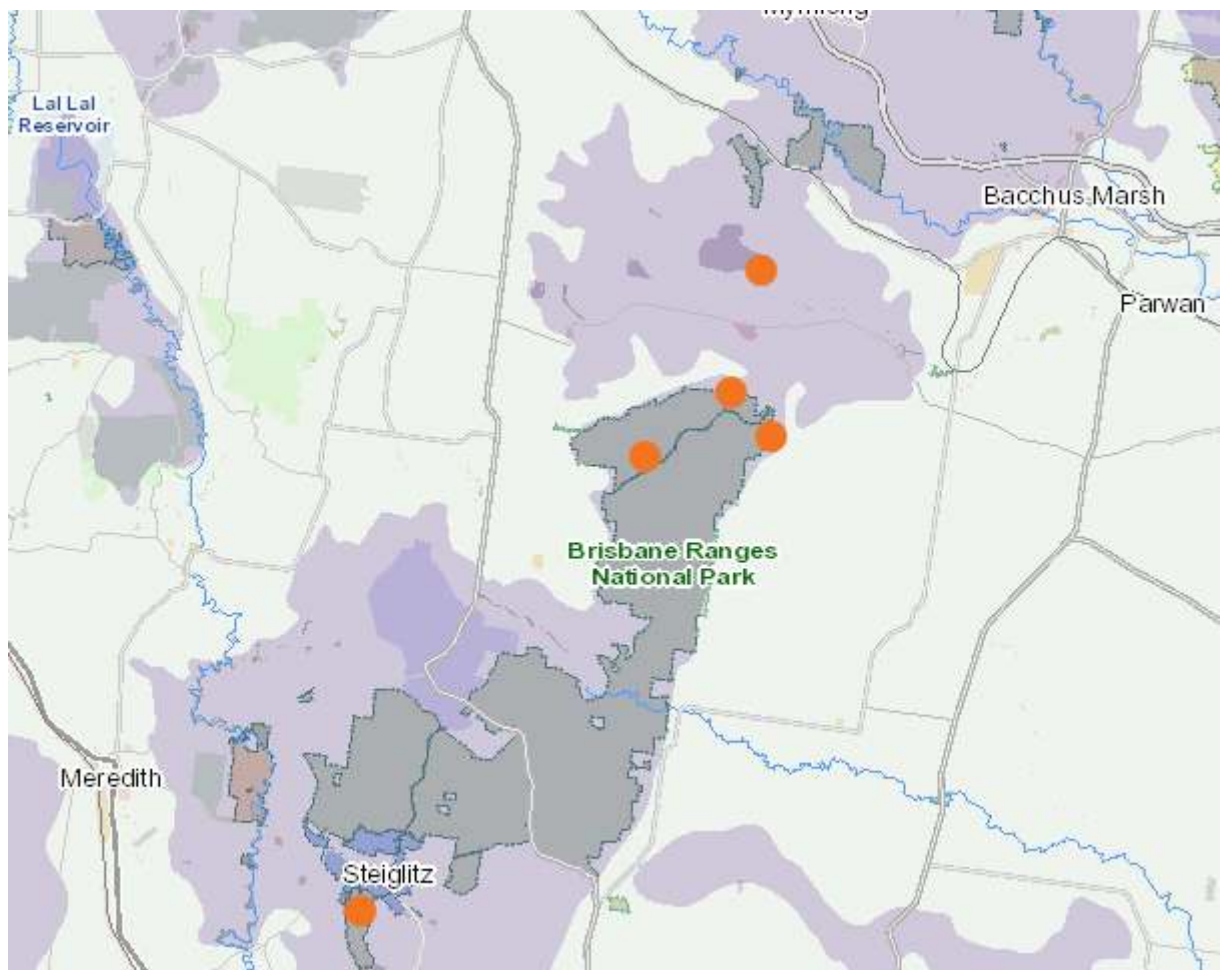
Table 4: List of all bird species identified in acoustic data in relation to the number of recordings in each Ecological Vegetation Class

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.

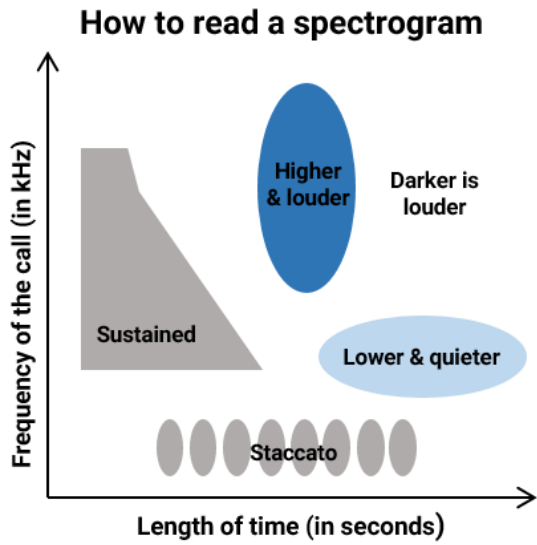


Figure 3: Spectrogram of Powerful Owl call

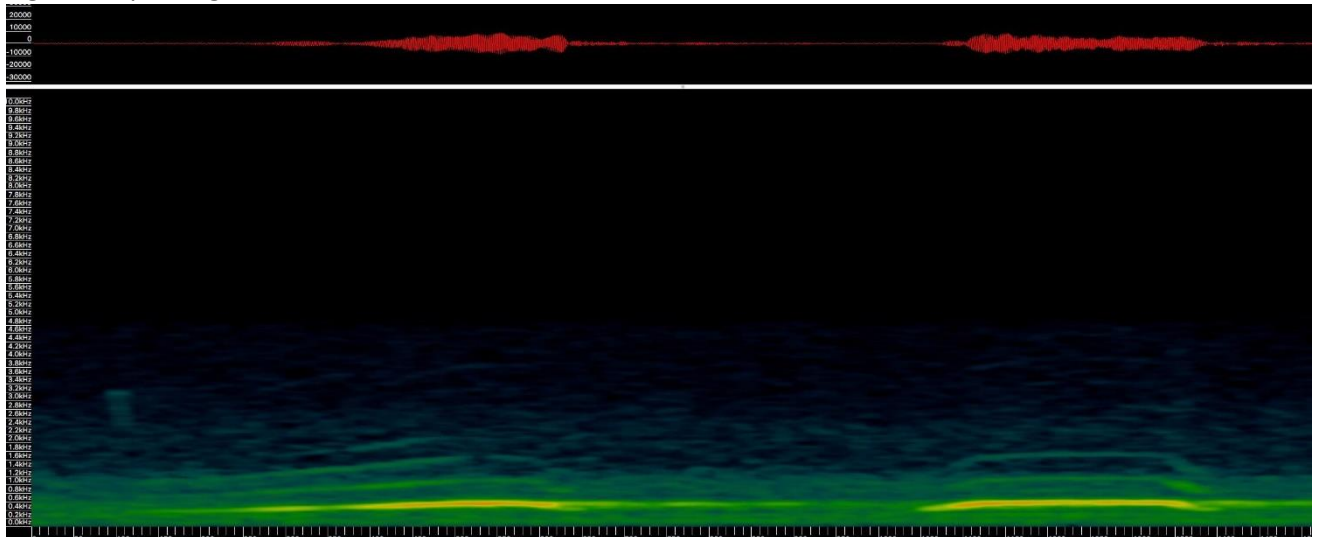


Figure 4: Spectrogram of White-throated Nightjar call

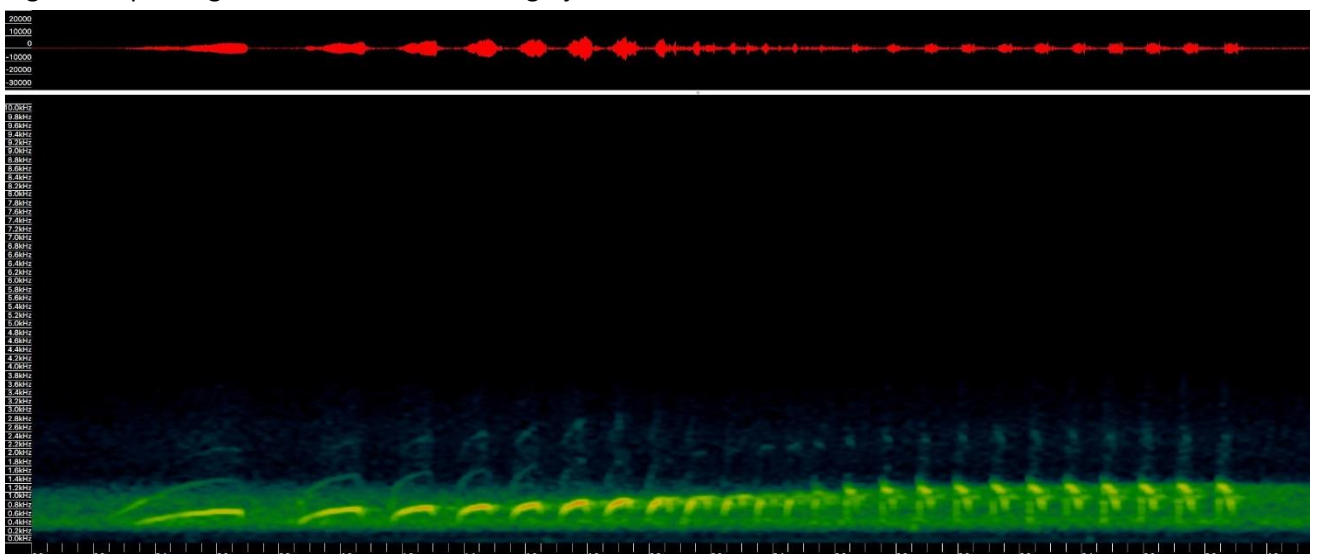
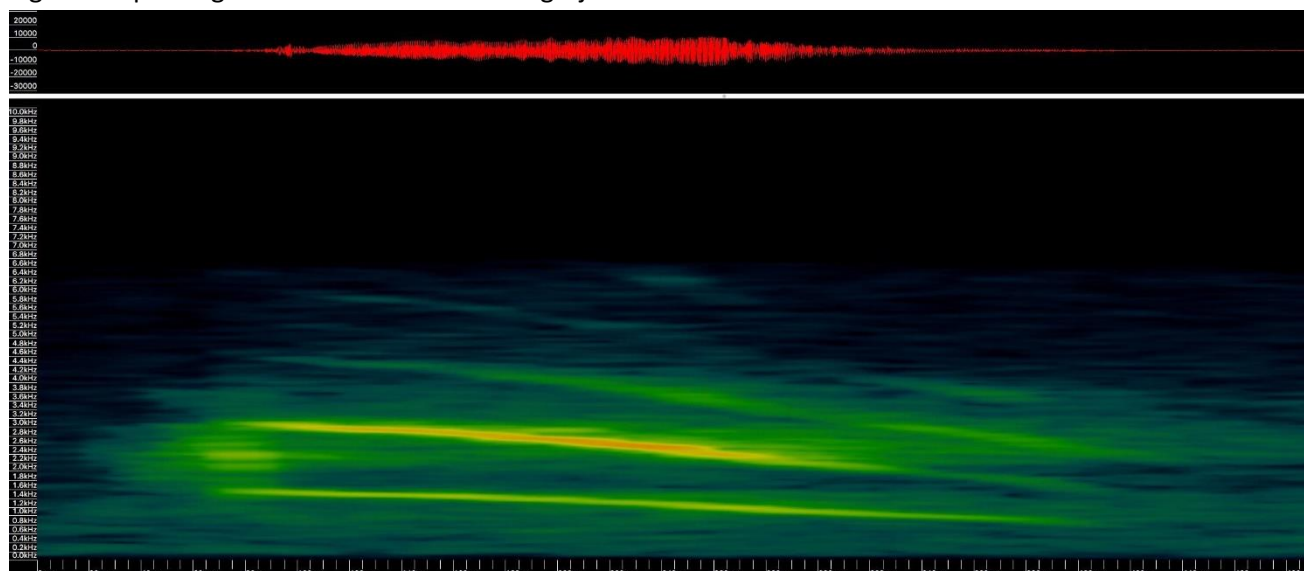


Figure 5: Spectrogram of Australian Owlet-nightjar call



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.

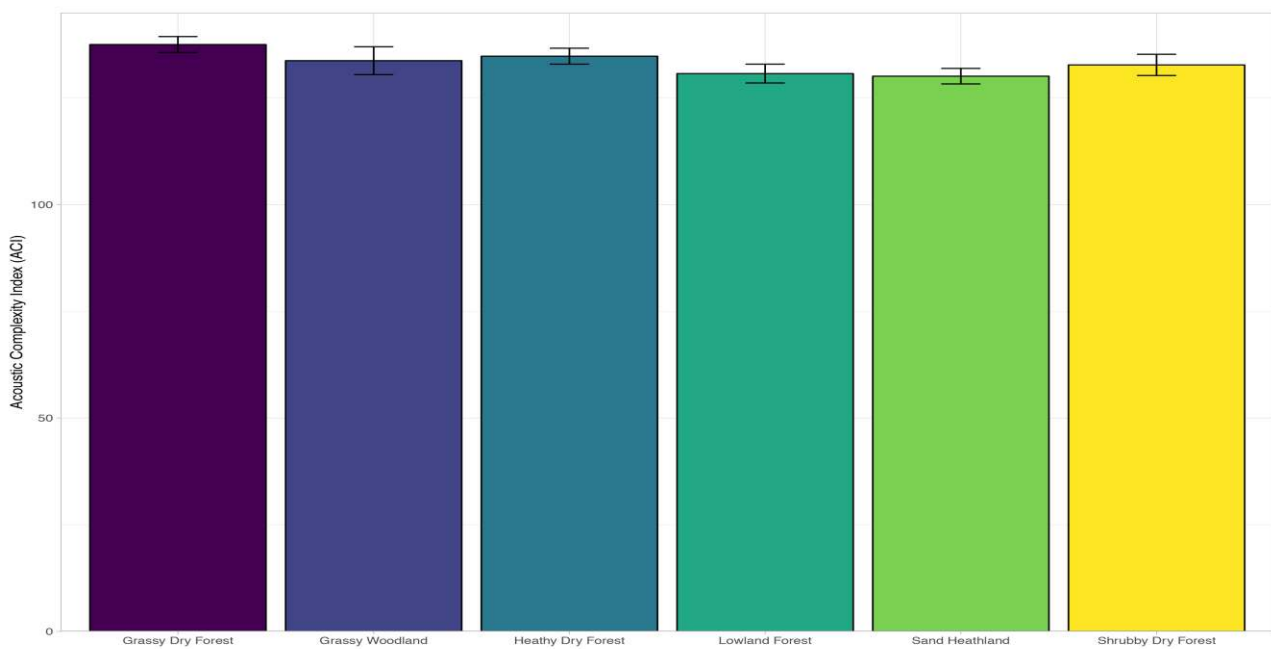
ACI by Ecological Vegetation Class

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

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

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

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

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

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



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