

Supporting Figures

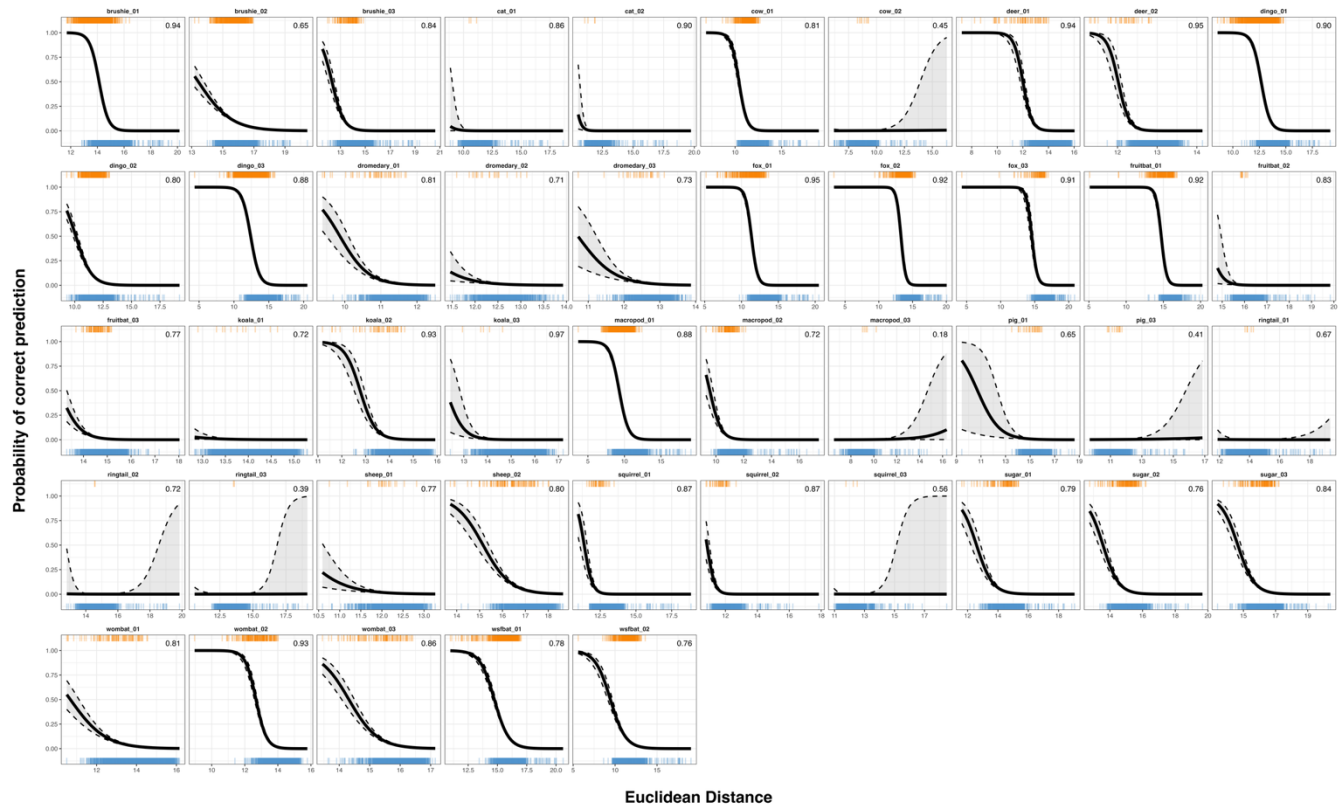


Figure S1. Probability of correctly predicting true positive detections based on the Euclidean distance for each of the 46 example calls across 17 vocal mammal species used in this study. The orange bars represent true positive detections and blue bars true negative detections. The dashed lines and grey area indicate the 95% confidence intervals. The number in the top right corner of each plot indicates the probability that a true positive detection had a lower Euclidean distance than a false positive detection on any given day for that specific example call. Lower Euclidean distances generally correspond to a higher probability of correctly predicting a detection of an example call.

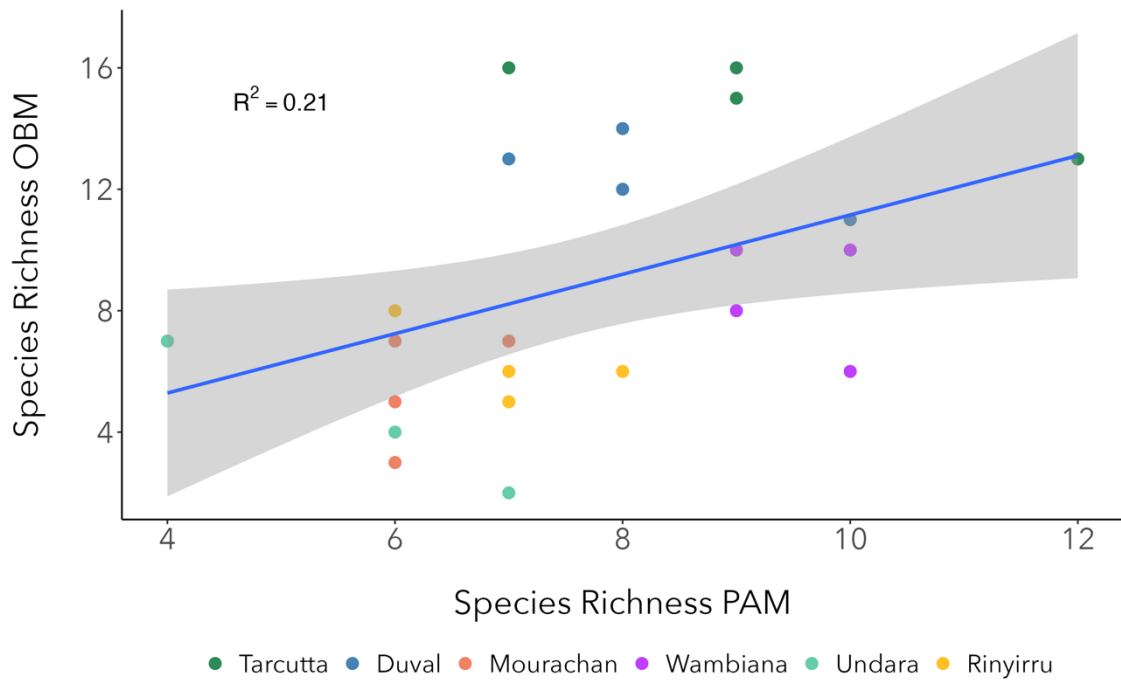


Figure S2. Relationship between species richness via PAM (passive acoustic monitoring) and species richness via OBM (observer-based monitoring) across six different study sites. Each point represents a sampling site, colour-coded by location. The blue line indicates the linear regression fit, with the grey shaded area representing the 95% confidence interval.

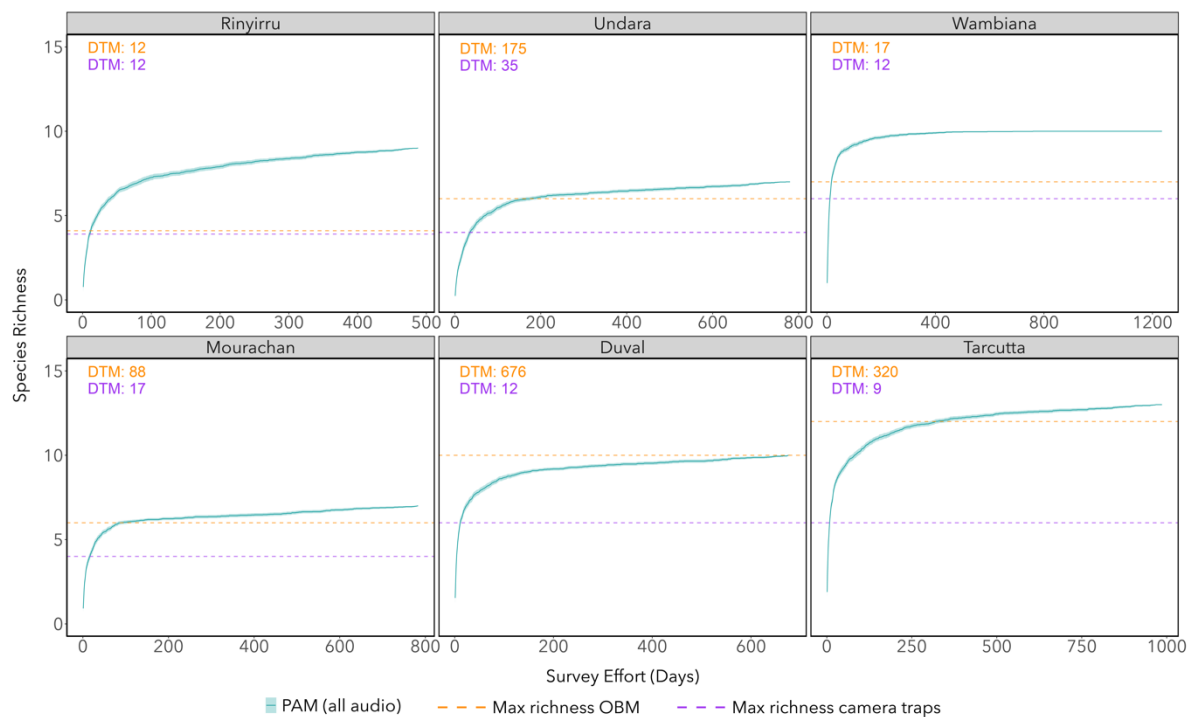


Figure S3. Species accumulation curves for passive acoustic monitoring (PAM) using all audio data available at six survey sites. Intersections between the green accumulation curves and dashed lines indicate the points where PAM's species richness equals the total vocal mammal richness identified by observer-based monitoring (OBM - orange) and camera trapping (purple). The numbers highlighted in the top left corner of each plot represent the 'Days to Match' (DTM), indicating the time it took for PAM to match the maximum total species richness recorded by either OBM or camera traps at each site.

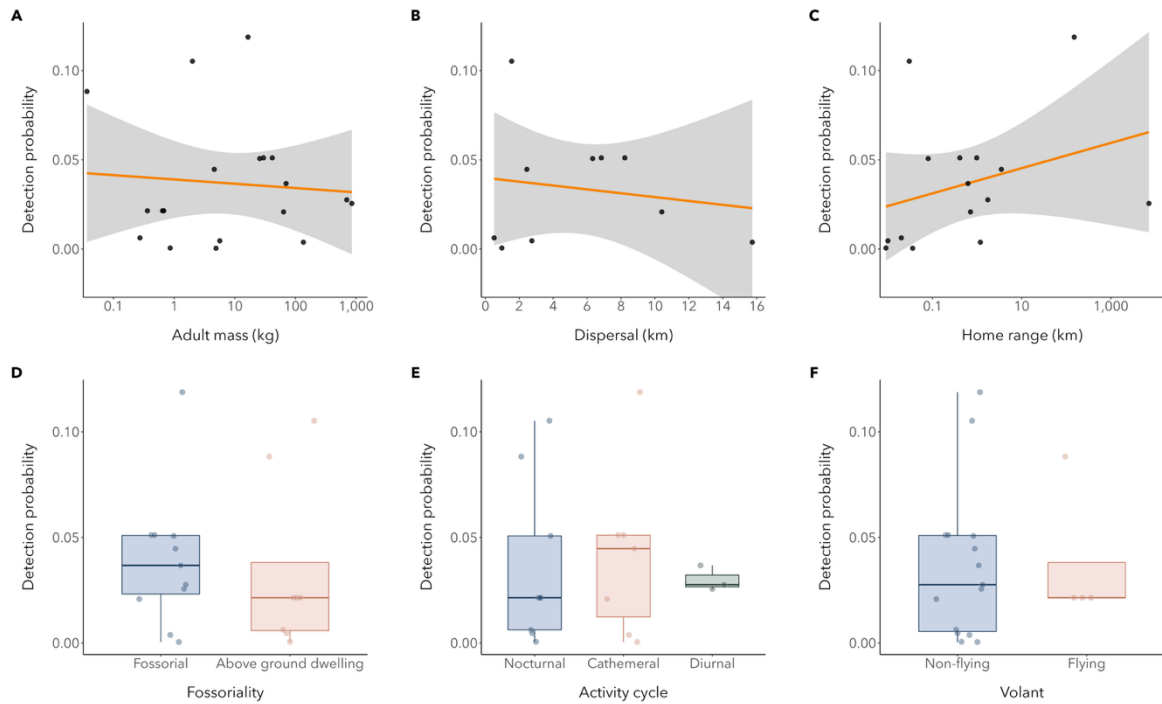


Figure S4. The relationship between the detection probability of vocal mammal species via passive acoustic monitoring (PAM) and six different life-history traits: (A) adult mass, (B) dispersal distance, (C) home range extent, (D) fossoriality, (E) daily activity cycle, and (F) volant capacity. The orange line represents the fitted linear regression model, with the grey shaded area indicating the 95% confidence interval.

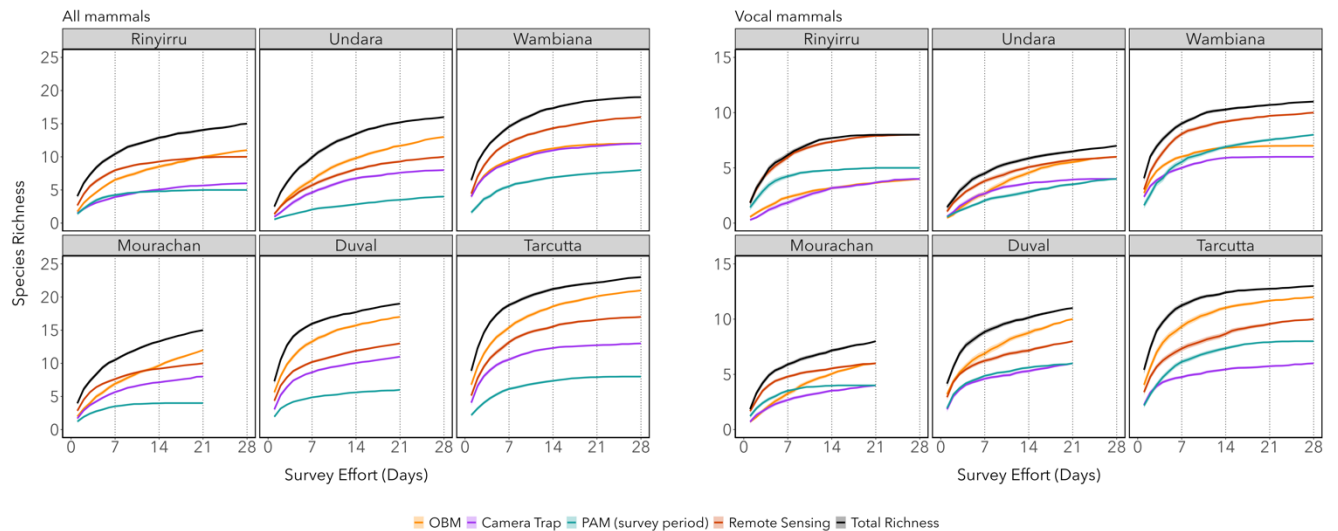


Figure S5. Species accumulation curves for mammal communities (all mammals [left] and vocal mammals only [right]) at six survey sites for each assessment method over up to 28 survey days. Lines represent the different assessment methods, as well as a combination of passive acoustic monitoring (PAM) for the survey period and camera traps (denoted as “Remote Sensing” in red) and all methods combined (total richness [black]). Shaded areas around each line corresponds to the 95% confidence intervals and dotted vertical lines mark the cumulative effort after each survey. This graph shows the differences in rate of species accumulation at each site for each method. Note that observer-based monitoring (OBM) accumulates species most effectively at most sites but “Remote Sensing” is more effective at some sites particularly for vocal mammals.

47 Supporting Tables

48 **Table S1.** Overview of the number and source of the 46 example calls for 17 Australian
49 vocal mammal species used in this study.

Common Name	Scientific Name	Example Call	Source
Black Flying-fox	<i>Pteropus alecto</i>	fruitbat_01	A2O Recordings (https://data.acousticobservatory.org/)
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	fruitbat_02	Wild Ambience (https://wildambience.com/about/)
Little Red Flying-fox	<i>Pteropus scapulatus</i>	fruitbat_03	Wild Ambience (https://wildambience.com/about/)
Cat	<i>Felis catus</i>	cat_01	Wild Ambience (https://wildambience.com/about/)
Cat	<i>Felis catus</i>	cat_02	Wild Ambience (https://wildambience.com/about/)
Cat	<i>Felis catus</i>	cat_03	Wild Ambience (https://wildambience.com/about/)
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	brushie_01	Wild Ambience (https://wildambience.com/about/)
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	brushie_02	Wild Ambience (https://wildambience.com/about/)
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	brushie_03	Wild Ambience (https://wildambience.com/about/)
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	ringtail_01	Wild Ambience (https://wildambience.com/about/)
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	ringtail_02	Wild Ambience (https://wildambience.com/about/)
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	ringtail_03	Wild Ambience (https://wildambience.com/about/)
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	macropod_01	A2O Recordings (https://data.acousticobservatory.org/)
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	macropod_02	A2O Recordings (https://data.acousticobservatory.org/)
Common Wallaroo	<i>Osphranter robustus</i>	macropod_03	Macaulay Library (https://macaulaylibrary.org/asset/232881)
Bare-nosed Wombat	<i>Vombatus ursinus</i>	wombat_01	Wild Ambience (https://wildambience.com/about/)
Bare-nosed Wombat	<i>Vombatus ursinus</i>	wombat_02	A2O Recordings (https://data.acousticobservatory.org/)
Bare-nosed Wombat	<i>Vombatus ursinus</i>	wombat_03	Wild Ambience (https://wildambience.com/about/)
Cattle	<i>Bos taurus</i>	cow_01	A2O Recordings (https://data.acousticobservatory.org/)
Cattle	<i>Bos taurus</i>	cow_02	A2O Recordings (https://data.acousticobservatory.org/)
Dingo	<i>Canis dingo</i>	dingo_01	A2O Recordings (https://data.acousticobservatory.org/)
Dingo	<i>Canis dingo</i>	dingo_02	Wild Ambience (https://wildambience.com/about/)
Dingo	<i>Canis dingo</i>	dingo_03	A2O Recordings (https://data.acousticobservatory.org/)
Dromedary	<i>Camelus dromedarius</i>	dromedary_01	A2O Recordings (https://data.acousticobservatory.org/)
Dromedary	<i>Camelus dromedarius</i>	dromedary_02	Macaulay Library (https://macaulaylibrary.org/asset/96255)
Dromedary	<i>Camelus dromedarius</i>	dromedary_03	A2O Recordings (https://data.acousticobservatory.org/)
Fallow Deer	<i>Dama dama</i>	deer_01	iNaturalist (https://www.inaturalist.org/observations/96822240)
Fallow Deer	<i>Dama dama</i>	deer_02	YouTube (https://www.youtube.com/watch?v=SkDKbmsn3HQ)
Koala	<i>Phascolarctos cinereus</i>	koala_01	Wild Ambience (https://wildambience.com/about/)
Koala	<i>Phascolarctos cinereus</i>	koala_02	Wild Ambience (https://wildambience.com/about/)
Koala	<i>Phascolarctos cinereus</i>	koala_03	Wild Ambience (https://wildambience.com/about/)
Pig	<i>Sus scrofa</i>	pig_01	A2O Recordings (https://data.acousticobservatory.org/)
Pig	<i>Sus scrofa</i>	pig_03	Wild Ambience (https://wildambience.com/about/)
Red Fox	<i>Vulpes vulpes</i>	fox_01	A2O Recordings (https://data.acousticobservatory.org/)
Red Fox	<i>Vulpes vulpes</i>	fox_02	A2O Recordings (https://data.acousticobservatory.org/)
Red Fox	<i>Vulpes vulpes</i>	fox_03	A2O Recordings (https://data.acousticobservatory.org/)
Sheep	<i>Ovis aries</i>	sheep_01	Macaulay Library (https://macaulaylibrary.org/asset/126289)
Sheep	<i>Ovis aries</i>	sheep_02	Macaulay Library (https://macaulaylibrary.org/asset/126289)
Squirrel Glider	<i>Petaurus norfolcensis</i>	squirrel_01	Wild Ambience (https://wildambience.com/about/)
Squirrel Glider	<i>Petaurus norfolcensis</i>	squirrel_02	Wild Ambience (https://wildambience.com/about/)
Squirrel Glider	<i>Petaurus norfolcensis</i>	squirrel_03	Wild Ambience (https://wildambience.com/about/)
Sugar Glider	<i>Petaurus breviceps</i>	sugar_01	Wild Ambience (https://wildambience.com/about/)
Sugar Glider	<i>Petaurus breviceps</i>	sugar_02	Wild Ambience (https://wildambience.com/about/)
Sugar Glider	<i>Petaurus breviceps</i>	sugar_03	Wild Ambience (https://wildambience.com/about/)
White-striped Freetail-bat	<i>Austronomus australis</i>	wsftbat_01	A2O Recordings (https://data.acousticobservatory.org/)
White-striped Freetail-bat	<i>Austronomus australis</i>	wsftbat_02	A2O Recordings (https://data.acousticobservatory.org/)

51 **Table S2.** Detailed summary of the survey dates, acoustic recording hours, and camera trapping days (summed for all four camera
52 traps) at a survey plot level across the six study sites.

Site	Plot	First survey			Second survey			Third survey			Fourth survey			Total survey days	Total camera trapping days	Total acoustic data (survey period) in hours	Total acoustic data (all audio) in hours
		Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days				
Tarcutta	Dry A	29/4/2021 – 6/5/2021	167	28	18/10/2021 – 25/10/2021	168	14	8/5/2022 – 15/5/2022	154	28	22/11/2022 – 29/11/2022	160	28	28	98	649	18600
Tarcutta	Dry B	29/4/2021 – 6/5/2021	167	28	18/10/2021 – 25/10/2021	168	28	8/5/2022 – 15/5/2022	166	28	22/11/2022 – 29/11/2022	158	28	28	112	659	22356
Tarcutta	Wet A	29/4/2021 – 6/5/2021	163	28	18/10/2021 – 25/10/2021	168	28	8/5/2022 – 15/5/2022	164	28	22/11/2022 – 29/11/2022	158	28	28	112	653	8605
Tarcutta	Wet B	29/4/2021 – 6/5/2021	167	28	18/10/2021 – 25/10/2021	168	28	8/5/2022 – 15/5/2022	163	28	22/11/2022 – 29/11/2022	158	28	28	112	656	20289
Duval	Dry A	18/4/2021 – 25/4/2021	167	28	NA	NA	NA	28/4/2022 – 5/5/2022	166	28	12/11/2022 – 19/11/2022	129	28	21	84	462	11397
Duval	Dry B	18/4/2021 – 25/4/2021	168	28	NA	NA	NA	NA	NA	NA	12/11/2022 – 19/11/2022	144	28	14	56	312	16209
Duval	Wet A	18/4/2021 – 25/4/2021	167	28	NA	NA	NA	28/4/2022 – 5/5/2022	163	28	12/11/2022 – 19/11/2022	148	28	21	84	478	12402
Duval	Wet B	18/4/2021 – 25/4/2021	168	21	NA	NA	NA	NA	NA	NA	12/11/2022 – 19/11/2022	133	28	14	49	301	10921
Mourachan	Dry A	9/5/2021 – 16/5/2021	167	28	NA	NA	NA	19/6/2022 – 26/6/2022	167	28	2/11/2022 – 9/11/2022	167	28	21	84	501	14894
Mourachan	Dry B	9/5/2021 – 16/5/2021	8	28	NA	NA	NA	19/6/2022 – 26/6/2022	1	28	2/11/2022 – 9/11/2022	166	28	21	84	175	10667

Site	Plot	First survey			Second survey			Third survey			Fourth survey			Total survey days	Total camera trapping days	Total acoustic data (survey period) in hours	Total acoustic data (all audio) in hours
		Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days				
Mourachan	Wet A	9/5/2021 – 16/5/2021	118	28	NA	NA	NA	19/6/2022 – 26/6/2022	4	28	2/11/2022 –	166	28	21	84	288	13299
Mourachan	Wet B	9/5/2021 – 16/5/2021	158	28	NA	NA	NA	19/6/2022 – 26/6/2022	165	28	9/11/2022 2/11/2022 – 9/11/2022	166	28	21	84	489	8083
Wambiana	Dry A	5/7/2021 – 12/7/2021	165	28	10/11/2021 – 17/11/2021	16	28	12/6/2022 – 19/6/2022	165	28	28/9/2022 – 5/10/2022	166	28	28	112	512	27108
Wambiana	Dry B	5/7/2021 – 12/7/2021	164	28	10/11/2021 – 17/11/2021	163	28	12/6/2022 – 19/6/2022	166	28	28/9/2022 – 5/10/2022	3	28	28	112	496	15323
Wambiana	Wet A	5/7/2021 – 12/7/2021	166	28	10/11/2021 – 17/11/2021	166	28	12/6/2022 – 19/6/2022	164	28	28/9/2022 – 5/10/2022	166	28	28	112	662	15108
Wambiana	Wet B	5/7/2021 – 12/7/2021	164	28	10/11/2021 – 17/11/2021	158	28	12/6/2022 – 19/6/2022	161	28	28/9/2022 – 5/10/2022	167	28	28	112	650	21185
Undara	Dry A	3/6/2021 – 10/06/2021	164	28	29/9/2021 – 6/10/2021	164	28	8/5/2022 – 15/5/2022	146	28	13/10/2022 – 20/10/2022	160	28	28	112	634	11971
Undara	Dry B	3/6/2021 – 10/06/2021	161	28	29/9/2021 – 6/10/2021	155	28	8/5/2022 – 15/5/2022	151	28	13/10/2022 – 20/10/2022	163	28	28	112	630	12280
Undara	Wet A	3/6/2021 – 10/06/2021	159	28	29/9/2021 – 6/10/2021	41	28	8/5/2022 – 15/5/2022	NA	28	13/10/2022 – 20/10/2022	NA	28	27	112	200	4382
Undara	Wet B	3/6/2021 – 10/06/2021	165	28	29/9/2021 – 6/10/2021	95	28	8/5/2022 – 15/5/2022	133	28	13/10/2022 – 20/10/2022	158	28	27	112	551	11212
Rinyirru	Dry A	14/6/2021 – 21/6/2021	166	21	8/10/2021 – 15/10/2021	145	28	7/8/2022 – 14/8/2022	137	28	23/10/2022 – 30/10/2022	130	28	28	105	578	8548
Rinyirru	Dry B	14/6/2021 – 21/6/2021	159	28	8/10/2021 – 15/10/2021	110	28	7/8/2022 – 14/8/2022	161	28	23/10/2022 – 30/10/2022	160	28	28	112	590	10495

Site	Plot	First survey			Second survey			Third survey			Fourth survey			Total survey days	Total camera trapping days	Total acoustic data (survey period) in hours	Total acoustic data (all audio) in hours
		Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days	Dates	Acoustic data (hours)	Camera trapping days				
Rinyirru	Wet A	14/6/2021 – 21/6/2021	158	28	8/10/2021 – 15/10/2021	142	28	7/8/2022 – 14/8/2022	146	28	23/10/2022 – 30/10/2022	135	28	28	112	581	5898
Rinyirru	Wet B	14/6/2021 – 21/6/2021	161	28	8/10/2021 – 15/10/2021	144	28	7/8/2022 – 14/8/2022	141	28	23/10/2022 – 30/10/2022	150	28	28	112	596	6178

54 **Table S3.** Common mammal traits and detectability in this study for 19 vocal mammal species. Trait information was compiled from
55 the COMBINE and HomeRange databases (Broekman et al., 2023; Soria et al., 2021), with additional data from the Field Companion to
56 the Mammals of Australia (Van Dyck et al., 2013).

Common Name	Scientific Name	Adult Mass (kg)	Dispersal Distance (km)	Home Range Extent (km)	Fossoriality	Daily Activity Patterns	Volant Capacity	Detectability
Black Flying-fox	<i>Pteropus alecto</i>	0.64			Above ground	Nocturnal	Volant	0.0214
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	0.68			Above ground	Nocturnal	Volant	0.0214
Little Red Flying-fox	<i>Pteropus scapulatus</i>	0.36			Above ground	Nocturnal	Volant	0.0214
White-striped Freetail-bat	<i>Austronomus australis</i>	0.04			Above ground	Nocturnal	Volant	0.0883
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	41.45	8.22	0.41	Fossorial/ground	Cathemeral	Non-volant	0.0511
Common Wallaroo	<i>Osphranter robustus</i>	29.65	6.84	0.98	Fossorial/ground	Cathemeral	Non-volant	0.0511
Bare-nosed Wombat	<i>Vombatus ursinus</i>	25.75	6.33	0.08	Fossorial/ground	Nocturnal	Non-volant	0.0507
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	2	1.55	0.03	Above ground	Nocturnal	Non-volant	0.1053
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	0.86	0.98	0.01	Above ground	Nocturnal	Non-volant	0.0006
Squirrel Glider	<i>Petaurus norfolcensis</i>	0.27	0.52	0.02	Above ground	Nocturnal	Non-volant	0.0063
Koala	<i>Phascolarctos cinereus</i>	5.65	2.75	0.01	Above ground	Nocturnal	Non-volant	0.0046
Dingo	<i>Canis dingo</i>	16.5		150.45	Fossorial/ground	Cathemeral	Non-volant	0.1188
Fallow Deer	<i>Dama dama</i>	63.61	10.41	0.71	Fossorial/ground	Cathemeral	Non-volant	0.0208
Cat	<i>Felis catus</i>	4.9		0.04	Fossorial/ground	Cathemeral	Non-volant	0.0005
Red Fox	<i>Vulpes vulpes</i>	4.58	2.45	3.50	Fossorial/ground	Cathemeral	Non-volant	0.0447
Pig	<i>Sus scrofa</i>	135	15.74	1.18	Fossorial/ground	Cathemeral	Non-volant	0.0038
Cattle	<i>Bos taurus</i>	700		1.74	Fossorial/ground	Diurnal	Non-volant	0.0276
Dromedary	<i>Camelus dromedarius</i>	850		7130.66	Fossorial/ground	Diurnal	Non-volant	0.0256
Sheep	<i>Ovis aries</i>	70		0.63	Fossorial/ground	Diurnal	Non-volant	0.0367

Table S4. Mammal species detected via Observer-based monitoring (OBM) through pitfall traps (PT), funnel traps (FT), Elliott traps (ET), cage traps (CT), spotlighting (SL), and incidental encounters (IE); camera trapping; and passive acoustic monitoring (PAM) for both matching only the survey period, and all available audio data. The numbers for each species represent instances of detection rather than abundances. Species are categorised by their conservation status according to the [EPBC Act List of Threatened Fauna](#), divided into “Threatened Fauna” and “Non-threatened Fauna”, as well as “Alien Fauna”. “Vocal” mammals, defined as those vocalising within the human audible range with available example calls, are indicated in red.

Common name	Scientific name	Observer-based monitoring (OBM)						Camera trapping	Passive acoustic monitoring (PAM)	
		PT	FT	ET	CT	SL	IE	Camera traps	Survey period	All audio
Threatened species										
Koala	Phascolarctos cinereus						1	1		64
Grey-headed flying-fox	Pteropus poliocephalus					12	1			
Fruit bat	Pteropus alecto/ Pteropus poliocephalus/ Pteropus scapulatus					28	2		16	312
Southern greater glider	Petauroides volans					37	1			
Alien species										
Cattle	Bos taurus					77	140		6	276
Sheep	Ovis aries						26	4	3	123
Dromedary	Camelus dromedarius					49	36	49	1	96
Red fox	Vulpes vulpes					4	4	86	26	648
Cat	Felis catus					1	5	31		7
Pig	Sus scrofa					2	7	31		39
Fallow deer	Dama dama						5	15	1	104
House mouse	Mus musculus	193	36	676	1	167		124		
Black rat	Rattus rattus	1		25		4		26		
European rabbit	Oryctolagus cuniculus					1	2	2		
Brown hare	Lepus europaeus					4	4	13		
Non-threatened species										
Eastern grey kangaroo	Macropus giganteus					87	119	158		
Common wallaroo	Osphranter robustus					1	2	6		
Macropod	Macropus giganteus/ Osphranter robustus					88	121	164	27	752
Black flying-fox	Pteropus alecto					29				
Little red flying-fox	Pteropus scapulatus					7	1			
Inland broad-nosed bat	Scotorepens balstoni					1				
Yellow-bellied sheath-tail-bat	Saccolaimus flaviventris					16	1			
White-striped freetail-bat	Austronomus australis					19			36	857
Dingo	Canis dingo					14	49	11	92	1720
Bare-nosed wombat	Vombatus ursinus					1	1	14	14	369
Short-beaked echidna	Tachyglossus aculeatus						1	23		
Antilopine wallaroo	Osphranter antilopinus					1		4		
Red-necked wallaby	Notamacropus rufogriseus					39	19	31		
Swamp wallaby	Wallabia bicolor					16	16	66		

Common name	Scientific name	Observer-based monitoring (OBM)						Camera trapping	Passive acoustic monitoring (PAM)	
		PT	FT	ET	CT	SL	IE	Camera traps	Survey period	All audio
Whiptail wallaby	<i>Notamacropus parryi</i>						1			
Agile wallaby	<i>Notamacropus agilis</i>					39	40	59		
Rufous bettong	<i>Aepyprymnus rufescens</i>				30	13	3	30		
Northern brown bandicoot	<i>Isodon macrourus</i>				8		1	46		
Common brushtail possum	<i>Trichosurus vulpecula</i>			1	130	198	13	363	59	1545
Common ringtail possum	<i>Pseudocheirus peregrinus</i>					65	8			9
Sugar glider	<i>Petaurus breviceps</i>					30	2		32	387
Squirrel glider	<i>Petaurus norfolcensis</i>					18	1		10	84
Feathertail glider	<i>Acrobates pygmaeus</i>					1	1			
Yellow-footed antechinus	<i>Antechinus flavipes</i>		1	82		5	4	20		
Common planigale	<i>Planigale maculata</i>	1								
Long-tailed planigale	<i>Planigale ingrami</i>	3								
Common dunnart	<i>Sminthopsis murina</i>			4				5		
Rakali	<i>Hydromys chrysogaster</i>					1				
Canefield rat	<i>Rattus sordidus</i>			1						
Bush rat	<i>Rattus fuscipes</i>			2						
Lakeland-downs mouse	<i>Leggadina lakedownensis</i>	7		10						
Delicate mouse	<i>Pseudomys delicatulus</i>	6	1	7		1	1			
Total species richness		6	3	9	4	33	32	25	13	17
Total vocal species richness		0	0	0	1	15	16	11	13	17
Total threatened species richness		0	0	0	0	2	3	1	1	2
Total alien species richness		2	1	2	1	9	9	10	5	7
Total non-threatened richness		4	2	7	3	22	20	14	7	8

Table S5. Overall and “Per day” time investment (in hours) to produce species lists via passive acoustic monitoring (PAM), observer-based monitoring (OBM), and camera trapping, as well as the time investment required per species detection for each method.

Activity	Time Investment (hours)		
	PAM (317,410 hours)	OBM (168 survey days)	Camera Trapping (~100,000 images)
Data analysis	252		49
Data validation	35		68
Fieldwork + data entry	12	4,032	64
Per day	0.02	24	0.7
Per species detection	17	90	5
Overall	299	4032	181