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Supplementary Material

Glacial origin of bat ensembles in tropical Western Australia

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Appendix 1. Background notes on relevant Quaternary climatic and sea-level events.

Environmental forcing mechanisms: Quaternary climates and refugia

On the basis of very limited and poorly dated evidence (e.g. Fairbridge 1964; Jennings 1975), the Last Glacial Maximum (LGM) was thought to be arid, with virtually no summer monsoon regime. This model drove both archaeological and ecological discussions but has to be revisited in the light of more recent work. A more comprehensive understanding of Quaternary paleoclimate events in the monsoon region of north-western Australia has become available over the last few years, specifically development of the proxy record (e.g. Bowler *et al.* 2001; Wyrwoll and Miller 2001) and information on the dynamics of the paleoclimatology (Wyrwoll and Valdes 2003; Wyrwoll *et al.* 2007; McRobie *et al.* 2015; Eroglu *et al.* 2016).

Mangrove forests in the context of Late Pleistocene sea-level and climatic fluctuations

The long-term record of global sea-level changes over Quaternary time scales is based both on proxy deep sea oxygen isotope (^{18}O) events and numerically dated stratigraphic sequences, such as the well know coral reef successions and coastal stratigraphic records more generally – among these being mangrove ecotones (Woodroffe 1990).

In the general discussion of the relationship between mangrove response and sea-level changes, there is the general claim that extensive mangrove development occurs during periods of marine transgression, while less pronounced mangrove stands characterize marine regressions and periods of relative sea-level stability (Grindrod *et al.* 1999).

A conceptual model that captures the response of mangroves to sea-level changes is provided by Soares (2009; also see Ellison 2015), while Krauss *et al.* (2014) outline the details of how mangrove stands accommodate rising sea-levels. Soares (2009) emphasises the importance of the rate of sea-level rise, sediment and sedimentation regimes, regional oceanographic controls and coastal geomorphology. Taking a more focused view, Krauss *et al.* (2014) add climate and atmospheric CO_2 concentrations as relevant considerations.

From ice cores, Monnin *et al.* (2001) inferred a significant increase in atmospheric CO_2 concentration between LGM (~180 ppm) and pre-industrial (280 ppm) periods. Although, a response of mangrove species to CO_2 changes has been demonstrated under controlled conditions (Ellison, 2015), it is not clear how this change could have influenced mangrove forests (see Krauss *et al.* 2014), and available evidence suggests that it is unlikely that Late Quaternary atmospheric CO_2 level changes acted prohibitively on mangrove ecology.

In the geomorphological and paleoecological literature there has been a persistent claim that mangrove changes are driven by climate (for example, Jennings 1975; discussion in Grindrod *et al.* 2002). Most recently, Proske *et al.* (2014) proposed that enhanced summer monsoon rainfall between 7.5 and 4.5 kyr BP, prompted widespread mangrove coverage in the Cambridge Gulf region (the lower Ord River) of north-western Australia (Fig. 1b). However, radiocarbon dating evidence from the South Alligator River in the Northern Territory show that extensive mangrove swamps developed between 6,500 and 7,000 years ago and flourished for about 1000 years (Woodroffe *et al.* 1985); rather than claiming a role for climate, these authors link the growth of these forests to the interaction of sea-level change and sedimentation.

Even so, the role of climate in present-day mangrove ecology is evidenced by the decrease in mangrove diversity with lower temperatures (Ellison 2015) and the reduction in mangrove primary productivity with decreased humidity associated with lower precipitation (Lovelock and Ellison 2007). But the stratigraphic record makes it clear that in the summer monsoon regions of north-western Australia-Indonesia, mangroves occupy an ‘environmental envelope’ that can accommodate the climate changes that characterised this region over Quaternary time scales.

While there is clearly a role for climate in mangrove ecology, the more general claim of climate being a direct driver remains open to doubt. A more certain claim is that over long time scales, mangrove abundance in the monsoon region of Australia-Indonesia is greatly influenced by environmental controls linked to the physical evolution of coasts. Sea-level change and stages in the geomorphological development of coasts in the monsoon region of Australia-Indonesia seem to be the dominant controls of mangrove abundance (Thom 1982; Woodroffe 1990; Grindrod *et al.* 2002). Sea-levels lower than present provided the necessary geomorphological settings, extensive mangrove forests are expected to have fringed the then existing coastal margins – which is exactly what the stratigraphic record indicates.

Appendix 2. Bioregional descriptions (see Fig. 1).

DAC (Darwin Coast): Has a mesic monsoon climate (1700 mm rainfall annually) and, like the ARC and TWI, is characterised by gently undulating plains on lateritized Cretaceous sandstones and siltstones mantled by sandy and loamy red and yellow earths and siliceous sands supporting tall open eucalypt forest with a shrub and cane grass understorey. Extensive, diverse floodplains are associated with the lower reaches of the many large river systems, with riparian vegetation fringing the rivers and substantial areas of rainforest. Extensive mangrove forests occur in embayments and river mouths, and fringing the coast.

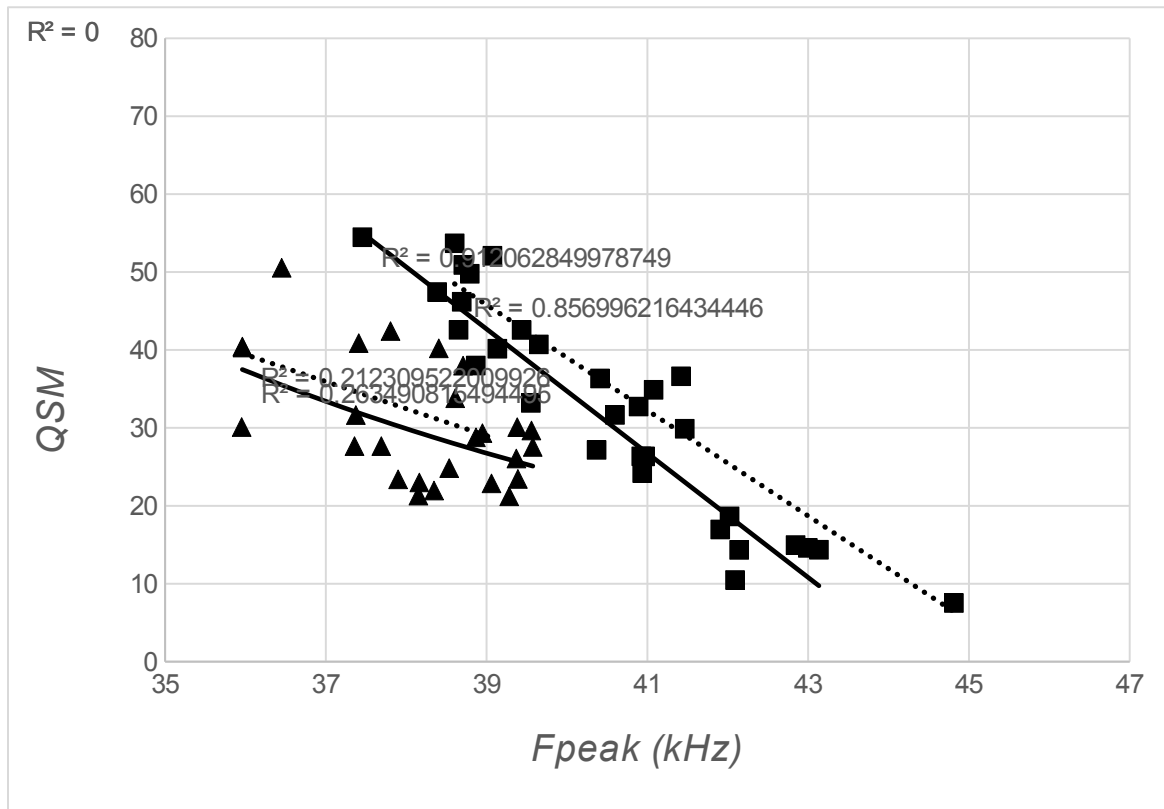
ARC (Arnhem Coast): With TWI, the most mesic bioregion in the study area. It includes sub-humid near-coastal as well as upland landscapes that are mainly expressed as coastal plains, gently undulating plains and low plateaux on lateritized Cretaceous sandstones and siltstones, as well as rugged, deeply incised, rocky, plateau surfaces dissected by gorges. The plains separate the uplands from the coast in places; they comprise extensive coastal dune systems, saline flats, wetlands and floodplains. Mangrove forests are common along the coast, particularly in sheltered embayments and estuaries. The wider landscapes of the uplands support grasslands, savannas, tree steppes, woodlands and open forests on: (1) red and yellow earths that mantle the undulating hill-country and broad valleys, and (2) rugged boulder country mainly associated with extensive quartz sandstone strata that are discontinuously mantled by skeletal soils. The uplands are drained by seasonally active, flood dominant river systems with many permanent pools fringed by tall trees that form riparian forests or woodlands.

GUC (Gulf Coast): Has a mesic monsoon climate, and receives 700 to 900 mm per annum. Its landscapes are dominated by gently undulating plains of red earths and shallow gravelly sand that support eucalypt woodlands over a tussock grass and spinifex understorey, with large meandering rivers and seasonal coastal swamps. Rugged areas on Proterozoic sandstone and Tertiary sediments occur in some places; coastal areas are not rocky, except on the Pellew Islands. The coastal plains support samphire shrublands and beach dunes. Mangrove forests are extensive along the coast, and fringe river estuaries for up to 10 km inland.

Appendix 3. Results of acoustic surveys at sites in CARn (see Appendix 5) and on the Northern Territory coast in August 2019 and June 2021, respectively. Species codes are explained in Table 1.

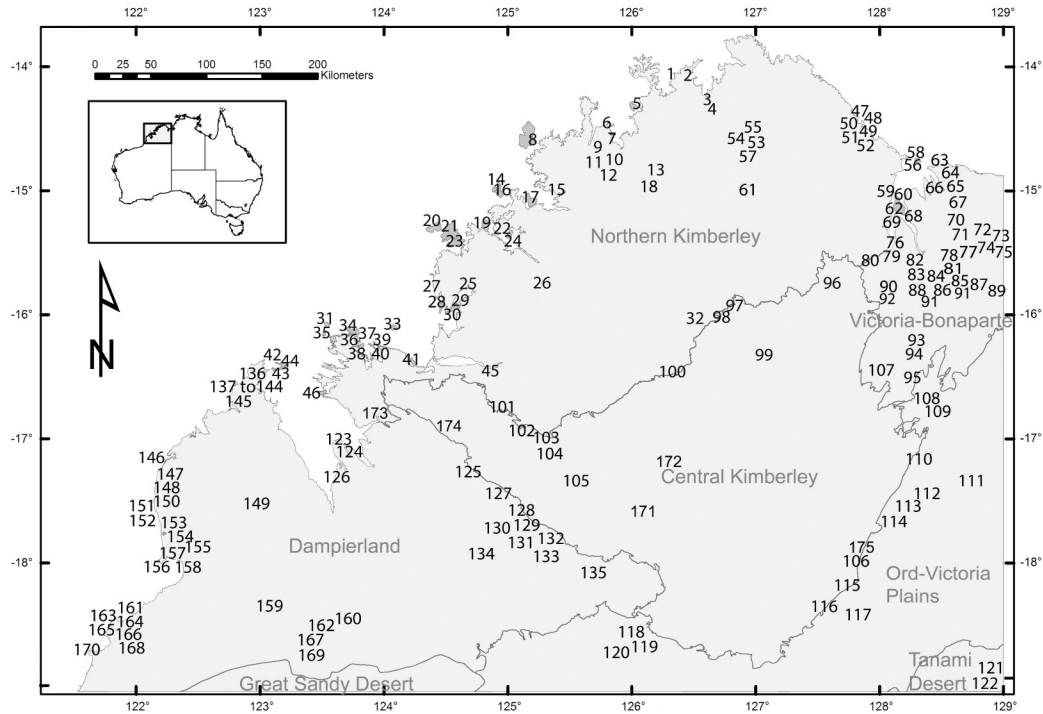
site #	Date	Lat °S	Long °E	Bioregion	Location & Habitat	Species detected
73	29Aug2019	22.8607	114.9544	CARn	Yannarie River bridge, riparian	Aa Cg Cj Ng Ol Sf Tg
71	29Aug2019	23.4829	114.2738	CARn	Lyndon River bridge, riparian	Aa Cg Cj Ng Ol Sf Sg Tg
70	30Aug2019	21.6521	115.131	CARn	Breadon Creek, Onslow, mangal	Aa Na Ng Oc Sf Tg Vf
72	30Aug2019	21.7788	114.9768	CARn	3-mile Pool, Ashburton River	Cg Cj Ng Sf Sg
74	30Aug2019	21.9765	115.0305	CARn	Ashburton River near Mindaroo Homestead, riparian	Cg Cj Ng Sf Sg
A	06Jun2021	15.6502	136.4109	GUC	Mule Creek, mangrove	Cg Cj Cn Ms Na Nd Nw Oc Pw Ra Sf Ss Tk
B	06Jun2021	15.6220	136.3375	GUC	BingBongW, mangrove	Cj Ms Na Nd Nw Oc Pa Pw Sf Sg Ss Tk
C	07Jun2021	16.0601	137.2546	GUC	SevenEmus, mangrove	Cg Cj Cn Ma Ms Na Nd Ng Nw Oc Ol Pa Pw Ra Sc Sf Sg Ss Tg Tk
D	10Jun2021	12.1659	136.7551	ARC	Gove beach, mangrove	Cj Cn Ma Ms Na Ol Pw Sg Tg Tk Vf
E	11Jun2021	12.1755	136.7297	ARC	Crocodile Creek, mangrove	Cj Ma Ms Na Nd Ng Oc Pw Sc Sf Tg
F	11Jun2021	12.1880	136.7962	ARC	Buffalo Creek, mangrove	Cn Ma Ms Ol Pw Sc Sf Ss Tk
G	15Jun2021	12.2532	131.9162	DAC	Point Stuart, mangrove	Aa Cj Cn Ms Na Nd Ng Oc Pa Pw Sc Sf Sg Ss Tk
H	16Jun2021	12.2882	131.0209	DAC	Tree Point, mangrove	Aa Cg Cj Cn Ms Na Nd Ng Nw Oc Ol Pa Pw Ra Sc Sf Sg Ss Tg Tk
I	17Jun2021	12.3383	130.9078	DAC	Darwin, mangrove	Aa Cj Cn Ma Ms Oc Ol Pw Sc Sf Sg

Appendix 4. Distinguishing *Chalinolobus nigrogriseus* (*Cn*, circles), *Scotorepens sanborni* (*Ss*, squares) and *S. greyii* (*Sg*, triangles) in terms of their search mode echolocation pulses sequence averages. Northern Territory data are plotted as solid symbols; Kimberley data are hollow symbols.

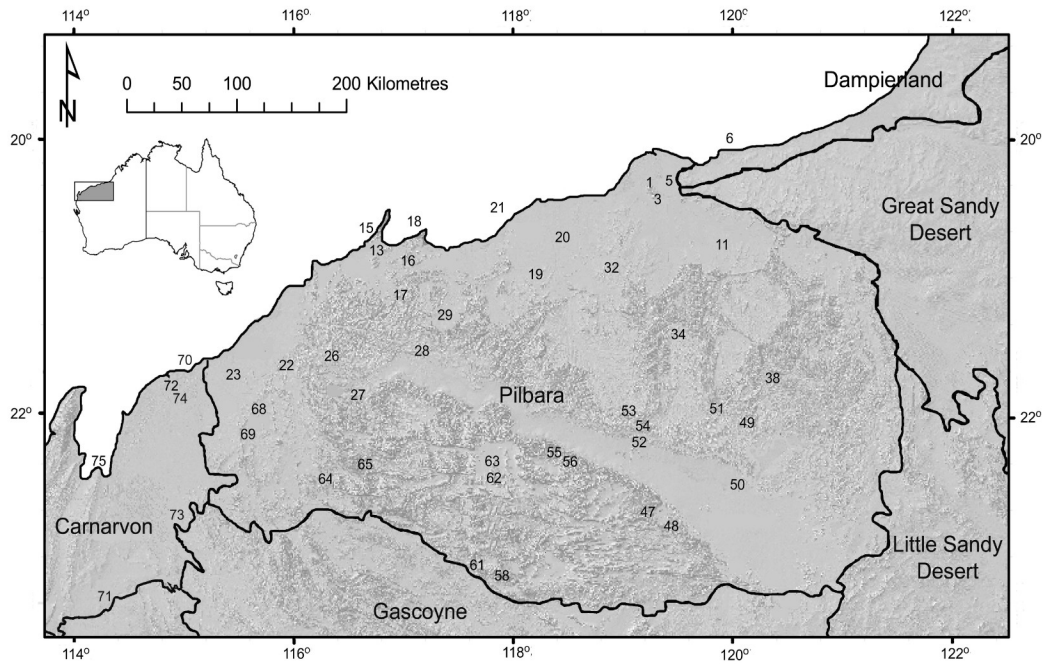


Appendix 5. (a) Locations of bat survey sites used in the Kimberley species classification analyses (see Appendix 2). (b) Locations of bat survey sites used in the “PIL+CARn” species classification analyses (see Appendix 3).

a.



b.



Appendix 6. OZCAM (2020), NRmaps and ALA online listings of specimens representing all zoophagic bat species known from coastal bioregions in the Northern Territory, other than those listed in Appendix 7. Certain relevant records from Queensland and Western Australia are also listed. Where feasible, the collection localities (Google Earth WMG) have been confirmed by the original collectors (specifically, by Damian Milne, Terry Reardon and Harry Parnaby).

Species	Specimen #	Date collected	Lat S	Long E	Bioregion	Location	km inland from mangal	State
<i>P. adamsi</i>	NT E&NR277265	22Aug2000	11.4789	130.6948	TWI	Melville Island. 7 km S of Milikapiti,	0.26	NT
<i>P. adamsi</i>	NTM U0679, 80	12Apr1990	12.1833	131.0167	DAC	Dunn Point, outer Darwin.	0.65	NT
<i>P. adamsi</i>	WAM M23113	1981	12.45	130.8333	DAC	Fannie Bay, Darwin. ID in Kitchener <i>et al.</i> (1986).	1.8	NT
<i>P. adamsi</i>	NTM U4093	9Nov2000	11.5454	132.9289	ARC	Murgenella Creek	13	NT
<i>P. adamsi</i>	NTM U5228	24Oct2001	12.4588	131.882	DAC	Swim Creek, Point Stuart. Eucalypt woodland.	21	NT
<i>N. walkeri</i>	NTM U5831	1997	12.3669	131.0333	DAC	Shoal Bay Reserve, 23km ENE of Darwin, mangal.	0	NT
<i>N. walkeri</i>	NMcK, released	7Jun2021	16.0602	137.2547	GUC	SevenEmus. Mist net in mangal	0	NT
<i>N. walkeri</i>	NTM U1538	2Aug1988	15.6833	137.0333	GUC	Lake Eames, Vandelin Island.	3.3	NT
<i>N. walkeri</i>	NT E&NR10532	1Nov2000	11.5454	132.9289	ARC	Murgenella Creek.	13	NT
<i>N. walkeri</i>	NT E&NR3207208	21Sep1982	12.7370	132.3346	DAC	Arnhem Highway, West Alligator River. Riparian.	42	NT
<i>C. nigrogriseus</i>	ANWC M02101	1Aug1967	15.7167	136.6667	GUC	South West Island.	0	NT
<i>C. nigrogriseus</i>	NTM U2189	25Mar1981	12.4514	130.8501	DAC	Dinah Beach, Darwin.	0.05	NT
<i>C. nigrogriseus</i>	NTM U4395	23Mar1983	12.4514	130.8501	DAC	Dinah Beach, Darwin.	0.05	NT
<i>C. nigrogriseus</i>	NTM U0287	15Nov1971	11.9666	135.7082	ARC	Echo Island. Site on track.	2.4	NT
<i>C. nigrogriseus</i>	ANWC M10019	29Aug1972	12.25	136.8333	ARC	Gove Peninsula.	6	NT
<i>C. nigrogriseus</i>	ANWC M01102	6Aug1965	11.1167	132.1333	TWI	Smith Point, coastal	14	NT
<i>H. inornatus</i>	NT E&NR1236697	Sep1978	13.2	130.8	DAC	Litchfield National Park	50	NT
<i>H. inornatus</i>	NT E&NR1236698	Sep1978	13.2	130.8	DAC	Litchfield National Park	50	NT
<i>S. saccolaimus</i>	NTM U4079, 80	31Oct2002	11.4503	132.7832	ARC	Coombe Point, coastal.	0.3	NT
<i>S. saccolaimus</i>	NTM U5231	25Sep2003	14.7756	135.2649	GUC	Woodland, near Port Roper.	4.1	NT
<i>S. saccolaimus</i>	NTM U5756, 60	31Dec2006	12.5194	131.0934	DAC	Howard Springs.	9	NT
<i>S. saccolaimus</i>	NTM U5763, 65	31Dec2006	12.5194	131.0934	DAC	Howard Springs.	9	NT
<i>S. saccolaimus</i>	NTM U5037	14Nov1999	16.0305	130.7973	VIB	Jasper Gorge.	88	NT
<i>O. lumsdenae</i>	NT E&NR10468	15Oct2000	12.2940	131.0195	DAC	Tree Point. Vine thicket. ID in Reardon <i>et al.</i> (2014).	0.2	NT
<i>O. lumsdenae</i>	NTM U4910	7Nov1968	12.05	132.9	DAC	Mount Borradaile. ID in Reardon <i>et al.</i> (2014).	9	NT
<i>O. lumsdenae</i>	NT E&NR452615	4Jun2012	13.9788	136.4496	ARC	Groote Island.	15	NT

<i>O. lumsdenae</i>	WAM M50037	26Aug1982	16.2048	136.0111	GUC	35 km W of Borroloola. ID in Reardon <i>et al.</i> (2014).	65	NT
<i>C. jobensis</i>	NT E&NR42229929	1Jul2018	12.5522	130.8605	DAC	Channel I. Mangroves	0	NT
<i>C. jobensis</i>	NT E&NR1722868	2Jun2013	16.3618	137.6726	GUC	Calvert River, SevenEmus	8.1	NT
<i>C. jobensis</i>	NT E&NR10392	10Feb2001	15.7829	136.3223	GUC	BingBong Stn. Woodland	14	NT
<i>C. jobensis</i>	NT E&NR10418	1Nov2000	11.5454	132.9289	ARC	Murgenella Creek	13	NT
<i>C. jobensis</i>	NT E&NR10412	24Oct2001	12.4589	131.8819	DAC	20 km S of Stuart Point	20	NT
<i>S. flaviventris</i>	VM DTC111	4Sep1935	12.1074	134.9219	ARC	Milingimbi, adj to mangal.	0.15	NT
<i>S. flaviventris</i>	NT E&NR10689	15Oct2000	12.2940	131.0188	DAC	Tree Point. Vine thicket.	0.2	NT
<i>S. flaviventris</i>	NT E&NR11287	30Nov2000	12.6502	130.9829	DAC	Litchfield, Darwin	0.4	NT
<i>S. flaviventris</i>	NMV C5133		11.83	133.53	ARC	King River, marine	0.8	NT
<i>S. flaviventris</i>	NTM U5237, 40	1Oct2001	15.6275	136.3538	GUC	Bing Bong Stn, Borroloola	1.1	NT
<i>S. flaviventris</i>	NT E&NR10690	24Oct2001	12.2463	131.884	DAC	Point Stuart. ID in Reardon et al. (2014).	1.7	NT
<i>S. flaviventris</i>	NT E&NR10684	8Oct2000	13.1754	130.6702	DAC	SW of Wangi Falls	41	NT
<i>S. flaviventris</i>	NT U5250	4Oct2001	17.1547	137.6525	GUC	TO to Pungalina Stn.	72	NT
<i>N. geoffroyi</i>	NTM U5387	24Oct2002	12.2947	131.554	DAC	Woolner Station Barrage, Mary River, mangal	0	NT
<i>N. geoffroyi</i>	QM J2267		12.45	130.8	DAC	Port Darwin, adj to mangal	0.05	NT
<i>N. geoffroyi</i>	SAM M1811	Mar1922	14.5358	135.2516	GUC	Mungejirri Yaalput Waterhole	1.3	NT
<i>N. geoffroyi</i>	ANWC M45632	4Nov1981	12.698	132.371	DAC	Kapalga Research Station	31	NT
<i>N. geoffroyi</i>	NTM U1986	22Aug1989	12.867	131.583	Pine Creek	Mt Bundy Station	64	NT
<i>N. geoffroyi</i>	NT E&NR393591	30Nov1991	17.1085	137.4612	GUC	42 km S of Pungalina airstrip	83	NT
<i>C. gouldii</i>	NT E&NR270231	13Dec1991	11.4672	130.7024	TWI	Melville I. South of Milikapiti, mangal	0	NT
<i>C. gouldii</i>	NT E&NR10425	10Feb2001	15.6275	136.3538	GUC	Bing Bong Stn, Borroloola	1.1	NT
<i>C. gouldii</i>	NT E&NR3722136	3Nov2001	12.2463	131.884	DAC	Point Stuart	1.7	NT
<i>C. gouldii</i>	NT E&NR1050114	10Oct2014	14.07	136.54	ARC	Groote Eylandt. Eucalypt open forest	11	NT
<i>C. gouldii</i>	NT E&NR10436	1Nov2000	11.5448	132.9289	ARC	Murgenella Creek, Waulk Lagoon	12.5	NT
<i>C. gouldii</i>	EBU B195	24Sep1982	13.5028	132.3948	Arnhem Escarpment	Rock pool, Kambolgie Creek	80	NT
<i>P. westralis</i>	NTM U5258	26Sep2001	14.7701	135.3599	GUC	Coastal mangal S of Roper River mouth.	0	NT
<i>P. westralis</i>	NTM U5066	1999	11.4	130.4167	TWI	Melville I. Garden Point	0.4	NT
<i>P. westralis</i>	NTM U4144	5Oct1996	11.7202	130.671	TWI	Melville I. 14km S of Taracumbie, creek.	0.4	NT
<i>P. westralis</i>	NTM U5296	23Nov2001	12.2463	131.884	DAC	Point Stuart	2.4	NT

<i>P. westralis</i>	NTM U5259	25Sep2001	14.7756	135.2649	GUC	Woodland west of Port Roper	4.1	NT
<i>P. westralis</i>	NTM U0299	24Oct1978	12.45	132.3	DAC	Kapalga, Kakadu NP	13	NT
<i>P. westralis</i>	AM M12846	14Oct1983	12.5806	131.3001	DAC	Monsoon forest near Middle Point	28	NT
<i>P. westralis</i>	NTM U5746	2007	14.2121	130.0842	DAC	Macadam Range, Port Keats	44	NT
<i>P. westralis</i>	NTM U5391	23Oct2002	13.2283	131.0980	Pine Creek	Snake Ck, 1km N of Adelaide River	56	NT
<i>P. westralis</i>	AM M12816	6Oct1983	17.4678	141.1838	Gulf Plains	Walker Ck on Normanton-Karumba Rd. ID in Kitchener <i>et al.</i> (1986).	16	Qld
<i>N. daedalus</i>	NMcK, released	7Jun2021	16.0602	137.2547	GUC	SevenEmus. Mist net in mangal	0	NT
<i>N. daedalus</i>	NT E&NR454063	11Jul2012	16.2378	137.7161	GUC	AWC. Eri Mulder.FW swamp, paperbarks	0.4	NT
<i>N. daedalus</i>	NT E&NR261045	16Oct1980	12.2986	131.5012	DAC	Woolner Station east of Mary River	1.6	NT
<i>N. daedalus</i>	NT E&NR452616	4Jun2012	13.9779	136.4496	ARC	Groote Eylandt. Eucalypt open forest	4	NT
<i>N. daedalus</i>	NT E&NR1078379	11Sep1998	12.544	134.9096	ARC	open forest	28	NT
<i>N. daedalus</i>	EBU B209	26Sep1982	13.5264	130.8222	DAC	Blackfellow Ck nr Daly River Rd	42	NT
<i>N. daedalus</i>	AM M34452	21Sep1982	12.7370	132.3346	DAC	Arnhem Highway, West Alligator River. Riparian	42	NT
<i>N. arnhemensis</i>	NT E&NR2175787	10Jul2016	16.0682	137.2815	GUC	AWC, mangal edge	0	NT
<i>N. arnhemensis</i>	NT E&NR1722876	30Jun2013	16.0603	137.2547	GUC	AWC, mangal edge	0	NT
<i>N. arnhemensis</i>	NMcK, released	7Jun2021	16.0602	137.2547	GUC	SevenEmus. Mist net in mangal	0	NT
<i>N. arnhemensis</i>	ANWC M02100	31Aug1967	15.6166	136.8771	GUC	Cabbage Tree Cove, North I. Melaleuca nr mangal	0.05	NT
<i>N. arnhemensis</i>	NT E&NR39925	29May1990	16.4485	137.8845	GUC	Milne bat survey. Coastal dune	0.2	NT
<i>N. arnhemensis</i>	NT E&NR45340	18Nov2011	16.2654	137.7403	GUC	AWC PUN-Calvert dune. coastal dune	0.9	NT
<i>N. arnhemensis</i>	NT E&NR2175786	15Jul2016	16.1654	137.4867	GUC	AWC Pungalina -seven Emu. Coastal dune	1.0	NT
<i>N. arnhemensis</i>	E&NR10501	10Feb2001	15.6275	136.3538	GUC	Bing Bong Stn, Borroloola	1.1	NT
<i>N. arnhemensis</i>	AM M27837	24Aug1948	12.3695	136.959	ARC	Cape Arnhem	4.7	NT
<i>N. arnhemensis</i>	VM C5422		12.12	133.46	ARC	King River	22	NT
<i>N. arnhemensis</i>	AM M34441	21Sep1982	12.7370	132.3346	DAC	Arnhem Highway, West Alligator River, riparian	42	NT
<i>N. arnhemensis</i>	EBU B210	26Sep1982	13.5264	130.8222	DAC	Blackfellow Ck nr Daly River Rd	42	NT
<i>O. cobourgianus</i>	USNM284243	25Sep1948	11.4103	131.9626	TWI	Cobourg Peninsula. Black Rock Point. ID in Reardon <i>et al.</i> (2014).	0.05	NT
<i>O. cobourgianus</i>	NT E&NR1359049	16Jun2001	12.5632	130.9046	DAC	Darwin, behind mangal	0.15	NT
<i>O. cobourgianus</i>	NTM U5293	3Nov2001	12.2463	131.884	DAC	Point Stuart. ID in Reardon <i>et al.</i> (2014).	2.4	NT
<i>O. cobourgianus</i>	NTM U5287, 8	25Sep2001	14.7756	135.2649	GUC	Woodland west of Port Roper. ID in Reardon <i>et al.</i> (2014).	4.1	NT
<i>O. cobourgianus</i>	ANWC M04627, 8	14May1971	12.3333	131.8833	DAC	Thrings Creek, coastal plains. ID in Reardon <i>et al.</i> (2014).	8	NT
<i>O. cobourgianus</i>	NT E&NR10484	1Nov2000	11.5454	132.9289	ARC	Murgenella Creek	13	NT

<i>cobourgianus</i>									
<i>O.</i>	NT E&NR10475	28Sep2001	15.6258	135.4617	GUC-GFU	Butterfly Springs, Nathan River.	41		NT
<i>cobourgianus</i>									
<i>H. stenotis</i>	NMV C5410		12.1	133.5	ARC	collected by W.R. McLennan	20		NT
<i>H. stenotis</i>	NTM U1157	23Sep1986	17.183	137.717	GUC	Red Bark Mine, Echo Gorge	60		NT
<i>V. caurinus</i>	NTM U5510	12Dec2002	12.25	135.05	ARC	Intertidal flats, Glyde River	0		NT
<i>V. caurinus</i>	ANWC M19007	22Oct1967	15.5637	136.8451	GUC	Webe Point, North I.	0.15		NT
<i>V. caurinus</i>	NTM U4106	6Aug1993	11.5783	136.3517	ARC	Raragala Island	0.4		NT
<i>V. caurinus</i>	ANWC M01923	13Aug1965	11.1239	132.1356	TWI	Smith Point, Port Essington, coastal cliff	14		NT
<i>V. caurinus</i>	NTM U4163	27Oct1994	13.0685	130.7129	DAC	Bamboo Ck, Litchfield NP	32		NT
<i>V. caurinus</i>	NTM U4343	27May1996	15.8355	135.458	GUC-GFU	Nathan River, Limmen Gate NP	63		NT
<i>H. ater</i>	WAM M4093	Jun1960	12.1074	134.9219	ARC	Milingimbi, adj to mangal, Milingimbi Island.	0.15		NT
<i>H. ater</i>	E&NR277337	9Mar1936	12.2519	136.8917	ARC	Yirkalla, coastal	4.5		NT
<i>H. ater</i>	NTM U5827	3Sep2004	12.2715	132.6687	DAC	Kakadu NP, track in open Euc forest	13		NT
<i>H. ater</i>	ANWC M04476	30Sep1970	12.5065	135.8056	ARC	Lake Evella, Arnhem Land	14		NT
<i>H. ater</i>	NTM U4115	23Apr1993	17.189	137.714	GUC	Echo Gorge	60		NT
<i>M. macropus</i>	E&NR10488	26Sep2001	14.7701	135.3599	GUC	Coastal mangal S of Roper River mouth.	0		NT
<i>M. macropus</i>	E&NR10487	10Feb2001	15.6275	136.3538	GUC	Bing Bong Stn, Borroloola	1.1		NT
<i>M. macropus</i>	NTM U5593	8Dec2003	12.3989	130.8749	DAC	Rapid Creek, nr Charles Eaton Drive, Darwin	1.3		NT
<i>M. macropus</i>	SAM M1810	1Mar1922	14.5358	135.2516	GUC	Mungejirri Yaalput Waterhole	1.3		NT
<i>M. macropus</i>	NTM U5911	16May2010	12.5842	131.0639	DAC	Gulnar Road, Bees Creek	3.1		NT
<i>M. macropus</i>	NT E&NR10497	1Nov2000	11.5454	132.9289	ARC	Murgenella Creek	13		NT
<i>M. macropus</i>	ANWC M01934	11Aug1965	11.1167	132.1333	TWI	Port Essington. Smith Point, coastal	14		NT
<i>M. orianae</i>	NT E&NR291696	30Nov1989	12.4486	130.8712	DAC	Darwin Harbour EIS, mangal	0		NT
<i>M. orianae</i>	NT E&NR3715181	1Jul1937	12.1074	134.9219	ARC	Milingimbi, adj to mangal, Milingimbi Island.	0.15		NT
<i>M. orianae</i>	NT E&NR1359075	16Jun2001	12.5665	130.9433	DAC	Darwin Harbour	0.7		NT
<i>M. orianae</i>	NT E&NR269446	7Jan1937	12.0818	134.8845	ARC	Milingimbi, Crocodile I.	0.9		NT
<i>M. orianae</i>	NTM U5958	9Dec2013	12.3989	130.8749	DAC	Rapid Creek, nr Charles Eaton Drive	1.3		NT
<i>M. orianae</i>	NT E&NR1158864	1Jan2001	11.4929	132.8989	ARC	Murgenella	6		NT
<i>M. orianae</i>	NT E&NR58831	1Jan2001	11.5454	132.9289	ARC	Murgenella Creek	13		NT
<i>M. orianae</i>	NT E&NR399584	22Jul1990	12.5986	136.5345	ARC	near Gove	14		NT
<i>M. orianae</i>	NT E&NR112899	30Jun1981	12.5652	132.0345	DAC	<i>vide.</i> Sue Churchill	24		NT
<i>M. orianae</i>	ANWC M15613	1Apr1972	13.0676	130.7101	DAC	Bamboo Ck, Litchfield NP	32		NT
<i>M. gigas</i>	NT E&NR4283878		12.1074	134.9219	ARC	Milingimbi, adj to mangal, Milingimbi Island.	0.15		NT
<i>M. gigas</i>	NTM U1156	30Jul1988	15.50	136.88	GUC	Cape Pellew, North I.	1.3		NT
<i>M. gigas</i>	NT E&NR441350	13Apr2010	12.4047	132.4902	DAC	Kakadu	7		NT
<i>M. gigas</i>	NT E&NR392107	Mar1990	12.1194	133.8973	ARC	creek crossing	14		NT
<i>M. gigas</i>	NT E&NR1158809	1Jan2001	11.8208	133.0405	ARC	Murgenella Creek	15		NT

<i>M. gigas</i>	NT E&NR1295886	31Nov2003	13.7028	130.6701	DAC	2.8 km along Woolianna Rd.	36	NT
<i>M. gigas</i>	NT E&NR1724568	Jul2013	16.7776	137.4703	GUC	Totem Pole Cave.	55	NT
<i>R. aurantia</i>	NT E&NR2384710	4Sep2016	12.4148	130.8312	DAC	Lake Alexander, Darwin.	0.3	NT
<i>R. aurantia</i>	NT E&NR399573	18Jul1990	12.2819	136.8845	ARC	East Arnhem, near Gove.	2.8	NT
<i>R. aurantia</i>	NT E&NR1297351	8May2009	12.4026	130.9295	DAC	Holmes Jungle, Darwin.	3.9	NT
<i>R. aurantia</i>	NT E&NR138002	31Mar1986	12.3652	131.3845	DAC	by H. Possmore.	5.5	NT
<i>R. aurantia</i>	NT E&NR1158806	1Jan2001	11.8208	133.0405	ARC	Murgenella Creek.	15	NT
<i>R. aurantia</i>	NTM U5164	15Jan1997	15.3762	135.4273	GUC	Nathan River H/S.	28	NT
<i>R. aurantia</i>	NT E&NR454723	27Jun2012	16.4647	137.5534	GUC	AWC Cycad Creek camp.	28	NT
<i>R. aurantia</i>	NT E&NR290961	27Sep2001	15.6258	135.4617	GUC-GFU	Butterfly Springs, Nathan River.	39	NT
<i>R. aurantia</i>	EBU B211	26Sep1982	13.5264	130.8222	DAC	Blackfellow Creek near Daly River Rd.	42	NT
<i>T. georgianus</i>	NTM U0243	28Apr1985	12.1611	136.7509	ARC	East Woody Island, seaward of mangroves.	0	NT
<i>T. georgianus</i>	ANWC M13204	1Feb1965	15.5701	136.7851	GUC	Pellew Islands. Recess in sea cliff adjacent to mangroves.	0.1	NT
<i>T. georgianus</i>	NT E&NR284791	5Feb1996	12.4598	130.8384	DAC	Smith St, Darwin, Darwin.	0.43	NT
<i>T. georgianus</i>	NMV DTC110	2Nov1935	14.1165	136.4686	ARC	Groote Island, Castle Rock.	2.8	NT
<i>T. georgianus</i>	NTM U1537	22Jul1988	15.6792	137.0227	GUC	Lake Eames, Vandelin Island.	3.1	NT
<i>T. georgianus</i>	NT E&NR152683	31Mar1986	12.3652	131.3845	DAC	by H. Possmore.	5.5	NT
<i>T. georgianus</i>	NT E&NR392677	30Mar1990	12.0685	133.9012	ARC	<i>Fide.</i> Sue Churchill, Rock Rat survey.	14	NT
<i>T. georgianus</i>	NTM U4157	26Oct1994	13.0685	130.7129	DAC	Bamboo Ck, Litchfield NP.	32	NT
<i>T. georgianus</i>	NTM U5253	27Sep2001	15.6258	135.4617	GUC-GFU	Butterfly Springs, Nathan River.	39	NT
<i>V. finlaysoni</i>	AM M10231	8Feb1976	15.8111	136.6749	GUC	Caranbirini, McArthur River, mangal	0	NT
<i>V. finlaysoni</i>	NT E&NR2468	30Jun1998	15.6259	136.8679	GUC	Pellew Is	1.2	NT
<i>V. finlaysoni</i>	NT E&NR452622	4Jun2012	13.9778	136.4496	ARC	Groote Island	15	NT
<i>V. finlaysoni</i>	SAM M1809	1Dec1921	14.5358	135.2516	GUC	Mungejirri-Yaalput Waterhole	1.3	NT
<i>V. finlaysoni</i>	AM M27890	24Nov1948	12.3273	133.0587	ARC	Oenpeli, East Alligator River	16	NT

Appendix 7. Identification of tropical Australian *Scotorepens* specimens based on cranial morphometrics (Kitchener *et al.* 1985, 1994), allozyme electrophoresis (Baverstock *et al.* 1987; Kitchener *et al.* 1994), and re-examination of museum specimens in terms of skull shape following McKenzie and Bullen (2012): mastoid angle (S)teep or (N)ot; rostrum (T)ilted or (N)ot. Specimen collection localities (Google Earth WMG) have been updated from information supplied by the original collectors. 'Mapped location' refers to the maps in **KC** (Kitchener and Caputi 1985), **B** (Baverstock *et al.* 1987) and **KA** (Kitchener and Adams 1994).

ID	Spec # (ALA ID)	Date	Lat S	Long E	Bioreg	Location & Habitat	km inland from mangal	Map location	Skull morph- ometrics (KC & KA).		Electro- phoresis (B & KA)		Skull shape
									(1985)	(1994)	(1987)	(1994)	
S. greyii	NTM U4076 (Sg)	15Oct2000	12.2941	131.0191	DAC	Tree Point Conservation Area. Vine thicket.	0.2	NT					Sg (N, N)
S. greyii	NTM U5241 (Sg)	1Oct2001	15.6275	136.3538	GUC	Bing Bong Rd.	1.1	NT					Sg (N, N)
S. greyii	EBU B166 = NTM U0785	20Sep1982	12.7133	131.0560	DAC	4 km E Berry Springs, pool in open country.	6.8	NT, 18	Sg		Sg		Sg (N, N)
S. greyii	EBU B170 = NTM U0789	20Sep1982	12.7133	131.0560	DAC	4 km E Berry Springs, pool in open country.	6.8	NT, 18	Ss	Ss			Sg (N, N)
S. greyii	EBU B171 = NTM U0790	20Sep1982	12.7133	131.0560	DAC	4 km E Berry Springs, pool in open country.	6.8	NT, 18	Sg		Sg		Sg (N, N)
S. greyii	NTM U4088 (Sg)	28Oct2000	11.1666	132.1724	TIW	behind beach near Smith Point, Port Essington. Pic3	14	NT					Sg (N, N)
S. greyii	EBU B187 = NTM U0792	21Sep1982	12.7370	132.3346	DAC	Arnhem Hwy crossing West Alligator River, riparian edge	42	NT, 18H	Sg		Sg		Sg (N, N)
S. greyii	EBU B188 = NTM U0793	21Sep1982	12.7370	132.3346	DAC	Arnhem Hwy crossing West Alligator River, riparian edge	42	NT, 18H	Sg		Sg		Sg (N, N)
S. greyii	EBU B206 = NTM U0802	26Sep1982	13.5393	130.8670	DAC	Reynolds River cross Daly River Rd	47	NT, 18H	Sg		Sg		Sg (N, N)

S. greyii	EBU B203 = NTM U0799	26Sep1982	13.5393	130.8670	DAC	Reynolds River cross Daly River Rd	47	NT, 18H	Sg	Sg	Sg (N, N)
S. greyii	EBU B143 = NTM U0768	26Aug1982	16.2048	136.0111	GUC	35k W of Borrooloola	65	NT, 19I	Sg	Sg	Sg (N, N)
S. greyii	EBU B146 = NTM U0772	26Aug1982	16.2048	136.0111	GUC	35k W of Borrooloola	65	NT, 19I	Sg	Sg	Sg (N, N)
S. greyii	EBU B214 = NTM U0805	29Sep1982	15.7166	130.7333	VB	Skull Ck Major Victoria Highway crossing. , between Timber Ck & Victoria River	77	NT, 17G	Sg	Sg	Sg (N, N)
S. greyii	EBU B216 = NTMU0807	29Sep1982	15.7166	130.7333	VB	Skull Ck Major Victoria Highway crossing. , between Timber Ck & Victoria River	77	NT, 17G	Sg	Sg	Sg (N, N)
S. greyii	EBU B198 = NTM U0795	24Sep1982	13.5028	132.3948		70 km NE Pine Ck, rockpool near escarpment	80	NT, 18H	Sg	Sg	Sg (N, N)
S. greyii	EBU B200 = NTM U0797	24Sep1982	13.5028	132.3948		70 km NE Pine Ck, rockpool near escarpment	80	NT, 18H	Sg	Sg	Sg (N, N)
S. greyii	EBU B239 = NTM U0813	2Oct1982	16.0333	130.7666		Jasper Gorge, between Timber Creek and Top Springs	87	NT, 17G	Sg	Sg	Sg (N, N)
S. greyii	EBU B142 = NTM U0769	25Aug1982	16.4323	134.1479		85 km east of Daly Waters, on Carpentaria Highway	185	NT, 16I	Sg	Sg	Sg (N, N)
S. greyii	WAM M26747 =B96	10Aug1982	20.37	140.28		Quamby	289	Qld, 24	Sg		Sg (N, N)
S. greyii	WAM M26782 =B99	10Aug1982	20.37	140.28		Quamby	289	Qld, 24	Sg		Sg (N, N)
S. greyii	WAM M26745 =B7	14Jul1982	23.6502	146.6334		Alpha	331	Qld, 31J	Sg	Sg	Sg (N, N)
S. greyii	WAM M46728	13Sep1995	24.8833	144.7667		Idalia NP	560	Qld			Sg (N, N)

S. greyii	WAM M26749 =EBU B311	22Oct1982	25.4203	142.6524		Windorah	780	Qld, 30J	Sg	Sg	Sg (N, N)
S. greyii	WAM M26750 =EBU B312	22Oct1982	25.4203	142.6524		Windorah	780	Qld, 30J	Sg	Sg	Sg (N, N)
S. greyii	WAM M24029	25Jan1982	17.6623	122.2028	DL	Barred Creek Bore	0.1	WA, 11F	Sg	Sg	Sg (N, N)
S. greyii	WAM M22660	25Apr1977	16.5685	122.8498	DL	Martins Well, Pender	0.3	WA, 11F	Sg	Sg	Sg (N, N)
S. greyii	WAM M22605	23Jun1981	16.5685	122.8498	DL	Martins Well, Pender	0.3	WA			Sg (N, N)
S. greyii	WAM M26769 EBU B125	14Jun1981	18.7385	121.6405	DL	over tank, Cape Bossut	0.5	WA, 11	Sg		Sg (N, N)
S. greyii	WAM M26771 =B127	14Jun1981	18.7385	121.6405	DL	over tank, Cape Bossut	0.5	WA, 11	Sg		Sg (N, N)
S. greyii	WAM M26770 =B126	14Jun1981	18.7385	121.6405	DL	over tank, Cape Bossut	0.5	WA, 11	Sg		Sg (N, N)
S. greyii	WAM M22661 =DL70	26Apr1977	16.7307	122.8081	DL	Cocky Well	1.3	WA			Sg (N, N)
S. greyii	WAM M62737 = Barck 6	12Jul1994	17.6799	122.2111	DL	Barred Creek tank	1.3	WA			Sg (N, N)
S. greyii	WAM M62736 =Barck 5	12Jul1994	17.6802	122.2109	DL	Barred Creek tank	1.3	WA			Sg (N, N)
S. greyii	WAM M26768 EBU B117	12Jun1981	18.7422	121.6714	DL	Earth Dam, Cape Bossut	1.5	WA, 11	Sg		Sg (N, N)
S. greyii	WAM M22659 =DL16	21Apr1977	17.288 8	122.1759	DL	Coulomb Point NR. FW tristania swamp	2.4	WA, 11	Ss		Sg (N, N), small
S. greyii	WAM M53738	20Mar2003	16.9844	122.6644	DL	Beagle Bay community	3.6	WA			Sg (N, N)
S. greyii	WAM M20922	7Sep1978	17.2351	123.7711	DL	One Tree Mill, Point Torment	4.6	WA			Sg (N, N)

S. greyii	WAM M21982	24Jul1982	14.8649	125.8311	NK	Camp Ck in laterite, Mitchell Plateau	17.6	WA, 14F		Sg	Sg (N, N)
S. greyii	WAM M12247	21Aug1974	15.8012	125.3458	NK	Blyxa Ck, Prince Regent	19	WA, 14			Sg (N, N)
S. greyii	WAM M12248 (Sg on label)	23Aug1974	15.8012	125.3458	NK	Blyxa Ck, Prince Regent	19	WA, 14	Ss/Sg		Sg (N, N), small
S. greyii	WAM M26767 =B116	10Jun1981	17.359	124.001	DL	Meda Stn	22	WA, 14F	Sg	Sg	Sg (N, N)
S. greyii	WAM M21576	6Oct1981	14.8917	125.7609	NK	lower Camp Ck in sandstone	23	WA, 14F		Sg	Sg (N, N)
S. greyii	WAM M20860 (FW1943)	17Sep1982	14.9058	126.2011	NK	King Edward R crossing	35	WA, 14F	Sg	Sg	Sg (N, N)
S. greyii	WAM M43136	1994	15.7542	128.7905	VB	near Kununurra	55	WA			Sg (N, N)
S. greyii	WAM M14081	13Aug1975	14.8178	126.9373	NK	Drysdale NP	71	WA			Sg (N, N)
S. greyii	WAM M14084	21Aug1975	15.0511	126.7389	NK	Drysdale NP, site C2	89	WA			Sg (N, N)
S. greyii	WAM M11617	8Oct1971	16.383	128.7170	VB	Ord River	104	WA			Sg (N, N)
S. greyii	WAM M48244	27May1995	24.5239	114.9683	CAR	Kennedy Range KE3	140	WA			Sg (N, N)
S. greyii	WAM M30930	15Jun1989	17.3094	128.4571	OVP	Bungle Bungle	193	WA, 15G		Sg	Sg (N, N)
S. greyii	WAM M30929	15Jun1989	17.3094	128.4571	OVP	Bungle Bungle	193	WA, 15G		Sg	Sg (N, N)
S. greyii	WAM M30928	13Jul1989	17.3094	128.4571	OVP	Bungle Bungle	193	WA, 15G		Sg	Sg (N, N)
S. greyii	WAM M26763-5 EBU B112-4	8Jun1981	18.292	125.5867	DL	Pinbilly Well, Gogo Stn	210	WA, 13	Sg	Sg	Sg (N, N)
S. greyii	WAM M26762 =B108	7Jun1981	18.1816	125.5983	DL	Fitzroy Crossing	215	WA, 13	Sg	Sg	Sg (N, N)
S. greyii	WAM M26766 =B115	8Jun1981	18.2921	125.5867	DL	Gogo Homestead	219	WA, 13	Sg	Sg	Sg (N, N)

S. greyii	WAM M26764 =B113	8Jun1981	18.2921	125.5867	DL	Gogo Homestead	219	WA, 13	Sg	Sg	Sg (N, N)		
S. greyii	WAM M26765 =B114	8Jun1981	18.2921	125.5867	DL	Gogo Homestead	219	WA, 13	Sg	Sg	Sg (N, N)		
S. greyii	WAM M26763 =B112	8Jun1981	18.2921	125.5867	DL	Gogo Homestead	219	WA, 13	Sg	Sg	Sg (N, N)		
S. greyii	WAM M30931 EBU B29	18Jul1989	17.7369	128.1493	OVP	Purnalulu. River Gum lining ephemeral creek	238	WA, 15G		Sg	Sg (N, N)		
S. greyii	WAM M62738 =Lamboos	11Jul1994	18.5418	127.3372	OVP	Pool on Mary River at old Lamboo HS	330	WA			Sg (N, N)		
S. sanborni	NT E&NR 1050196	30Jun2013	16.0602	137.2547	GUC	mangal edge, AWC field ID, released	0	NT					
S. sanborni	NTM U5960 = AM M46585 (Ss)	12Sep2013	12.3989	130.875	DAC	Rapid Creek, Darwin. Riparian.	1.3	NT			Ss (S, T)		
S. sanborni	EBU B163 = NTM U0783	1Sep1982	12.5849	131.0615	DAC	35k S Darwin on old hwy. Riparian	2.5	NT, 18B	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	NTM U4097 (Sg)	10Oct2000	13.1160	130.1847	DAC	L, near Channel Point Coastal Reserve.	6	NT					Ss (S, T)
S. sanborni	WAM M21078 =EBU B167 (Ss)	20Sep1982	12.7133	131.0560	DAC	4 km E Berry Springs, pool on creek in open country	6.8	NT, 18B	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	EBU B165 = NTM U0784	20Sep1982	12.7133	131.0560	DAC	4 km E Berry Springs, pool on creek in open country	6.8	NT, 18B	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	NTM U4742 (Sg)	25Jul1998	12.3687	134.9172	ARC	riparian, 3 km SE of Ramingining airstrip.	9	NT					Ss (S, T)
S. sanborni	NTM U4092 (Sg)	1Nov2000	11.5454	132.9289	ARC	Murgenella Creek, Waulk Lagoon.	12.5	NT					Ss (S, T)
S. sanborni	WAM M26759 =EBU B79	9Aug1982	17.6638	141.0847		mangrove lined estuary in tidal mudflat near	0	Qld, 25C	Ss	Ss	Ss	Ss	Ss (S, T)

S. sanborni	WAM M26760 =EBU B80	9Aug1982	17.6638	141.0847		Normanton mangrove lined estuary in tidal mudflat near Normanton mangrove lined estuary in tidal mudflat near Normanton	0	Qld, 25C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	EBU B75, B81-2	9Aug1982	17.6638	141.0847		Normanton mangrove lined estuary in tidal mudflat near Normanton	0	Qld, 25C	Ss	Ss	Ss	Ss	
S. sanborni	WAM M26751 =EBU B078	1981	13.8036	143.1458		10-20 km N of Coen	41	Qld, 27C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26752 =EBU B080	1981	13.8036	143.1458		10-20 km N of Coen	41	Qld, 27C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26758 =EBU B47 (Ss)	26Jul1982	13.5011	142.5347		Archer River	77	Qld, 27C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26757 =EBU B46	26Jul1982	13.5011	142.5347		Archer River	77	Qld, 27C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26756 =B20	16Juk1982	17.8671	145.1456		24 km S of Mount Garnett	95	Qld, 29C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26755 =B17 (Ss)	16Juk1982	17.8671	145.1456		24 km S of Mount Garnett	95	Qld, 29C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M26754 =EBU B089	14May1981	20.85	144.20		Hughenden. T Reardon	309	Qld,29C	Ss	Ss	Ss	Ss	Ss (S, T)
S. sanborni	WAM M22657 =FW1681	18Jun1981	17.2658	122.1769	DL	Coulomb Point mangal	0	WA, 11A	Ss		Ss		Ss (S, T)
S. sanborni	WAM M22658 =FW1677	18Jun1981	17.2658	122.1769	DL	Coulomb Point mangal	0	WA, 11A	Ss		Ss		Ss (S, T)
S. sanborni	WAM M22599 =FW660	31Aug1978	17.2661	122.1769	DL	Coulomb Point mangal	0	WA, 11A	Ss		Ss		Ss (S, T)
S. sanborni	WAM M22600 =FW662	31Aug1978	17.2661	122.1769	DL	Coulomb Point mangal	0	WA					Ss (S, T)
S. sanborni	WAM M22657	18Jun1981	17.2661	122.1769	DL	Coulomb Point mangal	0	WA, 11A	Ss		Ss		Ss (S, T)

S. sanborni	=FW1681 WAM M26776	13Jun1981	18.7104	121.6258	DL	mangrove, Cape Bossut	0	WA, 11	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B119 WAM M26777	13Jun1981	18.7104	121.6258	DL	mangrove, Cape Bossut	0	WA, 11	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B120 WAM M62726	2Apr1983	20.7152	117.5548	Pil	Sherlock River mouth, mangal, see Photo	0	WA				Ss (S, T)
S. sanborni	=FW2006 WAM M62727	2Apr1983	20.7152	117.5548	Pil	Sherlock River mouth, mangal, F/A=33.9mm	0	WA				Ss (?, T)
S. sanborni	=FW2007 WAM M43152 (Ss)	Jun1981	15.4639	128.0993	VB	Wyndham mangal	0	WA				Ss (S, T)
S. sanborni	WAM M26772	5Jun1981	15.4661	128.0991	VB	mangal, 'Pentecost River North'	0	WA, 13A	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B101 WAM M26773	5Jun1981	15.4661	128.0991	VB	mangal, 'Pentecost River North'	0	WA, 13A	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B102 WAM M26774	5Jun1981	15.4661	128.0991	VB	mangal, 'Pentecost River North'	0	WA, 13A	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B103 WAM M26775	5Jun1981	15.4661	128.0991	VB	mangal, 'Pentecost River North'	0	WA, 13A	Ss	Ss	Ss	Ss (S, T)
S. sanborni	=EBU B104 WAM M20861	22Sep1982	15.6463	127.8780		mangal, Pentecost River estuary	0	WA				Ss (S, T)
S. sanborni	=FW1953 WAM M49293	14Sep1982	17.1128	123.6797	DL	Point Torment grassed strip adj mangal	0.01	WA				Sg (S, T)
S. sanborni	=FW1941 WAM M22603	23Jun1981	16.5685	122.8498	DL	Martins Well, Pender	0.3	WA, 11A	Ss		Ss	Ss (S, T)
S. sanborni	=FW1713 WAM M22652	25Apr1977	16.5685	122.8498	DL	Martins Well, Pender	0.3	WA, 11A	Ss		Ss	Ss (S, T)
S. sanborni	=DL55 WAM M22656	25Apr1977	16.5685	122.8498	DL	Martins Well, Pender, broken skull	0.3	WA				Ss (S, ?)
S. sanborni	WAM M22604	23Jun1981	16.5685	122.8498	DL	Martins Well, Pender	0.3	WA				Ss (S, T)
S. sanborni	=FW1710 WAM	12May1996	15.0648	128.5585	VB	Cambridge Gulf,	0.3	WA				Ss (S, T)

	M62764 =G15					Tanmarra Creek mouth									
S. sanborni	WAM M62765	12May1996	15.0648	128.5585	VB	Cambridge Gulf, Tanmarra Creek mouth	0.3	WA							Ss (S, T)
S. sanborni	WAM M62766 =G19	12May1996	15.0648	128.5585	VB	Cambridge Gulf, Tanmarra Creek mouth	0.3	WA							Ss (S, T)
S. sanborni	WAM M62767	12May1996	15.0648	128.5585	VB	Cambridge Gulf, Tanmarra Creek mouth	0.3	WA							Ss (S, T)
S. sanborni	WAM M62768 =G21	12May1996	15.0648	128.5585	VB	Cambridge Gulf, Tanmarra Creek mouth	0.3	WA							Ss (S, T)
S. sanborni	WAM M62769 =G22	12May1996	15.0648	128.5585	VB	Cambridge Gulf, Tanmarra Creek mouth	0.3	WA							Ss (S, T)
S. sanborni	WAM M26778 =EBU B121	14Jun1981	18.7385	121.6405	DL	over tank behind mangal, Cape Bossut	0.5	WA, 11	Ss	Ss		Ss			Ss (S, T)
S. sanborni	WAM M26779 =EBU B122	14Jun1981	18.7385	121.6405	DL	over tank behind mangal, Cape Bossut	0.5	WA, 11	Ss	Ss		Ss			Ss (S, T)
S. sanborni	WAM M267780 =EBU B123	14Jun1981	18.7385	121.6405	DL	over tank behind mangal, Cape Bossut	0.5	WA, 11	Ss	Ss		Ss			Ss (S, T)
S. sanborni	WAM M60804 =Barck4	12Jul1994	17.6802	122.2109	DL	Mill 3km SE Barred Creek mouth	1.3	WA							Ss (S, T)

Sg: 39/42 cp published

Ss: 27/27 cp published

Appendix 8. Habitat specificity of southern Papua New Guinea (PNG) and Irian Jaya populations of taxa that are ecomorphological and phylogenetic counterparts of the four Western Australian mangrove specialists.

Bonaccorso (1998) and IUCN (2020) list southern PNG populations of *S. sanborni* as occupying coastal, lowland sclerophyll forests and rainforests from sea level to 3200 m altitude (although most specimens were recorded below 100 m); *Mormopterus loriae*, the counterpart of *O. cobourgianus*, as restricted to open sclerophyll forest and occurring from sea level to 100 m altitude throughout its range; *Pipistrellus papuanus*, the counterpart of *P. westralis* (see Kitchener *et al.* 1986), as occurring from sea level to 1300 m altitude, where it forages in village, plantation and wooded stream environments. Finally, they list PNG populations of *Nyctophilus microtis*, the counterpart of *N. arnhemensis*, as occurring from sea level to 1450 m altitude, where it has been mist netted in primary and secondary forest and forest clearings.

Appendix 9. Habitats each of the study area's bat species was likely to occupy by during the last glacial.

During the period of drier conditions synchronised with the lowered sea levels of the LGM:

- (a) Some bat species refuged in gorge/riparian habitat associated with uplands in or around the Kimberley (*M. macropus*, *N. walkeri* and *V. douglasorum*) and/or Pilbara cratons (*N. daedalus* and, perhaps, *C. morio*). Five others refuged there too, further shielded by their physiologically benign cave roosts (*H. ater*, *H. stenotis*, *M. gigas*, *M. oriana* and *R. aurantia*). The other two Western Australian landward species (*O. lumsdenae* and *S. greyii*) persisted throughout landward environments of the Kimberley and Pilbara because they are pre-adapted to drier conditions, hence their wide arid, semi-arid and/or mesic geographic ranges elsewhere throughout tropical Australia.
- (b) *O. cobourgianus*, *P. westralis*, *S. sanborni*, as well as the cave-dependent species component, refuged in mangrove forest fringing the exposed edge of the continental shelf, the cave-dependents roosting in barrier reef/limestone karst caves exposed along the shelf-edge and/or the incised drainage canyons (Voris 2006; McCaffrey *et al.* 2020).
- (c) *N. arnhemensis*, *C. nigrogriseus*, *S. saccolaimus* and *V. caurinus* refuged in both (a) and (b). Another five (*N. geoffroyi*, *S. flaviventris*, *C. jobensis*, *C. gouldii* and *A. australis*) are pre-adapted to drier conditions (i.e. their range includes semi-arid and/or arid regions) so persisted throughout landward and mangrove ecosystems, as did *T. georgianus* provided it was within reach of suitable cave roosts to mitigate its energy requirements.
- (d) The arid zone specialists (*T. hilli* and *V. finlaysoni*) may have penetrated further into the Kimberley uplands, like they do today in the more arid Pilbara and northern Carnarvon Basin.