

The Bilby *Macrotis lagotis* (Marsupialia: Peramelidae) in south-western Australia: original range limits, subsequent decline, and presumed regional extinction

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Abstract – Knowledge of the original south-western geographic range limits of the Bilby *Macrotis lagotis* in Western Australia, before its regional decline and apparent extinction, is currently underpinned by only six museum records, including three from near Bridgetown. The collector of one of the latter specimens in 1933 was interviewed, clarifying the source localities of these specimens. A further 155 residents, mostly aged 70 years or more, were interviewed, resulting in additional localities based on observations. A search of published and unpublished historical sources also revealed several acceptable records. This information was then coupled with detailed 1: 250 000 vegetation complex maps prepared in 1998 for the Regional Forest Agreement to produce a map of the inferred original distribution of the Bilby in south-western Australia. Bilbies appear to have occurred in suitable areas of open forest and woodland in the northern and eastern jarrah forests, west to about Chittering, Chidlow, Marradong, Bowelling, Boyup Brook and Bridgetown. The main southern limit appears to have been Warren River at Quillben forest block (along valleys containing sandy soils), Perup River near Deeside, Hay River near Forest Hill, and north of Porongurup Range. Bilbies also occurred, apparently sporadically, farther southwest at Margaret River, along the Blackwood River between Darradup and Alexandra Bridge, near Lake Jasper, near Dombakup, and between Kent River and Denmark.

Factors possibly implicated in the local extinction of the Bilby in south-western Australia are reviewed. Although drought, disease, trapping, and distribution of poison baits for rabbit control reduced population numbers of the Bilby, the *coup de grâce* was delivered by the arrival of the Fox in the late 1920s/early 1930s. The last specimens were collected in 1935, though a few populations might have persisted very locally until the 1970s or even 1980s.

Current proposals to re-introduce the Bilby to public land in its inferred former range will serve to test the hypothetical original distribution of the Bilby, prior to the arrival and establishment of the Fox.

INTRODUCTION

The Bilby, *Macrotis lagotis* (Reid, 1837), is a nocturnal, rabbit-sized marsupial with silky blue-grey fur, long naked ears, a pointed pink snout, and a long tail black near the base, white near the tip, and carried flag-like off the ground (Johnson, 1995). It lives in a burrow 1–2 m deep and with a single entrance, with one animal to a burrow, and there may be many burrows in an area of c. 1 ha (Ride, 1970). Its scientific description in 1837 was based on a south-western Australian specimen collected from “Swan River” (Thomas, 1888: 225; Mahoney and Ride, 1988). The Bilby originally occurred widely throughout the interior of Australia, being absent from the higher rainfall subcoastal zone (Southgate, 1990) except near Perth (average annual rainfall = 853 mm) and Bridgetown (856 mm). These somewhat anomalous, though biogeographically

interesting, former range limits in south-western Australia are, however, supported by six voucher specimens held in the Western Australian Museum (WAM), Perth (Kitchener and Vicker, 1981).

The first part of this paper addresses the question of how much more widely the Bilby may have occurred in the lower southwest of Western Australia, particularly in the forests, prior to its regional decline and apparent extinction. Christensen and Kimber (1977) did not record the Bilby for State Forest, noting, however, that their list “probably does not include all the mammals that live [or lived] in the forest areas”. The Bilby was also not listed as occurring [or having occurred] in the northern jarrah forest (Nichols and Muir, 1989) or southern forests (Christensen *et al.*, 1985), although Christensen (1992) considered that its habitat in the Blackwood valley was now largely

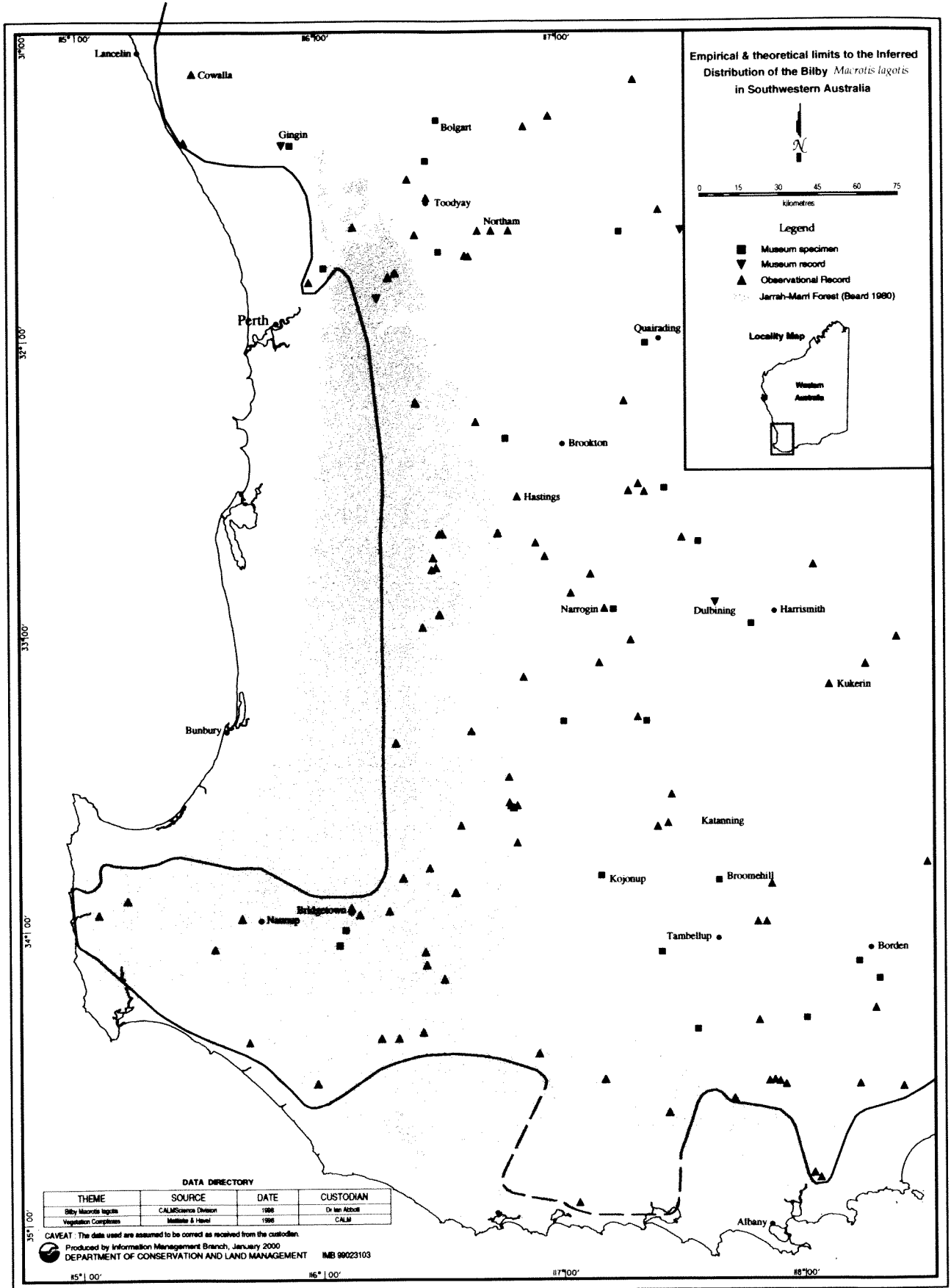


Figure 1 Source localities of voucher specimens and observational records of the Bilby in the lower southwest sector of Western Australia. Also shown is the original extent of forest before European settlement and the inferred southwest boundary of the geographic range of the Bilby. The term 'museum record' refers to a specimen that was either not retained by, or was retained but cannot now be located in, WAM.

cleared for farming. Abbott and Christensen (1994) stated that this species, on the basis of museum specimens, was not known to have occurred in State Forest.

Several approaches are used in order to elucidate the extent of the original geographic range limits of the Bilby in south-western Australia. The first is linked to using, and where possible clarifying, label data of museum specimens. The second is based on oral history (in this case based on interviews with farmers and other residents mostly older than 70 years), a technique used successfully by Sanders (1991) to document environmental change in wetlands in the Western Australian wheatbelt. The third approach is based on a search of numerous local histories (see Richards, 1993), the relevant zoological literature, and Department of Conservation and Land Management (CALM) files on the Bilby.

The second part of this paper analyses the possible causes of the decline of the Bilby in south-western Australia. This section integrates concepts from the scientific literature with observations and interpretations of landholders present before, during and after Bilby populations collapsed in the 1930s.

METHODS

Locality Data

All museum and other records of the Bilby from lower south-western Australia (Figure 1) were obtained from several sources. Specimen data were extracted from Kitchener and Vicker (1981: 156–7) and checked against specimen labels, catalogue entries, and letter archives in the Western Australian Museum. Published historical records were extracted from Krefft (1867), Haddleton (1952), Spencer (1966: 75), Jenkins (1974), de Burgh (1976), Kitchener *et al.* (1978: 68), and Douglas (1980). Many other historical sources were also searched, but without success. I also contacted Noongars (south-western Australian Aborigines) but this did not elicit any information (N. Nannup, personal communication 1999; C. Birdsall of the Noongar Land Council, personal communication 1999).

Most information was obtained by interviewing in the period 1997–2000 farmers and other residents 70 or more years old. I took great care to avoid asking leading questions. My interview technique

was first to introduce myself and explain how I obtained the contact's name, then to explain my purpose (to discover more information about the occurrence of native fauna earlier this century), and next to work through a list of conspicuous mammal and bird species. The term 'Dalgyte'¹, the Noongar name for *Macrotis lagotis*, was first mentioned in this context. If the interviewee was familiar with the term Dalgyte, I then ascertained whether this term was applied to the correct species by asking him or her to describe the appearance of the animal and where it lived. I expected a clear recollection of the species' characteristic ears, muzzle, fur, tail and burrowing habit. Details were then sought of the interviewee's recollections of its local distribution, abundance, habits, year when last observed, and why it disappeared. During these conversations, mindful of ongoing media reports of thylacines, I adopted a tone of amiable scepticism rather than one of naïvety and credulity.

If the interviewee did not know the term Dalgyte, I briefly described the animal and its burrowing habit in order to elicit a recollection. In most cases, if the term Dalgyte was not known, the interviewee had no personal experience of *M. lagotis*.

These records were then mapped (Figure 1), distinguishing between specimen-based records (Table 1) and observational records not supported by a voucher specimen (Table 2).

To provide context, other records (museum specimens, observations made by or reported to interviewees) adjacent to the forest were also mapped. These are referenced in Table 2. Eyewitness accounts of the ecology and behaviour of the Bilby in south-western Australia from the period 1837–1935 have been collated in Appendix 1 from published records and unpublished reports.

Vegetation Units

The 306 vegetation complexes recognized and mapped in the Regional Forest Agreement area of south-western Australia (Mattiske and Havel 1998; Commonwealth and Western Australian Regional Forest Agreement Steering Committee 1998) were overlaid in a GIS with the Bilby records and those for which a Bilby record was present were retained. The 31 types represented (Figure 2) may be characterized briefly as follows:

Darling Plateau Uplands

Y5 Yalanbee 5. Mixture of Jarrah *Eucalyptus marginata* / Marri *Corymbia calophylla* open

¹ The correct orthography appears to be *dalgayt* (Australian National Dictionary 1988, Oxford University Press, Melbourne), *djalkat* (Whitehurst, 1992), or *dalgaj* (Words from the West 1994, Oxford University Press, Melbourne). I have followed the orthography *Dalgyte* used by the mammalogists Shortridge (1910) and Ride (1970). Thirteen other spellings are recorded in Appendix 1. The term 'Rabbit bandicoot' was seldom used in WA. 'Bilby' is from the Yuwaalaraay (near Brewarrina NSW) word *bilbi* (Australian National Dictionary, 1988). This Dictionary gives the earliest published record as 1885 in a Melbourne magazine. *Bilby* appears to have been first used in a scientific context by Longman (1922, as 'bilbi'), Wood Jones (1924: 152), and Le Soeuf and Burrell (1926: 299, as 'bielby').

Table 1 Museum specimens of *Macrotis lagotis* from lower south-western Australia with locality data, listed in chronological order. As noted in the text, the provenances of WAM specimens M703 and M787 are rejected on the basis of information present on the label or in the catalogue. WAM = Western Australian Museum; AM = Australian Museum; MV = Museum of Victoria; SAM = South Australian Museum; BM(NH) = Natural History Museum, London; OUM = Oxford University Museum; AMNH = American Museum of Natural History, New York; MCZ = Museum of Comparative Zoology, Harvard University; USNM = National Museum of Natural History, Smithsonian Institution, Washington DC. Only specimens with locality data are included.

Specimen number	Label/Catalogue/Letter archives data	Other information
BM(NH) 41.1168	Northam. J. Gilbert. 1841	Male. Skin
BM(NH) 1939.3175	Warrenup Stirling Range [= Warrungup on Salt River Rd on the north side of the Stirling Range and west of Chester Pass Rd]. J.T. Tunney. 30.5.1900	Female. Skin + skull
BM(NH) 1939.3176	Variously given as N. Magetup Salt River or Mt Magetup Salt R [= Magitup, south-west of Borden on the Pallinup River]. J.T. Tunney. 5.6.1900.	Male. Skin + skull
WAM M16100	Jerramungup (approx.). J.T. Tunney. 15.6.1900	Male. Skull
WAM M16101	Broomehill. T. Carter. 23.8.1905	Male. Skin + skull
WAM M16102	Kojonup (approx.). J.T. Tunney. 1905	Male. Skull
BM(NH) 681319	Arthur River [c. 30 km west of] Wagin. G.C. Shortridge. 23.6.1905	Male. Skin + skull
BM(NH) 681323 [526]	Woyaline, East Pingelly [c. 30 km east of Pingelly]. G.C. Shortridge + J.W. Bell. 30.3.1906	Female. Skin + skull
BM(NH) 681320 [527]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 30.3.1906	Male. Skin + skull
BM(NH) 681324 [528]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 30.3.1906	Female. Skin + skull
BM(NH) 681325 [529]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 31.3.1906	Female. Skin + skull
BM(NH) 681321 [530]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 1.4.1906	Male. Skin + skull
BM(NH) 681326 [533]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 6.4.1906	Female. Skin + skull
BM(NH) 681322 [538]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 16.4.1906	Male. Skin + skull
BM(NH) 681327 [540]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell. 24.4.1906	Female. Skin + skull
OUM [531]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell.	Male. Skin + skull
OUM [537]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell.	Female. Skin + skull
OUM [539]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell.	Male. Skin + skull
OUM [541]	Woyaline, East Pingelly. G.C. Shortridge + J.W. Bell.	Female. Skin + skull
WAM M16103	Gracefield. J.T. Tunney. 26.5.1907	Female. Skin + skull
AM M2001	Gracefield. [J.T. Tunney]. 11.8.1908	Female. Skin + skull
AM M2002	Gracefield. [J.T. Tunney]. 11.8.1908	Male. Skin + skull
AM M2019	Cranbrook. [J.T. Tunney]. 21.10.1908	Male. Skin
USNM 154994	Broome Hill. J. Clarke. 23.10.1908	Male. Skin + skull
WAM M16104	Gracefield. J.T. Tunney. 27.7.1909	Female. Skin + skull
WAM M16105	Gracefield (approx.) J.T. Tunney. 10.9.1908	Spirit
MV C5876	Narrogin. Purchased H.J. Coles, Fremantle. 1911	Skin + skull
MCZ 17765	Broome Hill. 30.5.1910. Purchased from W.F.H. Rosenberg; donated in 1919 by T. Barbour	Male
WAM M6	Dalbinning [= Dulbinning] E Narrogin. W. Bird. 11.10. 1912	'useless'
WAM M234	Tammin. C. Blakely. 19.7.1915	Female. Skin + skull
WAM M334	Doodlakine. Mr Gamson. 30.6.1917	'useless'
WAM M452	Mokerdillup. F. Foster. 26.1.1921	Female. Skin + skull
WAM M456	Dangin. J.F. Jones. 17.2.1921	Foetal. Spirit
AM M2955	Coorigan [?Corrigin]. A.S. Le Soeuf. 28.4.1921	Skin + skull

Specimen number	Label/Catalogue/Letter archives data	Other information
AM M3101	Tenterden. E. Troughton & J. Wright. 18.11.1921	Male. Skin + skull
WAM M610	Gingin. Mr Oliver of Bridgetown. -.6.1923	'not kept'
WAM M637	Cunderdin. W. Blyth. 7.5.1924	Male. Skin + skull
WAM M638	Cunderdin. W. Blyth. 7.5.1924	Female. 'a young' Skin + skull
WAM M641	Cunderdin. W. Blyth. 17.5.1924.	Male. Skin
WAM M687	State School Clackline. E.W. Memberg. 1925	Male. Skin + skull
WAM M692	Malyalling via Wickepin. W. Howard. -.3.1925	Male. 'a young Dalgyte from the pouch'
WAM M697	Cunderdin. W. Blyth. 19.5.1925	Male. Skin + skull
WAM M703	Upper Swan. E. Howard. 3.8.1925	Male. Skin + skull
WAM M718	Cunderdin. W. Blyth. -.9.1925	Female. Skin + skull
WAM M750	Cunderdin. Mr Menzel. -.12.1925	'a young Dalgyte...liberated'
WAM M787	Mounts Bay Road, run over near Swan Brewery. Mr Hillard. 13.7.1926	Male. Skin
WAM M980	Chidlow. Mr Garland of Buckland near Northam. Catalogued 20.2.1928	Young animal
WAM M1020	Cunderdin. J.J. Flanagan. 19.6.1928	Female
WAM M1021	Cunderdin. W. Blyth. 19.6.1928	Female
WAM M1022	Cunderdin. J.J. Flanagan. 19.6.1928	'a young Dalgyte from pouch of M1020'. Spirit
WAM M1023	Cunderdin. W. Blyth. 19.6.1928	'a young Dalgyte from pouch of M1021'. Spirit
WAM M1024	Cunderdin. W. Blyth. 19.6.1928	'a young Dalgyte from pouch of M1021'. Spirit
WAM M1025	Cunderdin. J.J. Flanagan. 20.6.1928	Male
WAM M1036	Cunderdin. W. Blyth. 6.7.1928	Female. Skull
WAM M1040	Cunderdin. W. Blyth. 25.7.1928	Female. Skin + skull
WAM M1041	Cunderdin. W. Blyth. 25.7.1928	'a young Dalgyte from pouch of M1040'. Spirit
WAM M1042	Cunderdin. W. Blyth. 25.7.1928	'a young Dalgyte from pouch of M1040'. Spirit
WAM M1044/1	Cunderdin. W. Blyth. 28.7.1928	Female. Skin + skull
WAM M1044/2	Cunderdin. W. Blyth. 28.7.1928	Female. Skin + skull
WAM M1067	State School Bolgart. Master B. Pinkin. 10.9.1928	Male. Skin + skull
WAM M1377	Bruce Rock. Mr Corvu. 1931	'caught near Bruce Rock by Mr Corvu who had it loose in his garden at Subiaco'. Road at side of railway between Subiaco and Dalglish. Spirit
WAM M1391	Culham via Toodyay. Mr S.F. Howie. 27.4.1931	Male. Skin + skull
WAM M1399	Prestbury farm, Bridgetown. E.T. Moyes. 15.5.1931	Skull
WAM M1551	'Tinkurrin E. Narrogin' [i.e. Tincurrin]. F. Jensen. 19.8.1931	Male. Skull.
WAM M1644	Wagin. H.S. Goldsmith. 11.8.1932	Male. Skin + skull
WAM M1749	Prestbury farm Bridgetown. H.S. Moyes. 19.5.1933	Male. Skin + skull
AM M18287	Narrogin. S. Larnach. 1933	Spirit
AM M20060	Narrogin. S. Larnach. 1935	Skull
WAM M1931	'The Nook', South Dale via Brookton. E. Wills. 19.2.1935. Eva Wills (b. 1921) advised me that this locality is 16 miles west of Brookton and is now owned by Neil Walker. This is Avon Location 8099/8086.	Male. Live animal sent to Zoo, thence to WAM 11.6.1935. Skin + partial postcranial
AMNH 74486	Gingin. F.W. Teesdale, 1926	Female
AMNH 74487	Gingin. F.W. Teesdale. 1926	Female

forest and Wandoo *E. wandoo* woodland on lateritic uplands.

- D4 Dwellingup 4. Jarrah / Marri open forest to woodland on lateritic uplands.
 DMg Dalmore. Mosaic of Wandoo / Marri woodland on deeper soils with open heath / lithic complex on shallow soils near granite outcrops.
 Dk1 Darkin 1. Jarrah / Wandoo / Marri woodland over *Dryandra sessilis* on uplands.
 CO2 Collis 2. Jarrah / Marri / *Banksia grandis* open forest on low uplands, with some lithic complex associated with granite outcrops.
 BE1 Bevan 1. Marri / Jarrah tall open forest on uplands.
 BEY2 Bevan 2. Open forest of Jarrah / Marri / *Banksia grandis* on undulating uplands.
 PP Perillup. Marri / Jarrah open forest / woodland on low undulating hills and low woodland of *Melaleuca preissiana* on depressions.

Darling Plateau Valleys

- Mi Michibin. Wandoo / Jam *Acacia acuminata* woodland with some York Gum *E. loxophleba* on valley slopes and Rock Sheoak *Allocasuarina huegeliana* on granitic outcrops.
 Bi Bindoon. York Gum woodland on slopes / Wandoo-Powderbark *E. accedens* woodland on breakaways and upper slopes.
 LK2 Lukin 2. Wandoo woodland with some mixtures of Jarrah / Marri on valley slopes with occasional Flooded Gum *E. rudis* on valley floors.
 Blf Balingup. Flooded Gum woodland on valley floors and Yarri *E. patens* / Marri woodland on footslopes with some Jarrah on lower slopes.
 CC1 Catterick. Jarrah / Marri open forest mixed with Yarri (slopes), Flooded Gum and *Banksia littoralis* on valley floors.
 NWf2 Newgalup 2. Flooded Gum / Yarri woodland with occasional Wandoo on footslopes on valley slopes.
 NWg1 Newgalup 1. Marri / Jarrah woodland on slopes, open heath on shallow soils near granites and Flooded Gum / Wandoo open forest on steeper slopes and valley floors.
 Dk2 Darkin 2. Mixture of Jarrah / *Banksia* woodland and Wandoo / *E. drummondii* / *E. decipiens* open woodland on lower slopes.
 Dk3 Darkin 3. Rock Sheoak / Jam woodland with occasional Flooded Gum / Wandoo near granite outcrops and *E. astringens* / Wandoo woodland on breakaways.
 Dk4 Darkin 4. Wandoo / Rock Sheoak / Jam woodland on slopes and Flooded Gum woodland on lower slopes.
 BR Brockman. Marri / Wandoo woodland over *Hakea prostrata* and *Acacia saligna* on valley slopes.

WL Wilgarup. Marri open forest with some Jarrah on slopes and tall shrubland of *Melaleuca* species on valley floors.

- YN1 Yanmah. Mixture of tall open forest of Karri *E. diversicolor* / Marri / Yarri / Jarrah over *Agonis flexuosa* and *A. juniperina* in valleys.
 LF Lefroy. Tall open forest of Karri / Marri on slopes and low woodland of *A. juniperina* and *Callistachys lanceolata* on lower slopes.

Darling Plateau Valley Floors and Swamps

- Dk5 Darkin 5. *Casuarina obesa* / *Melaleuca* spp. low woodland on low lying moister soils and *Banksia prionotes* / Marri / Flooded Gum / Jam woodland on sandy lunettes.

Darling Plateau Depressions and Swamps on Uplands

- CL2 Corbalup 2. Jarrah / Marri open forest on low rises and low woodland of *Melaleuca preissiana* / *B. littoralis* on depressions.

Margaret River Plateau Valleys

- W1 Wilyabrup. Tall open forest of Karri / Marri / *Allocasuarina decussata* / *Agonis flexuosa* on deeply incised valleys.

Blackwood Plateau and Plain Uplands

- MP Milyeanup. Open forest to tall open forest of Jarrah / Marri / *Allocasuarina fraseriana* with some *Agonis flexuosa* on less undulating slopes.
 T Treeton. Woodland of Jarrah / Marri on undulating sandy slopes.

Blackwood Plateau and Plain Valleys

- BK Blackwood. Marri / Jarrah open forest on slopes

Unicup Uplands

- FH1 Frankland Hills. Woodland / low open forest of Jarrah with some Marri on uplands.

Scott Coastal Plain Valley Floors and Swamps

- Swd Scott. Mosaic of sedge land and closed heath with occasional *Banksia* on swampy depressions and stunted Jarrah, *Banksia* and *Xylomelum occidentale* on low sandy rises.

Redmond Siltstone Plain Uplands

- F Fernley. Mixture of woodland of Bullich *E. megacarpa*, woodland of Yarri, tall shrubland of Myrtaceae species with some sedge field of *Anarthria* species on broad plains.

RESULTS

Museum Records

A search of WAM letter archives revealed little

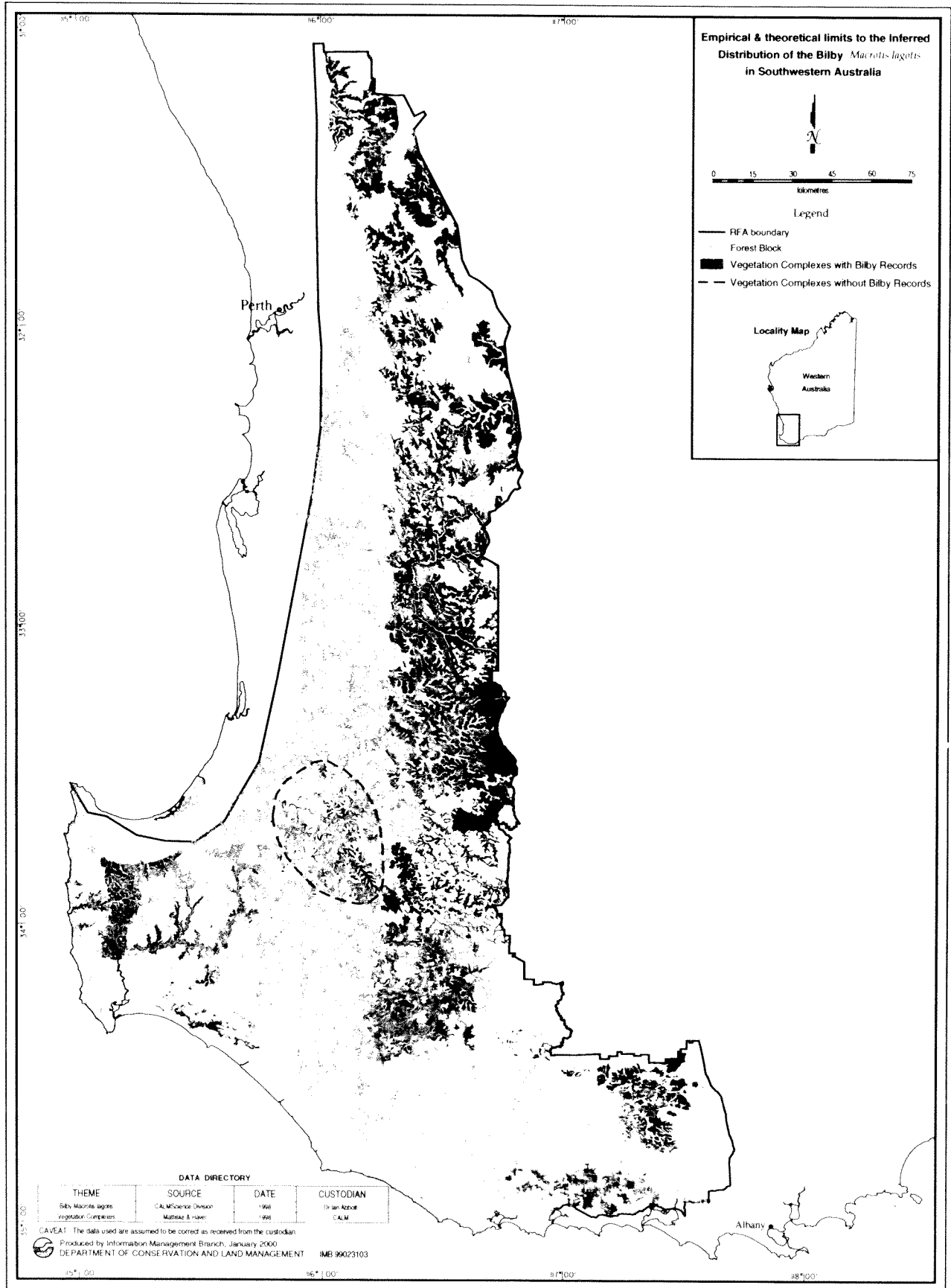


Figure 2 The hypothesized distribution of the Bilby. Also shown are the outline of forest blocks (management units which collectively constitute State Forest), and the RFA boundary (within which the vegetation complex information of Matisoff and Havel 1998 was used to model the distribution).

Table 2 Literature references, observational records, or other reports of the Bilby in southwestern Australia but from outside the RFA area. Listed chronologically by year of last observation, marked in **bold**.

Locality	Years of Observation	Notes
Northam	Museum specimens (Natural History Museum, London); two of which were collected by Gilbert in 1839 (Glauert 1950a)	Gray in Grey (1841: 401) and Thomas (1888: 225).
Mongup	One specimen collected 1866	Kreffft (1867). This cannot now be found in the collection of the Australian Museum, Sydney (S. Ingleby, pers. comm. 1999)
Near Hastings (c. 20 km northeast of Wandering).	1898	In a letter written to the Director of WAM on 13.1.1898 from Wandering, John Tunney noted that I "expect to camp between here and Beverly for a week or so as I hear there are a lot of Rabbit Bandicoots about a place called Hastings". See also Table 1.
Watheroo	1904 to 1906 , details unknown	Museum specimen. Shortridge 1910: 833. I have been unable to trace further details.
Parker Range	1904 to 1906 , details unknown	Museum specimens. Shortridge 1910: 833.
Morawa area	–	Glauert (1950b) stated that the town of Morawa (gazetted 1913) was named after an Aboriginal word for the 'Dalgyte'. Goldsmith (1961: 10) repeated this but also provided an alternative derivation.
Grass Valley	1918	A. Gale (79 yrs in 1983) noted that he last saw a Dalgyte there 65 years ago (CALM file 015178F3807). A neighbour was fond of eating them. One animal observed to snap an onion in half with one bite.
Corrigin area	1923	L. Ainsworth with a black and white photograph of a Dalgyte (CALM file 015178F3807). The reverse side has the following caption: 'The last dalgyte I saw alive, caught in a rabbit trap at Corrigin. It's back fur was blue and not grey...It was infested with hundreds of soft-bodied parasites about the size of a flea'.
Rabbit proof fence near Needilup	1920s to 1981	Elinor Pocock (b. 1920) recalled seeing a Dalgyte captured (unharmd) in 1923 .
Benjaberring near Wyalkatchem	1925	Tom Ball (b. 1919) recalled capturing one when trapping rabbits.
36 km west of Pingelly, along York-Williams Rd	1920s to 1938	Alf Marshall (b. 1911) last saw the Dalgyte there c. 1925 , soon after the Fox arrived.
Woogenilup	1902 to c. 1925	W.G. Pearce reported in 1963 (CALM file 015178F3807) that in 1902–3 old Dalgyte burrows were present though no animals were seen. In 1909 a few were sighted and the species remained until Foxes arrived. One animal observed dead [undated], killed by Fox. His grandson informed me that the area referred to is near Pearce Rd, c. 15 km from Mt Barker.
Watheroo	1928	Nicol Croot (b. 1912) came to Western Australia in 1928 and spent c. 3 months at Watheroo. Dalgytes were captured there when he was trapping rabbits.
c. 10 km southwest of Wongan Hills, near Lake Ninan	Late 1920s to 1939	Marjory McNeill (b. 1923) recalled one in c. 1928 .
Woodanilling	1910s and 1920s	Ray Garstone (b. 1931) stated that his father (b. 1897) mentioned their occurrence in 1928 .

Locality	Years of Observation	Notes
Morawa	1920s to present	John and Joyce White (b. 1923, 1927) observed Dalgyte burrows in heavier soils on their farm near Morawa, and John's father had reported seeing a dead Dalgyte before 1920. Dalgytes were also reported to have occurred but only very locally in 1928–1929. It appears that the Dalgyte was a very rare species around Morawa, Merkanooka, Canna and Gutha, as Nicol Croot (b. 1912), Frank Lanagan (b. 1912), Patricia Yewers (b. 1916), Dick Sasse (b. 1920), Jim Stokes (b. 1924), Ken Tilley (b. 1924), Ken Granville (b. 1925), Brian Knight (b. 1927), Harvey Broad (b. 1929), Peter Collins (b. 1929) and Ron Baxter (b. 1931) had not seen it there.
South Caroling	Late 1920s to present	Henry Hall (b. 1920) last saw the Dalgyte in 1929. His father, who settled in the district in 1903, had informed him that Dalgytes were common then. Fox first recorded 1929.
c. 18 km east of Pingelly	Early 1920s to 1928, and then after 1942	Gil Gardner (b. 1918) last sighted Dalgytes on farmland (captured in Rabbit traps) in c. 1928–1929. Fox arrived c. 1923–1924.
Dryandra	1920s to present	Arthur Hunter (b. 1920) last saw Dalgytes there and in uncleared country between Dryandra and Narrogin in 1928–1929.
Culbin Siding (Williams Location 1066)	Before 1929	George Cowcher (b. 1929) did not know of the Dalgyte but recalled that his father had spoken of its occurrence on this farm before 1929.
East Woogenilup, c. 30 km from Mt Barker	Late 1920s to present	Jim Hunt (b. 1921) occasionally caught Dalgytes in rabbit traps. Not common. Last observed there c. 1929.
Near Mortlock River c. 7 km south of Northam	1920s	Jenkins (1974). See Appendix 1.
Norrine Hill (between Wandering and Hotham River).	1920s and 1930s	Kate White (b. 1912) remembered an isolated colony of the Dalgyte in Wandoo woodland on a farm on the southern foot of Norrine Hill. She last saw this species there in the late 1920s and blamed its disappearance on the Fox. She noted that the Dalgyte was not as common there as the Boodie.
Near Lake Grace	?1920s	Seen by Snow Gibbs when about 14 years old (CALM file 015178F3807).
Marsh Rd, c. 7 km north of Qualeup	1912 to early 1920s	George Marsh (b. 1922) recalled his father (Edward, b. 1888), who settled there in c. 1912, speaking of the occurrence of the Dalgyte there. Fox arrived 1932–3.
c. 20 km east of Broomehill	1920s	Eric Fletcher (b. 1912) recalled that Dalgytes and their burrows were common in the area, especially in the sandy soils associated with patches of sheoak. He attributed their disappearance to cultivation and Fox predation.
Pallinup River near Gnowangerup	Early 1920s	'Dalgite' warrens recorded near river (Mouritz 1986)
Pallinup River near Gnowangerup	Early 1920s	Rex Herbert (b. 1926) recalled that his father spoke of the occurrence of Dalgytes on his farm there.
20 km north of Ongerup	1910s and 1920s	Susanne Dennings stated that her father mentioned Dalgytes as present on his farm (established 1912).

Table 2 (cont.)

Locality	Years of Observation	Notes
c. 10 km north of Kwolyin	1920s	Phil Stone (b. 1932) informed me that his father (b. 1904) spoke of Dalgytes on the farm where his father had lived c. 1923-c. 1940.
Quaalup and Marningerup Spring	1920s and 'even later'	Chapman (1995: 92).
c. 6 km east of Woogenilup	1920 to 1938	Ted Ferry (b. 1914) last saw the Dalgyte there in 1930. They were not common and their burrows were in sandy soil within c. 500 m of the Kalgan River. They disappeared c. 5 years before the Fox arrived.
Henley Brook, near the corner of Gnangara and West Swan Roads	1925 to present	Frank Edgecumbe (b. 1908) saw Dalgytes occasionally up to 1930 in Jarrah/Banksia country (sandy soil). He linked their disappearance to Fox predation.
c. 8 km northwest of Tammin	1920s to 1950	Jim Masters (b. 1917). Last seen 1931.
c. 20 km northeast of Dalwallinu	Late 1920s to present	Milton McNeill (b. 1923). Never very plentiful on farmland (which still has much uncleared vegetation). Last seen 1933, with tracks for several years afterwards. Disappearance attributed to fumigation of burrows, Fox predation, and distribution of poison baits for rabbit control.
6 km west of Cuballing	1920s to 1930s, then 1946 onwards	Norm Candy (b. 1914) noted Dalgytes as scarce (e.g. 10-15 Boodies to each Dalgyte). Last observed c. 1933. As a child he trapped both species for pocket money, with each worth c. 1 shilling per skin. Fox arrived c. 1930.
c. 16 km WNW of Katanning (Kojonup Location 444)	1927 to present	Neville Beeck (b. 1920) noted presence of 3-4 burrows in an area of c. 20 ha. Last observed c. 1933. Fox arrived c. 1928.
c. 9 km ESE of Hyden	1930s	Dick Lane (b. 1930) reported that his father caught a Dalgyte in a rabbit trap in c. 1934; Dick told me that he has never seen one. He blamed their disappearance on the Fox, which began to establish in the district in c. 1935.
Tarin Rock and Kukerin	1920s to 1934	Douglas (1980). Athol Douglas (b. 1915) stated that Dalgytes were very common. He once observed one eating a snake.
Nyabing - Point Ann (along Rabbit Proof Fence)	1930s to 1954	Serventy (1954: 138). Last seen c. 1934.
'Yaralla', Woogenilup (c. 23 km from Mt Barker)	Late 1920s to present	Colin Adams (b. 1922) recalled that Dalgytes were 'not uncommon' in mallee plain country. They were occasionally captured in rabbit traps. Last seen there c. 1934.
Cowalla and Guilderton, Moore River	Early 1920s to 1977	"Dalgytes...were common along the [Moore] River" near Cowalla pastoral station, some 20 km southeast of Lancelin, as well as near Guilderton (de Burgh 1976: 65, 187). Bill de Burgh (b. 1912) told me that he occasionally caught Dalgytes in Dingo traps at Cowalla. Burrows were numerous to the extent that when cantering a horse through the bush, one had to watch for Dalgyte burrows. Disappearance (late 1920s to early 1930s) linked to Fox (arrived c. 1925) and poisoning of rabbits with phosphorus baits. Noted that Dalgytes in

Locality	Years of Observation	Notes
About halfway between Goomalling and Dowerin, 2 km south of highway	1920s to present	digging burrows pile up excavated soil into a heap, unlike rabbits. Udell (1979: 327) recorded the occurrence of the 'Dalgyte' in the Gingin area before the 1920s, noting that they lived in "huge colonies on sandplains" and were "smelly animals". The reference to odour is clearly to the Dalgyte, as mature males emit a strong odour when stressed (C. Sims, personal communication 1999).
c. 14 km north of Bungalla, on Bungalla-Yorkrakine Rd ['Fairfields' farm]	1930s	Fred Boase (b. 1921) recalled that Dalgytes were occasionally caught on his farm in rabbit traps. Last seen c. 1935.
c. 12 km north of Katanning (on road to Wagin); also more generally in the Katanning district.	1880s to 1940s	Main (1967: 87). Captured in rabbit traps "less than thirty years ago". Possibly still present in the 1960s ("recently observed tracks in the wodjil"). Barbara Main (b. 1929) advised me that she last saw a Dalgyte in c. 1935, when her brothers had captured one while trapping rabbits.
Glenelg Rd, c. 8 km north of Isongerup Peak	Late 1920s to present	Haddleton (1952). Last seen 1935. See Appendix 1.
c. 15 km southwest of Mullewa (Devil's Ck)	Early 1930s to 1939, 1943 to 1970	Basil Moir (b. 1922) recalled that Dalgytes lived along Woolaganup Creek but were not common. Last seen c. 1935. Fox arrived c. 1929.
10 km north of Wickepin	Early 1930s to present	Jim O'Brien (b. 1927) saw one Dalgyte in a remnant Salmon Gum woodland on his father's farm in 1936.
c. 4 km northeast of Highbury	Mid 1920s onwards	Bill Butler (b. 1924) last observed the Dalgyte in 1936. There were 20-30 burrows on his farm, close to rocks. Fox not common until early 1930s.
c. 10 km southwest of Highbury	Mid 1920s onwards	Gwen Warren (b. 1917) last observed the Dalgyte c. 1936. Fox arrived c. 1927. She attributed their extinction to the Fox, habitat loss, and phosphorus poison baits laid for rabbits.
Near Minning, 15 km northwest of Narrogin (Bradford Road)	From 1920s	Dos Vickers (b. 1919) last observed the Dalgyte in the 1930s. It was a common animal. Fox arrived c. 1928.
Mokine, between Spencers Brook and Clackline	1944 to 1945	Dawson Bradford (b. 1915) and Bill Bradford (b. 1918) remembered Dalgytes from the 1920s until c. 1939 (when Dawson went to war) and c. 1942 respectively. Dawson Bradford recalled that they occurred in sandy high country (c. 6 animals in a warren) and did not live in the same warrens as the Boodie <i>Bettongia lesueur</i> . He believed that both species became locally extinct after a feline enteritis outbreak during World War II, and not as a result of Fox predation. Bill Bradford thought that both species declined after poison baits for rabbits were distributed and following the establishment in c. 1928-1930 of the Fox.
c. 6 km northeast of Merredin	1920s to 1962	Harry Butler (b. 1930) recalled catching Dalgytes in rabbit traps on his way to high school in Northam.
		M.B. Mills (CALM file 015178F3807). Margaret Mills (b. 1916) recalls seeing Dalgytes in Jam

Table 2 (cont.)

Locality	Years of Observation	Notes
Duck Rd, c. 5 km northeast of Mt Barker	Late 1920s to 1947	country near Hunts dam (c. 5 km north of Merredin) in c. 1936 and last seeing their scratchings in c. 1946 in a nature reserve c. 10 km north-east of Merredin. Jerry Enright (b. 1923) informed me that Dalgytes were common in this area (Jarrah/Marri forest) and lived in warrens near an apple orchard. 'A few dozen' were trapped in the 1930s and their skins sold, a valuable source of pocket money. Noted as difficult to skin. Last recorded in the early 1940s. Disappearance attributed to arrival of Rabbit (late 1930s) and Fox (1937).
Farm adjacent to northern boundary of Tutanning NR	1946 to 1969	Judy Dhu (b. 1924) recalled that she never caught Dalgytes in Rabbit traps, unlike Boodies. Both species last recorded there in c. 1958. Neither species was recorded on the nature reserve in the period 1967–1970 (Sampson 1971).
8 miles (c. 13 km) east of Billericay Siding	1956 or 1957	R. Loveridge of Naremben reported one Dalgyte seen (<i>Fisheries Dept WA Bulletin for Honorary Wardens</i> 1957 4(1–4): 20).
Mount Churchman reserve, north of Beacon	1959	Dalgytes sighted by C.A. Gardner in November 1959 (CALM file 033959F3807).
Mokine, between Spencers Brook and Clackline	1920s to present	Tom Wilding (b. 1919) recollected the occurrence of a colony on his farm in the 1950s. The colony was destroyed by bulldozers when a major powerline to Kalgoorlie was installed. The persistence of this colony may have been assisted by the introduction of 1080-dosed grain in 1954 to poison rabbits. Fox numbers may have been kept low by secondary poisoning resulting from eating poisoned rabbits (Christensen 1980).
Near Cramphorne Peak	c. 1958; 1962	Sighted by T.J. Hooper of Muntadgin (CALM file 015178F3807).
Wongan-Ballidu Shire	Not disclosed	'Dalgite' noted as a 'mere name' [i.e. locally extinct] (Ackland 1965: 104).
Goomalling (Avon Location 2753)	c. 1967	One seen by J.A. Schell's mother. His father remembered this species as present in the 1920s.
Jitarning	1967	Two animals seen by A. Cook and a Mr Nash during clearing operations. Both knew this species as children (CALM file 015178F3807).
Many Peaks-Bremer Bay Rd [Highway 1], ½ mile before reaching Moates [= ?Dempster] Rd.	September 1970	C. Ostle and R. Gardiner (Inspector and cadet warden, Dept of Fisheries and Fauna). Animal crossed road at 4.30 a.m., described as size of rabbit, with large pointed ears, elongated snout, distinct black tail with white tip. Hopping locomotion. Regarded by J.L. Bannister as convincing but requiring confirmation (CALM file 015178F3807).
c. 27 km south of Cranbrook on Salt River Rd at Middle Springs waterhole	1973	D. Gillam sighted (during the day) two Dalgytes, noting their long ears and crested tail (CALM file 015178F3807). He had lived in the Cranbrook area as a boy and noted that Dalgytes were common there 40 years before.
Koorda district	Not disclosed	Dalgyte found in the district, no details provided (Antonio-Crake 1974: 6).

Locality	Years of Observation	Notes
Toodyay district 12 km northwest of Lake Grace	Not disclosed 1978	Erickson (1974: 2). A. Marshall and J. Stevens saw animals at late dusk and early morning on farmland. One was chased on foot. Described as like a rabbit, with long, tufted tail (CALM file 015178F3807).
Maringarup Rd, North Gairdner	1964 to 1978	F. Plapp made several sightings of Dalgytes in a paddock opposite the Bremer River. Five burrows noted in sandy hillside (CALM file 015178F3807).
South Stirling: Area between Branson Rd, Palmdale Rd, Manypeaks, Green Range and Kojaneerup Spring Rd.	1960s to 1980s	Terry Marden (b. 1934), a bulldozer contractor who cleared parts of the South Stirling area by dragging a log or chains behind a tractor, reported seeing Dalgytes regularly while clearing. Last seen in the early 1980s. He also reported that burrows matching those seen in the South Stirling area were numerous on his father's farm on Yellanup Rd, between Woodlands and Rogers Rds. No Dalgytes were seen on this farm, however.
Karroun Hill Nature Reserve	1987 to 1991	Listed as present before 1987, without details (Friend 1991).
Mukinbudin Shire	Not disclosed	Dalgyte 'fairly common in these parts' (Maddock 1987: 20).

additional information to that reported in Kitchener and Vicker (1981) for three key specimens from Clackline (M687), Chidlow (M980) and Culham (M1391). M687 was donated in February 1925 by E.W. Memberg of the State School at Clackline. It is a reasonable supposition that this specimen was collected by a pupil and brought to school for exhibition and that its provenance is near Clackline. M980 was donated in February 1928 by a Mr Garland of Buckland near Northam. There is no reason to doubt that the specimen was collected close to Chidlow. M1391 was evidently collected by a Mr Sam F. Howie at Culham via Toodyay and transmitted by E.W. Beard to WAM, where it was accessed in April 1931.

Two specimens (M1399, M1749) labelled 'Bridgetown' were respectively collected by E.T. Moyes in 1931 and H.S. Moyes in 1933. Initial enquiries about the collection locality by CALMScience officer A. Annels revealed that Harry Moyes (b. 1921) lived on a farm ('Prestbury') comprising Nelson Location 2313, c. 8 km southwest of Bridgetown on Mokerdillup Road. In January 1997 and November 1998 I interviewed Harry Moyes, who advised that his father (Ernest) took up this Location in 1921. At that time little clearing of forest had taken place. Dalgytes were not uncommon in the Bridgetown district in the 1920s, though the species was very rare on his farm, which is why he sent the specimen to the museum. He collected specimen M1749 on 19.5.33 when he

was trapping rabbits in a burrow near the orchard on the farm. He told me that Dalgytes disappeared soon after he saw the first Fox *Vulpes vulpes* in 1936. In his 1933 letter to WAM, Harry Moyes wrote 'If I catch any more [Dalgytes] I will send them to you' (File A199/74/21).

The museum specimen (M452) from Mokerdillup (donated by Fredric Foster in 1921) is acceptable. Harry Moyes advised me that Foster lived on a farm ('Mokerdillup') on Nelson Location 1248, at the head of Pink Eye Gully, a tributary of Mokerdillup Brook. The specimen was apparently collected on the farm, as Foster wrote on 21.1.21 that it had been "picked up dead here" (WAM letter archives, File A199/74/11). Foster also noted that the animal had "evidently only been dead a few hours" and observed "a few small tooth marks, probably a cats, on the throat". Its stomach "seemed to contain a great many grass seeds". The occurrence of the Bilby in the area was clearly very local, as Foster wrote "...people who have been in these parts for 50 years & more admit to having seen nothing like it before".

Observational Records

These records, all from within the RFA area of south-western Australia, are listed chronologically by year of last observation.

1. The record published by Spencer (1966) of 'dalgytes' in the first years of settlement (1860s) near Darkan refers to observations made by

- W.J. Gibbs of Boolading Homestead. Tom Perry (personal communication to K. Morris 1994) also observed the Dalgyte from near Darkan. This record is considered too vague to be mapped and cannot now be clarified as Tom Perry is deceased.
2. Near Bannister. John Tunney wrote to the Director of WAM on 9.8.1900 from 'The Williams' that he "will try & get the P Lagotis you require between here and Bannister". On 15.8.1900, at Bannister, he wrote "I am camping here [i.e. Bannister] for a few days to try & get the P lagotis as Mr Pollard tells me there are some about". On 22.8.1900 he wrote that he "had traps set [at Bannister] every night for Lagotis I caught 5 but only got a female this morning she has two young ones in Pouch". These quotations are from the original letters, held by WAM.
 3. Buckingham. Les Carroll (b. 1926) reported that his father lived at Buckingham from 1910 and had mentioned the occurrence of the Dalgyte there.
 4. Near the Warren River. Bill Young (b. 1915) remembered seeing them once, in 1921, c. 200 m west of Wordimup Pool (Wilgarup River) and recalled their burrows as present in the area. This area is in Quillben forest block. He first saw the Fox there in 1928.
 5. Camballup, Kent River, c. 3 km north along the river from Muir Highway. George Higgins (b. 1914) last saw the Dalgyte there in 1921 in jarrah forest on his father's farm.
 6. Pinjarrah-Boddington Road, c. 2 km west of Hotham River crossing. Arthur Batt (b. 1917) saw one Dalgyte there in c. 1922-3 and recalled that this species was not common in the Marradong area. The few burrows observed each occurred close to the foot of a tree. The Fox arrived c. 1935.
 7. c. 8 km north of Kulikup, near Balgarup Rd. Jim Torrie (b. 1921) told me that his father, who settled there in 1908, had spoken of the occurrence there of the Dalgyte before the mid 1920s. Fox arrived 1933.
 8. Farm at Doust Road c. 19 km east of Bridgetown. Hilda Green (b. 1901) recalled that her father showed her in the 1920s a Dalgyte, which had been killed when the horse he was riding put a hoof into its burrow. Burrows were numerous on the farm. Hilda Green recalled that her husband first observed the Fox there in the early 1930s.
 9. Sussex Loc. 2149 near Margaret River (town), adjacent to Bramley forest block. Bill Nilsson (b. 1914) arrived there as part of the Group Settlement Scheme in 1922 with his parents. He recalled seeing a few Dalgytes in 1926. Fox arrived c. 1930.
 10. Near Coolingoort, Salt Valley Road, northwest of Bakers Hill. Walter Chitty caught one Dalgyte in c. 1927 in a trap on a farm (Avon Location 1681). Walter Chitty stated that the Dalgyte was rare and that the Fox arrived in the district in c. 1932.
 11. Mokine, between Marradong and Quindanning, (Williams Location 82 and adjacent locations). Charles Fawcett (b. 1912) recalled the presence of the Dalgyte c. 1925-7. He linked its disappearance with the arrival of the Fox in c. 1930.
 12. 100 m north of Nelson Location 1640 (near Walcott forest block). Ken Smith (b. 1912), a retired farmer and Dingo trapper, recorded a large warren "about 3 acres in area" dug up by the burrowing activities of Dalgytes. He used to catch the occasional Dalgyte in a Dingo trap. Ken Smith's father (T.E. Smith) selected this land in 1897 and acquired nearby Locations 7881, 1636 and 1638. Ken Smith stated categorically that the Dalgyte did not occur on these other Locations. It preferred depressions in open Jarrah forest that were not waterlogged but contained yellow sands, presumably to facilitate burrowing. The species was consequently patchy in its distribution. He last saw Dalgytes there in 1928, two years after the Fox arrived.
 13. Halfway between Nelson Location 1636 and Corbalup Swamp (Kingston and Corbal forest blocks). Ken Smith also reported that he caught one Dalgyte in a Dingo trap in about 1929. There was only a single burrow nearby.
 14. Farm c. 3 km west of Boyup Brook on Bridgetown Road. Josie Outridge (b. 1907) recalled that her mother captured a Dalgyte on the farm in the late 1920s and skinned and stuffed it. Burrows were present on the farm. The Fox was first observed here in the early 1930s.
 15. Farm on Campbell Road near Matta Matta Brook, c. 5 km east of Bridgetown. Brenda Trigwell (b. 1914) saw a Dalgyte in 1929 on her father's farm and stated that they were common at that time.
 16. Farm 36 km west of Beverley, along the Dale River. Geoff Lodge (b. 1933) reported that his father (Verne, b. 1898) had spoken to him of the occurrence there of the Dalgyte between the wars. Geoff never saw one there.
 17. Near Duranillin. WAM in 1999 acquired a rug made from c. 16 Dalgyte skins (catalogued as Object No. H99.475). The rug was made in the 1920s from Dalgytes trapped on farmland near Duranillin (A. Haebich, personal communication 1999).
 18. Mt Anderson, close to the town of Toodyay. Walter Chitty (b. 1919) recalled that a Dalgyte was caught at this locality in c. 1930.
 19. Farm c. 8 km east of Boyup Brook on the

- Blackwood River. Janet Purse (b. 1917) recalled the presence of burrows and that a Dalgyte was trapped there in c. 1930.
20. Deeside, Hay Location 6. Andrew Muir (b. 1917) stated that Dalgytes were not common in this area and were last seen c. 1931. The Fox arrived in 1934. He attributed the disappearance of the Dalgyte, Boodie and Woylie and decline of possum species (all early 1930s) to disease. His brother, Jim Muir (b. 1920), had not observed the Dalgyte, perhaps suggestive of an earlier decline.
 21. Farm south of the Arthur River < 1 km east of Moodiarrup. Rudolf Schinzig (b. 1910, personal communication to John Schinzig 1999) caught a Dalgyte in a rabbit trap in c. 1931–32.
 22. South side of Lake Towerrinning. Lowden Cochrane (b. 1924, personal communication to John Schinzig 1999) saw a Dalgyte there in c. 1931–32.
 23. Sussex Loc. 2292, Osmington, next to the Margaret River. Leonard Burton (b. 1919) lived on Group Settlement 85 from 1927 to 1932, where he and his father saw a 'hare', an animal with long ears, in c. 1932. Leonard Burton was not familiar with the name Dalgyte. Because the Brown hare *Lepus capensis* has never established in Western Australia, this record is confidently attributed by me to the Dalgyte.
 24. Hay Location 36, near Hay River c. 5 km east of Forest Hill. George Elverd (b. 1912) recalled the presence of Dalgytes and their warrens in 1932 on farmland. His mother tanned Dalgyte skins for domestic clothing. Fox first recorded c. 1931.
 25. Plantagenet Location 4192, c. 4 km east of Kent River near South Coast Highway. Len Turner (b. 1917), who lived on this farm from 1924 to 1938, recalled the occurrence of animals fitting the description of the Dalgyte. They were not common and were seen in the late 1920s and early 1930s. This farm originally carried Karri, Jarrah, Yarri and Banksia vegetation.
 26. Between Moodiarup hall and bridge. Bill Hawley (b. 1924, personal communication to John Schinzig 1999) trapped a Dalgyte in c. 1933. John Schinzig (b. 1925) saw his first Fox in this area in c. 1932.
 27. Near the southeast corner of Julimar forest (Trig forest block). Sam Cook (b. 1916) caught a Dalgyte in c. 1930 when trapping rabbits on farmland (Avon Location 5870), in Marri / Wandoo / Powderbark woodland. He first observed the Fox in c. 1928. His brother Harry Cook (b. 1923) observed a few Dalgytes close to the homestead on Avon Location 5870 in c. 1935.
 28. Near Hotham River, c. 5 km north of Boddington. Jim Farmer (b. 1918) recalled that Dalgytes were plentiful in the district. On his farm they occurred in sandy hollows near the river. Last observed c. 1935. Fox first recorded in the early 1930s.
 29. Near the Warren River at Nelson Loc. 320, adjacent to Quininup forest block and c. 3 km west of Warren hall site. Cliff Mottram (b. 1920) recalled seeing Dalgytes in this area until c. 1935. They were not common. The Fox arrived in this locality in c. 1930.
 30. Ranford, c. 1 km northeast of Boddington. Vera Farmer (b. 1925) remembered capturing a Dalgyte in a rabbit trap and releasing it unharmed (1937).
 31. Brancaster farm, c. 10 km south of Dinninup. Harold Whistler (b. 1907) caught a Dalgyte in a rabbit trap set in a burrow in sandy soil in c. 1937.
 32. Farm c. 1 km north of Bridgetown. Stan Doust (b. 1922) first saw Dalgytes there in c. 1932 and blamed their disappearance in the late 1930s on the arrival of the Fox.
 33. Bannister (Williams Location 43 and adjoining locations). Horace Pollard (1899–1972) had told his son Alec (b. 1937), whom I interviewed, of the occurrence of the Dalgyte on this farm. The species disappeared soon after the arrival of the Fox.
 34. Haddleton farm (Wellington Location 1300) c. 1.5 km northwest of Trigwell Bridge. Richard Trigwell (b. 1912) stated that Dalgytes were last seen there in the 1930s and were uncommon.
 35. Farm at Moodiarrup (Williams Loc. 221). Michael Cusack (b. 1939), whom I interviewed, informed me that his father settled there in 1929 and had spoken of the occurrence of the Dalgyte there. Michael Cusack also has in his possession a typed document of a conversation with a Mrs Trigwell recalling her life at Moodiarrup in the 1890s. This document mentions the presence of 'Dalgyts'.
 36. Swampy areas between Warren Bridge and Dombakup Brook (?near Warren River and Barker/Callcup Road intersection), and near Lake Jasper. Fred Brockman (b. 1925) informed me that his father had spoken to him, while mustering cattle in these areas in the 1930s/40s, of the occurrence of Dalgytes in these localities. His father considered them as plentiful and remarked that they had disappeared suddenly, attributing this to a virus followed by the arrival of the Fox in c. 1930–1.
 37. Wellington Loc. 1804, Quindanning-Harvey Road, adjacent to Williams River (c. 4 km southwest of Mt Saddleback). Basil Fletcher (b. 1936) remembered the Dalgyte on farmland and last saw it in 1947.
 38. Sussex Location 921 on the Blackwood River (between Darradup and Sollya forest blocks). Vic Roberts (b. 1920), whom I interviewed in June 1997, recalled one animal and one burrow in sandy soil in forest that had been ringbarked

in 1903 and was densely vegetated in 1947, when the observation was made. Older settlers had reported Dalgytes even farther to the south west. Vic Roberts informed me that Dalgytes occurred also along St John Brook. The local Aboriginal name was Cundin. He first saw the Fox in this area in 1929.

39. Hay Location 342, Crosby/Quindinup Road, c. 4 km north of Frankland River/Muir Highway crossing. Robert Crosby (b. 1953) recalled that his mother had mentioned the occurrence of the Dalgyte on this farm up until the early 1950s.
40. Near Wooroloo. W.H. Butler (b. 1930) noted that a farmer had caught a Dalgyte in a trap in 1955 (CALM file 015178F3807). Harry Butler informed me that this was north of Burma Rd.
41. Werribee (Methodist Boys' Home). W.H. Butler noted that a Dalgyte was seen there in 1956 during clearing (CALM file 015178F3807). This locality is c. 6 km east of Wooroloo (Harry Butler, personal communication 1999).
42. Avon River near Wooroloo. W.H. Butler reported Dalgytes there in 1956 and 1957 (CALM file 015178F3807). Harry Butler informed me that they were caught in rabbit traps set at Moondyne Spring.
43. 43 miles from Perth on Dale Rd (i.e. c. 69 km from Perth on Brookton Highway, which places the locality between Watershed and Yarra Rds). In March 1958 H.W. Norris and R. Abbey saw a Dalgyte at 10 pm hopping along the side of the road (CALM file 015178F3807; see also *Fisheries Dept WA Bulletin for Honorary Wardens* 1959 5(1): 11–12). The description provided is accurate. This was the first time in 25 years that H. Norris had seen a Dalgyte.
44. Along Perup River, between Yerraminnup River and Boyup Brook-Cranbrook Road, especially Nelson Loc. 2889. Ashley Giblett (b. 1919) stated that when he moved there in 1939 Dalgytes were very plentiful along, and up to 100 m from, the eastern bank of the Perup River. Last seen c. 1975. Fox arrived c. 1933.

Negative Records

The term 'negative record' in the context of the Bilby refers to the absence of reliable observations from localities where observations were made of other conspicuous mammals. Such records need to be treated cautiously, however, as absence of evidence can not necessarily be equated with evidence of absence (e.g. Ride 1970: 20). The best that can be achieved is to document negative records and examine whether they form a pattern that complements the known distribution based on records and observations.

1. Caves between Boodjidup and Karridale, Leeuwin-Naturaliste National Park. No remains of Bilbies have been retrieved from these caves

(Lundelius 1957; Merrilees 1968a, b; Archer and Baynes 1973; Baynes *et al.* 1976; Balme *et al.* 1978; Porter 1979). Woodward (1914) listed *Macrotis lagotis* as a component of the fossil mammal fauna from Mammoth Cave, and this was repeated by Glauert (1926, 1948) and Lundelius (1960). However, Merrilees (1968a, b) could find no specimens to support this identification and concluded that it was incorrect. Particularly significant to this point is the fact that *M. lagotis* was not one of the inland species (including *Perameles bougainville*, *Bettongia lesueur*, probably *Lagorchestes hirsutus*, *Petrogale lateralis*, *Notomys* sp., *Pseudomys albocinereus* and *P. occidentalis*) that invaded the southern Leeuwin-Naturaliste region during the drier times of the last glacial but disappeared from the area before or during the Holocene (Baynes *et al.* 1976; Balme *et al.* 1978).

2. Swan Coastal Plain. The occurrence of the Bilby on the Swan Coastal Plain south of Millendon is not supported by the surface fossil record or observations of George Moore and John Gilbert in the 1830s and 1840s. There is a substantial literature on the mammal faunas from the caves of the northern Swan Coastal Plain between Wanneroo and Dongara (Lundelius 1957, 1960; Merrilees 1968b; Archer 1972, 1974a, b; Baynes 1982). Among all the specimens identified, there is just one record (of a single jaw) of *M. lagotis*, from Wedge's Cave, northeast of Lancelin (Lundelius 1960, personal communication 2000). The material originated from more than 2 m depth in the deposit and, on the basis of the radiocarbon date reported by Lundelius (1960), is probably several thousand years old.

John Gilbert made no mention of Bilbies at Perth, Mt Eliza, banks of the Canning River south of Perth, Fremantle, Pinjarra, Drakesbrook, Harvey, Australind or Vasse River (see Fisher 1992). See also Gilbert's comments about distribution cited in Appendix 1.

George Moore lived at Millendon (Swan Locations 5a and 6) from 1830 to 1852 and recorded observations about conspicuous fauna in his letters from 1830 to 1841 (Moore 1884). He did not mention the occurrence of the Dalgyte on or near his farm. Living off the land was an urgent necessity for most settlers in the 1830s; if Bilbies were present near Perth there should be records in letters, but none have been found (Durack 1976; Statham 1981).

Evidence against the occurrence of the Bilby in the Perth metropolitan area is that most other medium-sized mammal species that occur or occurred within the area are well represented in the WAM mammal collection by pre-1934 specimens and/or catalogued records. Examples include Chuditch *Dasyurus geoffroyi*, Numbat *Myrmecobius fasciatus*, Quenda *Isodon obesulus* and Koomal

Trichosurus vulpecula.

The presence of the Bilby in the Gingin-Lancelin area, in and adjacent to the northeast sector of the Swan Coastal Plain, is believed to represent a specialized incursion only. Gingin lies in the middle of an area of uplifted Mesozoic sediments that form a block between the Hill River and Darling Scarps. These substrates differ from the highly leached sands characteristic of the Swan Coastal Plain. The presence of relatively friable Mesozoic sediments in the catchment of Gingin Brook (e.g. Molecap Greensand) and along part of the Moore River (Seddon 1972) may therefore explain the presence of Bilbies along the Moore River, if the outwash fans from the scarp associated with it are large enough not to be inundated by the Quaternary sediments blowing inland across the coastal plain.

The record supposedly from Kelmscott, noted in a letter by J.T. Tunney on 15.8.1900 (and quoted by Kitchener *et al.* 1978: 68 as "Mr. Pollard tells me there are some (*M. lagotis*) about the pool near Kelmscott") is considered to be a misreading of what Tunney actually wrote (see the correct quotation under number 2 above).

The proposal of Glauert (1933: 17) that the Bilby attempted to establish itself near Perth where formerly it was entirely absent (presumably alluding to specimens M703 and M787) is considered implausible. The Upper Swan specimen (M703) is supported by an observational record near Henley Brook (see Table 2). M787 was donated by a Mr Hillard in July 1926, having been "found run over near Swan Brewery" (WAM mammal catalogue), "killed by motorcar" (specimen label), Mounts Bay Road, Perth. Kitchener and Vicker (1981: 157) listed this specimen as from "Perth G.P.O. (approx)". Specimen M787 evidently represents the same animal as M750 (see Table 1), as the liberation in Kings Park of live specimens donated by the public was common practice at the time (A. Douglas, personal communication 1999).

An undated specimen from Port Leschenault [Bunbury] presented to the Natural History Museum in London [BM(NH)] by a W.E. Bates (Thomas 1888: 225) and reference to 'dalgers' in a book (Buckton 1840: 96) ostensibly about the Bunbury region are suggestive of the occurrence of the Bilby on the southern Swan Coastal Plain. I remain unconvinced. Buckton (1840) appears to have compiled accounts from the settled parts of WA. The reference to the Bilby is in a paragraph discussing the food of Aborigines without allusion to any particular locality and appears to have been paraphrased from Ogle (1839: 63). I concur with Whittell's (1954a) judgment that references to fauna in Buckton (1840) have been "obviously compiled without any knowledge of the facts".

H.W. Bunbury, the first European to travel overland between Pinjarra and Vasse, does not

mention the Dalgyte (Bunbury and Morrell 1930), nor do early residents of Bunbury and Australind (see Johnston 1962; Bolton *et al.* 1991, 1992). The BM(NH) specimen may have come from the Margaret River area, from inland after Bunbury was linked to Kojonup by road in 1840, or from a pet animal. Bilbies are attractive animals and were on occasion kept as pets (Reid 1837; Millett 1872: 169; Wood Jones 1924: 164; Le Souef and Burrell 1926: 300; Jenkins 1974: 170-1; notes about WAM specimen M1377 in Table 1). Animals in South Australia have been kept successfully in captivity for nearly 3 years (Aslin 1982).

My conclusion from the above records, taken together, is that Bilbies did not occur on the typical sandy soils of the Swan Coastal Plain at the time of European settlement. As noted by Baynes (1979: 203), the large burrows of Bilbies would probably collapse if dug into pure sand.

3. Margaret River. Shortridge (1910) did not collect or record the Bilby from Burnside or Ellenbrook. He readily obtained specimens of other species now rare or extinct there, namely *Macropus eugenii*, *Pseudocheirus occidentalis* and *Dasyurus geoffroii*, and Bilbies elsewhere (see Table 1), and so is unlikely to have overlooked the Bilby if it had occurred at these localities.
4. Albany. No local Aboriginal name was recorded by Nind (1831). Gilbert (1843a, b) did not list it (see also Whittell 1954b, Fisher 1992). Shortridge (1910) did not record it from King River or Big Grove. George Masters' specimen from the vicinity of King George Sound (Kreffft 1867; Glauert 1950a: 126) is surely referable to Mongup, not Albany. This is the case with several bird species collected by him (Abbott 1999).
5. Wellstead district. Not listed by Leighton (1996). Not observed by Doug Moir (b. 1931) who has lived at Cape Riche since 1931. In addition, his father (Neil, b. 1898) had never spoken of the occurrence of Dalgytes at Cape Riche (Doug Moir, personal communication 1999). Not present at Warriup (Bill Hassell, b. 1927, personal communication 1999).

Residents of south-western Australia aged 70 years or more are an additional, though less scientific, source of negative records. Given that the last specimen was collected in 1935, I reasoned that a child of at least 5 years and living on a farm on which Bilbies were present would be unlikely to forget an observation of this morphologically extraordinary animal. All interviewees (Table 3) had an impressive familiarity with most of the medium-sized and large species of mammal present in the southwest in the 1920s and 1930s. Dick Perry, the most senior of the interviewees, was from 1917 a forester and traversed "hundreds of miles" of forest on foot and horseback. Many of these

traverses were before Rabbits established in the forest, when any excavations by Bilbies would have been conspicuous. Dick Perry marked the areas that he knew well on maps supplied by me in May 1997. Moreover, Dick Perry is a keen naturalist and in neither his published papers (Perry 1971, 1973) nor his interview did he mention the occurrence of the Dalgyte in the forest known to him.

Modelling the Original Distribution of the Bilby in south-western Australia

Combining the acceptable museum and observational records of the Bilby with the mapped vegetation types indicates (Figures 1, 2) that the Bilby had an extensive distribution in the southwest at the time of European settlement.

Observational records completed much of the inferred distribution in the northern forests, based on the Chidlow (M980), Clackline (M687) and Culham (M1391) specimens. The modelled distribution indicates that the Bilby could have occurred extensively in the Julimar forest and in the northern jarrah forest as far west as Moondyne, Sawyers, Helena, Beraking, Dale, Brady, Leona, Cooke, Geddes, Boonerring, Duncan, Wells, Hedges, Bombala, George, Hakea, Bell, Chalk, Bednall, Nalyerin, Trees, Palmer, Fleays, Centaur and Goonac forest blocks². Specimens from near Bridgetown (M1399, M1749, M452) generated an extensive inferred distribution north to Arcadia, Yabberup and Noggerup forest blocks, very nearly linking with Goonac forest block already mentioned. The mismatch between State Forest (forest blocks) and the original eastern extent of forest is evident from comparing Figures 1 and 2, and shows that much of this area has been converted to agricultural purposes. The inferred distribution extends west to Ryall and Mullalyup forest blocks, and then south to Nelson and Carter forest blocks.

The two observational records near Walcott forest block and in Kingston and Corbal forest blocks generated an inferred distribution southeast of Bridgetown and east of Manjimup to Keninup, Moopinup and Talling forest blocks. The observational records east of Bridgetown, around Boyup Brook, near Moodiarrup, and near Forest Hill generated an extensive, though patchy, inferred distribution on land now almost completely cleared for agriculture. The remaining southern observational records generated inferred distributions near Margaret River, along the Blackwood River and tributaries west of Nannup, along the Scott coastal plain, and along parts of the Warren River, and between Kent River and Denmark.

DISCUSSION

The hypothesized original distribution of the Bilby in south-western Australia developed in this paper, using vegetation data, differs from one predicted on the basis of climatic variables (Southgate 1990). The latter showed the Bilby not to have occurred so extensively in the southern or eastern jarrah forests but to have occurred on the coast near Albany and Denmark.

How Reliable are the Bilby Records?

Museum Specimens

All of the WAM specimens were collected in the period 1900–1935, an era before and just after the Fox arrived in south-western Australia. However, typical of most species (Ride 1968), the suite of Bilby specimens collected is unrepresentative. This is for several reasons: resources were scarce; WAM had a policy at the time of not collecting specimens (A. Douglas, personal communication 1999); and the regional decline and local extinction of the Bilby and other medium-sized mammal species were not foreseen. Nonetheless, WAM curator L. Glauert actively solicited the donation of specimens of small marsupials from the public, including school teachers and rabbit trappers. Specimens forwarded to the museum by rail were carried free and the Trustees were prepared to consider payment for rare species (various letters dated 1928, filed at WAM in A199/74/15 & 21).

Conflicts in the Oral Data

There are gratifyingly few disagreements in the oral information collected, with most of the negative records complementing the inferred distribution of the Bilby based on positive (museum and observational) records. Particularly heartening is the strong concordance of oral information and museum records in the wheatbelt (see Figure 1, Tables 1 and 2).

The inferred distribution indicates that suitable habitat for the Bilby occurs in Sawyers, Helena and Beraking forest blocks east and southeast of Mundaring. Dick Perry, however, did not know of the occurrence of Dalgytes in this forest. When in the area he was involved in planting pines at Beraking. The observations by Vic Roberts on the Blackwood River are from an extensive area of the Donnybrook sunklands traversed by Dick Perry, who was not aware of the occurrence of Dalgytes there (see also Perry 1971). The observations by Bill Nilsson and Leonard Burton near Margaret River conflict with Shortridge's lack of mention of the

² State Forest consists of 418 management units called forest blocks, each of c. 5 000 ha. Because the forest is sparsely settled, the most convenient method of referring to records within State Forest is by nominating forest blocks. A map (scale 1: 650 000) of the forest showing the names of all forest blocks is available from Information Management Branch, CALM, Como.

Bilby at two localities close by, and several negative records (Table 2). These minor discrepancies may indicate that occurrences of the Bilby near Mundaring, the lower Blackwood River, and Margaret River were very local. It is possible that Bilbies occurred along the lower Blackwood River only where suitable substrate exists along the river valley but not on either side.

The inferred distribution indicates the presence of suitable habitat for the Bilby near Brookhampton, Newlands, Kirup, Balingup and Greenbushes. As its former occurrence in this area has not been confirmed, this remains a significant discrepancy. On 7.9.1999 the *Donnybrook-Bridgetown Mail* published a letter from me seeking further information from readers about the occurrence of Dalgytes in this area. This elicited one response (A. Foan, b. 1929, Wellington Location 17, who did not know the term Dalgyte), thus reinforcing my belief (based on evidence of seven interviewees cited in Table 3) that the Bilby did not occur between Donnybrook and Greenbushes.

Because I have only one observation of the Dalgyte on the south coast west of Denmark, its geographic range limit there has been indicated tentatively in Figure 1 by a dashed line.

Biogeographic Significance

The penetration of the Bilby from inland south-western Australia into the Bridgetown area and then farther downstream along the Blackwood River is of considerable biogeographic interest. It is not, however, unique as other inland species show a similar coastal or subcoastal south-western

termination to their range (Shortridge 1910; Perry 1971; Abbott 1999 and unpublished). These species are the Woylie *Bettongia penicillata* (to Margaret River), Boodie *B. lesueur* (to Donnybrook Sunlands), Malleefowl *Leipoa ocellata* (to Leeuwin-Naturaliste ridge, Lake Muir, karri forest, Scott River plain), White-browed babbler *Pomatostomus superciliosus* (Vasse River and karri forest) and Crested shrike-tit *Falcunculus frontatus* (Swan Coastal Plain, Leeuwin-Naturaliste ridge and karri forest).

Possible Causes of the Decline and Presumed Extinction of the Bilby in South-western Australia

The museum records and observational data presented in this paper demonstrate that the Bilby up to 1935 was reported widely from south-western Australia and was clearly not an uncommon animal in most of this region. After that year, there are fewer dated reports (all observations): 1936, 1937, 1939, 1942, 1945, 1946, 1947, 1955, 1956, 1957, 1958, 1959, 1962, 1967, 1970, 1973 and 1978 (Figure 3). Many factors *prima facie* appear to have contributed to the decline and apparent extinction of the Bilby in south-western Australia. Indeed, Jenkins (1974) noted that no entirely satisfactory explanation had yet been presented for the population crash in the 1930s. The following analysis seeks to place in historical context the 15 factors usually invoked to explain declines of mammal species in south-western Australia (Shortridge 1910; Le Soeuf 1923; Baynes 1979; Kitchener *et al.* 1980; Burbidge and McKenzie 1989; my interviewees) and to determine which if any of the factors have primacy.

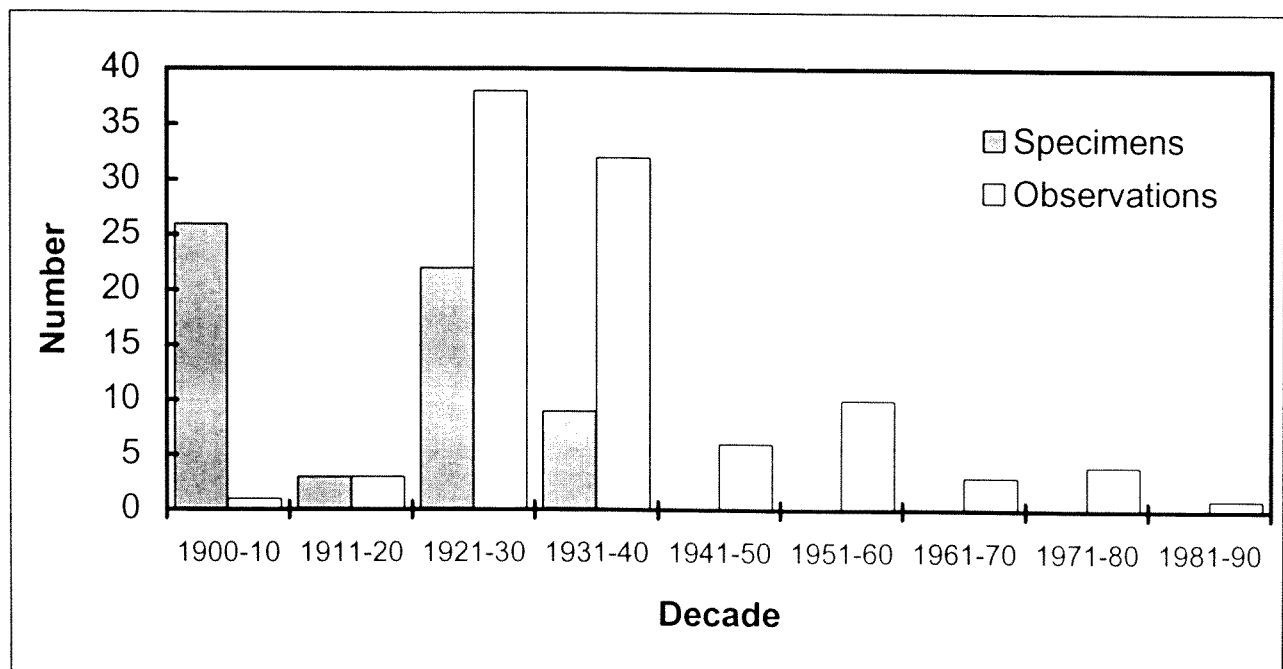


Figure 3 Frequency of all records of the Bilby in southwestern Australia, classified by decade of collection or observation. Observations listed in Appendix 2 are excluded.

Drought

The occurrence of years with low rainfall in the Mediterranean climate of south-western Australia is frequent and natural (e.g. 1837–41, 1849–50, 1865–6, 1870s, 1881, 1894, 1897, 1903, 1911, 1914, 1919 (Haddleton 1952; Leake 1962; Erickson 1971; Garden 1979; Prince 1984; Meteorological Bureau data for Perth 1880 – 1998). Although it is unconvincing to link the decline of the Bilby solely to drought, it is relevant that most of the period from 1935 to 1940 experienced below average annual rainfall. Mammal populations in Australia do decrease during periods of low rainfall (e.g. Shortridge 1910; Leake 1962; Tunbridge 1991; Baker *et al.* 1993; Rose 1995; Short *et al.* 1997; Braithwaite and Muller 1997). Drought has been linked to the decline of Bilby populations in the Kellerberrin area by 1899 (Leake 1962) and in parts of the Northern Territory by 1965 and subsequently (Johnson and Southgate 1990).

Changed Fire Regimes

Changes in the pattern of fires resulting from European occupation, resulting in large areas of vegetation kept at the early stages of pyric succession, may have been a principal cause of the onset of mammal declines in the Western Australian wheatbelt (Kitchener *et al.* 1980). The critical factor is to what extent species depended on late successional patches for food and shelter. Large scale homogeneity is unlikely to be relevant to the Bilby, which persisted throughout the era of clearing burns, e.g. near Gnowangerup in 1912 (Bignell 1977) and the wheatbelt in 1900–10 when the area cleared increased from 30 000 ha to 235 000 ha (Glynn 1975). Prescribed burning in forests was introduced progressively from 1954 to 1961 (Abbott and Loneragan 1986) and thus post-dates the regional decline and apparent extinction of the Bilby.

Aboriginal Predation

Aborigines are known to have hunted the Bilby for food (see Appendix 1; also Troughton 1965: 70). I have found no record that they hunted Bilbies in south-western Australia for their tail tips (for decorative purposes), as was the case in central Australia (see Johnson and Southgate 1990). Aboriginal populations in south-western Australia declined precipitately after 1860 following the spread of European diseases (Green 1984). This may have led to an increased Dalgite population in the following 30–40 years. Aboriginal predation as a factor in the decline of the Bilby can thus be discounted.

Pastoralism

Shortridge (1910: 818) linked the decline of several mammalian species to the introduction of

sheep, particularly in arid parts of Western Australia, before the arrival of rabbits. Sheep divert or export nutrients formerly available to native mammals (Burbidge and McKenzie 1989). Although sheep were depastured throughout much of south-western Australia in the period 1850–1900 (Jarvis 1979), the Bilby showed no sign of decline then as evidenced by its widespread occurrence in the wheatbelt up to about 1930. Moreover, the Bilby's shelter and food resources are mostly subterranean and there does not appear to be a direct link between damage to ground cover by sheep and the ecology of the Bilby.

Dingo Predation

Corbett (1995) proposed that the Dingo may have played as great, if not a greater, role in the decline and extinction of medium-sized mammals than other factors. The expansion of the pastoral industry in south-western Australia from the 1850s enabled the Dingo to increase in abundance and thus have a pronounced impact on smaller mammal species during periods of drought. Although the Dingo may be a contributing factor in certain areas, the weakness of this theory is that it can not explain why extinctions of mammal species also occurred in the deserts far from pastoral stations.

Relevant here are observations by Jim Masters (b. 1917), who farmed at North Tammin until 1950. He noted that Dingoes were still common there until 1930 and that Foxes did not become common until after 1930. Near Northam, the Dingo had been extirpated and Foxes were very common in the late 1920s. The Bilby was last seen at North Tammin and Northam in 1931 and c. 1928, respectively.

Feline Predation

The Cat *Felis catus* colonized south-western Australia with European settlement in 1826 and increased in distribution with the expansion of settlement, especially pastoralism (Abbott 2000). Cats initially commanded high prices because rodents and small native mammals infested dwellings and store rooms (Erickson 1974; Heal 1988). The Cat thus coexisted with the Bilby for 50–100 years. Furthermore, although adult Bilbies weigh 800–2500 g (Johnson 1995), which is well within the prey size of cats, cats prefer to eat animals of the size of a young rabbit, 200–300 g (Jones 1977; Coman 1991). It is unclear how capable the Bilby is in defending itself from attack, as some will bite readily and savagely (Wood Jones 1924; Troughton 1965; A. Gale and J. Schugg CALM file 015178F3807; N. Beeck personal communication 1999), whereas others are docile (Christensen and Liddelow 1992). Cat predation can be discounted (cf. Watts 1969).

Trapping for the Fur Trade

Following settlement, especially from 1885 to 1910 (Erickson 1974; Haebich 1988) and again during the 1930s Depression, the Koomal *Trichosurus vulpecula* was snared throughout the southwest for its pelt and was the basis of an important export industry. Although Bilby skins were sold (Jenkins 1974; Mouritz 1986; J. Enright personal communication 1999), this was not a commercially attractive activity because of the strong smell and difficulty in preparing skins (Jenkins 1974). This is in contrast to South Australia, where skins were collected in very large numbers (Wood Jones 1924). Trapping for the fur trade as a cause of Bilby decline can be discounted for south-western Australia.

Disease

There are anecdotal records of spectacular declines in native mammal species attributed to disease (e.g. Shortridge 1910; Grasby 1925; White 1952; Spencer 1966; Perry 1973; Erickson 1974; G. Gardner cited in How *et al.* 1987: 565; B. Hanekamp and A. Muir personal communication 1997, 1999). Shortridge in particular noted declines in otherwise little altered parts of the inland, except for the presence of sheep, horses, rats, mice, cats and dogs. It is now well established that marsupials are sensitive to toxoplasma, for which the cat is a vector, not the sheep or dog (Andrew Thompson, Veterinary and Biomedical Sciences, Murdoch University, personal communication 1999). It is also possible that fleas or ticks on introduced mammals (Roberts 1952) may have spread disease among native mammals. Ray Garstone (b. 1931) informed me that his father reported that Dalgytes were common in 1928 near Woodanilling town site. His father last saw them in 1936, noting that he found dead animals present. This event was attributed by his father to disease.

John Tunney in 1913 implied that Dalgytes were rare at Gracefield, south of Kojonup, as he noted "There are still a few left about this locality". My study is suggestive of a more extensive decline before 1920 of Bilbies in the area bounded approximately by Quelarup, Kulikup, Tunney and Kojonup. This was before the Fox arrived and may indicate a disease epidemic. Nonetheless, Amy Crocker, who lived at Balladonia from 1903 to 1989, stated that Bilbies survived a disease epidemic of the 1880s/90s and were "fairly numerous until late 1917" (Richards and Short 1996).

Clearing of Vegetation for Agriculture

Le Soeuf (1907: 404) attributed apparent extinction of Dalgytes to cultivation and ringbarking of trees on farms. Clearing of native vegetation on first class land [Salmon Gum, Gimlet, Morrell and Jam woodland] for cultivation was regarded by Douglas (1980; personal

communication 1999) as relevant. However, Dalgytes could sometimes be found near Northam in cultivated paddocks in the late 1920s (Jenkins 1974) and their burrows were found near Kellerberrin often in cleared land (Leake 1962). L. Jenkins also noted two burrows in a garden at the foot of a fruit tree (Letter to L. Glauert 6.7.1927, held in WAM archives). N. Beeck (personal communication 1999) also reported that Dalgytes lived on cleared land near Katanning. Hobbs *et al.* (1993) implicated fragmentation of the original vegetation in the extinction of the Bilby in the WA wheatbelt. However, in many parts of the wheatbelt, clearing was not extensive until the 1960s (Muir 1976: 17, 20; Muir 1977a: 27; Muir 1977b: 14–15; Chapman 1978: 10–14; Chapman 1981: 11). The pattern of railway construction in the wheatbelt serves as an early indicator of when and where most clearing took place. The maps published by Glynn (1975) thus demonstrate extensive clearing in the western wheatbelt in the period 1909–18.

The area alienated for farmland or sown for grain actually declined throughout the 1930s (Burvill 1979: 43), as a consequence of a severe economic depression curtailing the marketability of agricultural produce. Yet, as is clear from Tables 1 and 3, there are few records of Dalgytes after 1935.

Habitat removal and fragmentation through clearing for agricultural development, though it may cause local declines and extinctions, has not caused significant or widespread declines or extinctions of mammal species (Burbidge and McKenzie 1989). Watts (1969) also indicated that the decline and disappearance of the Bilby in New South Wales and South Australia (c. 1900) preceded extensive habitat alteration, so that this factor could not have been a prime cause. The most telling counter-evidence is the failure of the Bilby to persist in the Great Victoria Desert or several large areas of uncleared vegetation within or adjacent to cereal-growing areas, e.g. Stirling Range NP (116 000 ha), Lake Magenta Nature Reserve (108 000 ha), Lake King NR (40 000 ha), Dragon Rocks NR (32 000 ha), and Dryandra Woodland (formerly 'State Forest', 28 000 ha).

Rabbit – Competition for Resources

Rabbits colonized south-western Australia in the period 1905–25 (Long 1988). Hoy (1923) believed that Rabbits are "the worst of agents working toward the extinction of the native fauna". Morton (1990) placed emphasis on the patchy distribution of nutrients in arid landscapes and proposed that native mammal species relied on patches of nutritious plant growth during droughts. These patches were postulated to have then been preferentially depleted by exotic grazers and browsers such as Rabbits. Hobbs *et al.* (1993) also

Table 3 Negative records of the Bilby within or near the original extent of forest in south-western Australia. Listed chronologically by the year at which observations began.

Name	Years of observation	Localities and notes
Andrew Torrent (b. 1903)	1907 to 1923	Yoongarillup (c. 12 km east of Busselton). Fox first recorded 1922
Dick Perry (b. 1902)	From 1919	Near Gngangara, Mundaring, Hamel, Argyle, Margaret River east to Nannup, Pemberton to Walpole, Denmark
Charlie Tozer (b. 1913)	1920 to 1934	Eastbrook Group Settlement No. 8, near Pemberton
Louis Torrent (b. 1915)	1920 to 1939	Yoongarillup
Ernest West (b. 1916)	1922 to present	Cowaramup (Sussex Loc. 2943-4, 3851, 4004). Rabbit and Fox arrived c. 1932.
Philip Blond (b. 1916)	1923 to 1929	Cowaramup Group Settlement No. 20. Rabbit and Fox arrived in early 1930s
Les Court (b. 1913)	1923 to 1939	Five Mile Brook, near Pemberton
Dick Smith (b. 1917)	Early 1920s to 1934	Grimwade. Fox first recorded c. 1934.
Eileen Croxford (b. 1914)	1924 to 1929	Group settlement at Parryville, c. 18 km west of Denmark
George and Dorothy Brenton (b. 1917, 1921)	1924 to 1945, 1928 to 1945	Mt Shadforth area near Denmark
Dick Charteris (b. 1905)	From 1925	Near Wilga
Ted Ashton (b. 1914)	1920s to present	Margaret River (town and adjacent areas)
Fred Bamess (b. 1914)	From 1920s	Near Channybearup (next to Big Brook forest block)
Frank Brockman (b. 1915)	1920s to 1936	Dudinyillup (Nelson Locations 6 & 7). Fox arrived c. 1928 30
Wes Forrest (b. 1915)	1920s & 1930s	Yallingup (to 1932), Balingup (1932-33)
Alf Simmonds (b. 1916)	1920s & 1930s	Collie
Rob Brockman (b. 1917)	1920s to 1988	Dudinyillup (Nelson Locations 6 & 7). Fox arrived c. mid 1920s
Les Cluett (b. 1917)	1920s to present	Near Porongurup Range (area bounded by Spring, Mt Barker-Porongurup and Chester Pass Rds). Fox arrived c. 1933-5. He knew of the Bilby's occurrence in the Woogenilup area
George Treloar (b. 1917)	From 1920s	4-5 km southwest of Boyup Brook on Blackwood River
Vern Scott (b. 1918)	1920s to present	Tanjanerup (Nelson Location TAA 13)
Gordon Padman (b. 1918)	From 1920s	Near Brookhampton (Wellington Locations 235/81). Fox first recorded early 1930s
Clem Mitchell (b. 1918)	From 1920s	Near Newlands (Camfield, Wellington Location 727). Fox first noted c. 1932-33
Ted Mills (b. 1918)	1920s to 1942	Bowelling to 1942; thereafter at Collie. Fox first seen c. 1928
Roy Simmonds (b. 1919)	1920s & 1930s	Collie
Lew Scott (b. 1920)	From 1920s	Near Storry and Strickland forest blocks; and near mouth of Donnelly River. Fox first recorded 1928-29
Arthur Dawson (b. 1921)	1920s & 1930s	Near Northcliffe (to 1927), near Manjimup (to 1934), Dwellingup (1934 onwards)
Arthur Watson (b. 1918)	Mid 1920s & 1930s	Near Manjimup
Tom Ball (b. 1919)	1927 to present	Sawyers Valley and Mt Helena. Fox arrived 1930
Alf Tindale (b. 1919)	1928 to present	Kentdale
Dick Korn (b. 1910)	From 1929	Settled near Dwalganup (Nelson Location 3831)
Dave Stewart (b. 1921)	1929 to present	Walpole
Arthur Ashcroft (b. 1921)	From late 1920s	Near Dwellingup (His father knew of Bilbies in the Tambellup/Kojonup area c. 1914)
Ted Birmingham (b. 1921)	From late 1920s	Near Dwellingup (Murray Locations 94 & 687)
Jack Dearle (b. 1922)	From late 1920s	Near Greenbushes, Balingup. Fox first observed at Balingup 1938
Roland Muir (b. 1922)	From late 1920s	West side of Lake Muir (until 1944)
Bob Pugh (b. 1922)	Late 1920s to 1979	Narrakup
Frank Sounness (b. 1922)	From late 1920s	Merryup, c. 5 km west of Mt Barker. Fox arrived 1930

Name	Years of observation	Localities and notes
Cedar Armstrong (b. 1924)	Late 1920s to 1991	Carter Rd area near Margaret River (town), Sussex Loc. 1137, 464 and 933. Fox arrived early 1930s.
David Blythe (b. 1924)	From late 1920s	Near Nannup
Harry Mewett (b. 1924)	From late 1920s to present	Sussex Location 665, Quindalup
Keith West (b. 1925)	From late 1920s to 1972	Cowaramup (Sussex Location 1719)
Aub McEvoy (b. 1915)	From 1930	Dwellingup and Harvey
Wally Dunnett (b. 1928)	From 1931	Between Treen Brook and Fly Brook forest blocks
George Gardner (b. 1912)	From 1932	Near Northcliffe. He knew the Bilby from his childhood spent on a farm east of Pingelly, 1912-32 and stated that it started to decline in the 1920s following the widespread use of rabbit poison baits, before the Fox was first observed in 1928 near Pingelly
Basil Hanekamp (b. 1920)	From early 1930s	Middlesex; east side of Lake Muir (1948 onwards). Fox first seen at Middlesex in 1935. He noted that native mammals became scarce in the 1930s, and observed instances of them 'travelling in circles' which was attributed to disease
Lionel Scott (b. 1922)	From early 1930s	Near Storry and Strickland forest blocks; and near mouth of Donnelly River. Fox first observed c. 1934
Fred Brockman (b. 1925)	1930s to 1978	Dudinyillup (Nelson Locations 6 & 7).
Ernie Young (b. 1925)	Early 1930s to 1946	Near Kin Kin forest block
Jack Studsor (b. 1925)	Early 1930s	Collie
Len Talbot (b. 1926)	From early 1930s	Near Nannup (Carlotta) until 1946
Les Carroll (b. 1926)	Early 1930s	Buckingham
Jimmy Shanhun (b. 1926)	Early 1930s to 1951	Woodburn area, southeast of Porongurup Range
Tom Warren (b. 1927)	From early 1930s	Dwellingup
Audie Kern (b. 1927)	From 1930s	Pemberton
J.S. Whyte (b. 1927)	From early 1930s	Sussex Locations 1734 & 1736, Warring and Whyte Rds, between Bramley and Treeton forest blocks near Margaret River
Brian Mitchell (b. 1928)	From early 1930s	Near Newlands (farm, Wellington Location 2538)
Bevan French (b. 1929)	From early 1930s to present	Gidgegannup
Charlie Miles (b. 1932)	From early 1930s to present	Gidgegannup (Swan Location 149)
Laurie Butterly (b. 1915)	1934 to present	Sussex Loc. 963, Wildwood Rd near Yallingup. Fox arrived c. 1934-1935
Bruce Beggs (b. 1928)	1935 to 1939	East Kirup (Grimwade)
Fred Delandgraftt (b. 1930)	From mid 1930s	Tonebridge
Walter Korn (b. 1907)	From 1938	24 km south of Boyup Brook
Neville Tichbon (b. 1928) & Michael Tichbon (b. 1936)	From 1930s	Between Gwindinup and Argyle, adjacent to Preston River (Wellington Location 3217). Their father had told them that the first Fox was shot in the district in 1929.
Bill Tame (b.1924)	From 1940	Near Nannup
Frank Smith (b. 1910)	From 1947	c. 19 km west of Cranbrook. Before 1947 he lived at Bruce Rock and knew the Bilby there, where he last saw it in c. 1928

suggested that regeneration following fire was hindered by Rabbits. Being partly carnivorous, however, the Bilby should only have competed with Rabbits for tubers.

Usurpation of Bilby burrows by Rabbits was probably more relevant (Wood Jones 1924; Ratcliffe

1938; Rolls 1969; Watts 1969; J. Masters and N. Beeck personal communication 1999), although Bolam (1927) noted that Bilbies apparently "live in complete harmony" with Rabbits. In the early 1930s overproduction and declining wheat prices led to severe financial constraints (Bolton 1972: 189) and

facilitated the development of Rabbit plagues on farms in the 1930s (Tomlinson 1979). Perhaps it is only a coincidence that Rabbits are sparse to nearly absent in the northern and central deserts of Western Australia (King 1990), the only parts of Western Australia where the Bilby has persisted.

Introduced Rodents

The House mouse *Mus domesticus* probably became a valuable food resource for the Bilby (cf. Watts 1969). Because it was not a competitor for food, it was not instrumental in that way in the decline and apparent extinction of the Bilby in south-western Australia.

Bycatch from Rabbit Trapping and Poisoning

During the era of Rabbit plagues, poisoned grain and fruit were distributed in agricultural areas to control Rabbits (Crawford 1921; Hoy 1923; Haddleton 1952; Gooding 1956; Leake 1962; Troughton 1965; Udell 1979; Pustkuchen 1981; Ferrell 1992; G. Gardner and W. Bradford personal communication 1999). These baits reduced the abundance of parrots, native mammals and introduced mammals that ate this grain. This incidental mortality of non-target species is here termed bycatch. Being insectivorous and carnivorous (Longman 1922; Jenkins 1974; A. Douglas personal communication 1999), the Bilby ate poisoned grasshoppers, Rabbits, mice and birds (Haddleton 1952; Udell 1979; Pustkuchen 1981; A. Douglas, personal communication 1999). Haddleton (1952), G. Warren, and C. Fawcett (both personal communication 1999) linked the decline of the Dalgyte to poisoning. N. Candy (personal communication 1999) surmised that Dalgytes and Boodies died in their burrows after having eaten phosphorus bait, which is a slow acting poison; this may account for why this factor has generally been underestimated.

Bilbies were also killed through ripping and fumigation of Rabbit warrens on agricultural land (Glauert 1954; Serventy 1954; Jenkins 1974; Hobbs *et al.* 1993), or were killed or maimed in steel traps set for Rabbits (Shortridge 1910; Wood Jones 1924; Leake 1962; Jenkins 1974; N. Beeck, W. de Burgh, J. Masters, D. Vickers personal communication 1999). None of these Rabbit control measures, however, can explain the extinction of the Bilby in nature reserves and national parks and in the Great Victoria Desert, where these practices did not occur.

Vulpine Predation

The Fox colonized south-western Australia in the period 1920–30 (Long 1988). Bilbies declined in the southwest mostly within 10 years of the arrival of the Fox, with the last specimens collected in the area in 1935 (Kitchener and Vicker 1981, Australian

Museum collection) and the last sighting in the 1980s (T. Marden, personal communication 1999). Many interviewees linked the disappearance of the Bilby with the Fox, as have Le Soeuf (1923), Bolam (1927), Serventy (1954), Finlayson (1961), Troughton (1965) and Watts (1969). Erickson (1971: 151) cited anecdotal evidence of "a sudden increase of foxes" in the period 1934–6, based on "an increase of 800% in sheep deaths" on a farm near Calingiri.

The failure of the Fox to become permanently established in the north of Western Australia (King and Smith 1985) may explain the persistence of the Bilby there and its apparent extinction elsewhere in the State (Friend 1990, Christensen and Liddelow 1992). Moreover, in the Warburton region and Gibson Desert the Fox is widespread and Bilby populations appear to be declining (Burbidge and Fuller 1979; Burbidge *et al.* 1988; Christensen and Liddelow 1992). In the Great Sandy Desert, Bilbies still persist (Youngson *et al.* 1981; McKenzie and Youngson 1983) and may be numerous (Burbidge and Pearson 1989), with Fox numbers decreasing at lower latitudes. In the southeast of WA Amy Crocker noted a decline in Bilby abundance at Balladonia after 1917 following the arrival of the Fox (Richards and Short 1996). In 1929, Dingo trapper W.A. Wills collected Bilbies near Rawlinna, noting that "foxes were non existent or very rare" (A.J. Wills, personal communication 1999).

Logging

The Bilby occurred most extensively in forest with a codominant height <25 m (cf. Map 2 of Bradshaw *et al.* 1997; Figure 1 of this paper). Much of this forest remained unlogged until after 1960 (Heberle 1997), for the reason that it is commercially unattractive, as few trees have long boles. Even where it was logged earlier (1940–59), the low density of stumps (pers. obs.) indicates that the impact was not intensive. Furthermore, forest around Chidlow and Wooroloo, where the Dalgyte persisted to 1927–56, was logged in the period from 1880 to 1920 (appendix 5 of Heberle 1997). Much of the south-western geographic range limits of the Bilby lie almost completely east of the high quality jarrah forest (see map on p. 9 of Abbott and Loneragan 1986). For all these reasons, logging may be discounted as a relevant factor.

Mining

The earliest and probably most intensive impact of mining was east of Collie (Heberle 1997), where jarrah forest was logged for props for underground mine shafts in the period 1900–19. Mining for bauxite within the Bilby's geographical range was commenced by Worsley Alumina in 1984 at Mt Saddleback, well after the population crash of the 1930s. Gold mining began near Boddington in 1987 (Bartle and Slessar 1989). In all of these operations,

the actual extent of deforestation is relatively limited.

Synthesis

The above analysis has revealed that some factors are not relevant, others appear to have contributed indirectly, and several have directly influenced the decline and apparent extinction of the Bilby in south-western Australia. Moreover, some of these factors have cross-linkages. In order to clarify the role of this set of interacting factors, it is useful to recognize three categories.

In the context of this paper, pre-disposing factors to the extinction of the Bilby are those natural or pre-European variables that reduce, usually temporarily, population size: drought, aboriginal burning of vegetation, Dingo predation, and disease. Contributing factors are those that have reduced population sizes only since European settlement: clearing of native vegetation, spread of clearing burns to adjacent vegetation, crossing over of diseases from domesticated or feral animals, bycatch from rabbit control programs, and predation by Cats and Foxes. Primary factors are any of those listed with an overarching role in the process of extinction. In the case of the Bilby, all of the circumstantial evidence leads me to concur with the hypothesis proposed by Watts (1969), that the Fox is both the necessary and sufficient factor associated with regional declines.

This hypothesis can be tested by establishing when, in the range of the Bilby in southern Australia, the Fox arrived and the Bilby was last

recorded or observed. Data for New South Wales, South Australia and Western Australia have been taken from Friend (1990), Leake (1962), Jenkins (1974), Ashby *et al.* (1990), Kemper (1990), Tunbridge (1991), Richards and Short (1996), and from this paper. The mean interval between the arrival of the Fox in a district and the last record there of the Bilby varied from 12 years in 1890 to 5 years in 1930 (Figure 4). As the Fox spread from southern Victoria, the Bilby disappeared sooner in southeast South Australia and New South Wales than in Western Australia and northwest South Australia, consistent with the hypothesis.

Drought is a significant pre-disposing factor in that it permits depletion of reduced populations of native species by Foxes and Cats (cf. Morton 1990). The late 1930s and early 1940s was a period of drought in south-western Australia. Fire, depending on its scale, intensity and frequency, temporarily modifies vegetation cover, an important factor in the presence of exotic predators. Sheep damage the ground cover and make it more open, assisting predation by Cats and Foxes. Pastoral areas also tend to have higher Fox numbers due to the presence of dead sheep and cattle on which Foxes can scavenge. Disease epidemics and clearing of native vegetation also reduce population sizes. Rabbits are important because they constitute key prey of Foxes (Catling 1988), allowing these predators to maintain high numbers and continue to prey on declining native species which might otherwise attain an equilibrium with the Foxes, albeit at lower population densities. Predation by

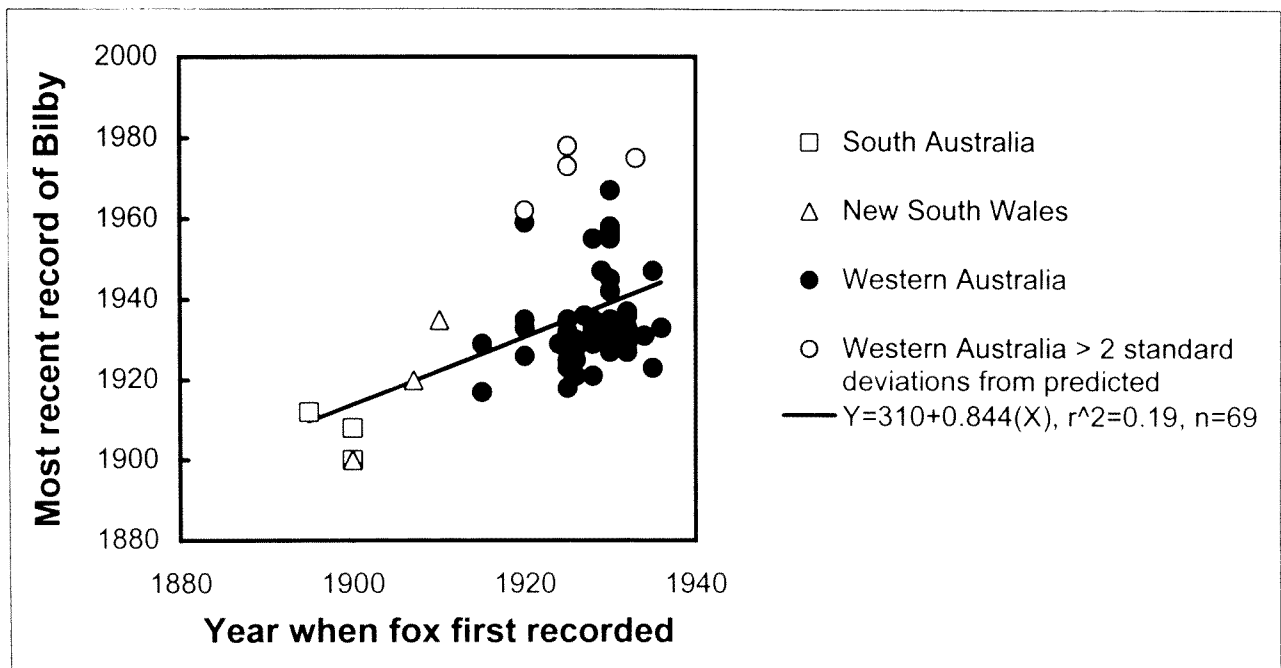


Figure 4 Relationship between the year of arrival of the Fox in localities across southern Australia and the occurrence up to 1945 of the Bilby, now apparently extinct, in the same localities.

Foxes on native mammal species can be unremitting (Smith and Quin 1996). The accidental trapping of Bilbies by rabbiters and the poisoning of Bilbies during the era of the poison cart also reduced population sizes.

Implications for Conservation Management

Due consideration of all of the above issues leads me to formulate an hypothesis that: if the Fox had not established in south-western Australia, the Bilby would have persisted in national parks, nature reserves, the eastern portion of State Forest, and patches of remnant vegetation on agricultural land.

The Department of Conservation and Land Management is now poisoning Foxes over 3.5 M ha of native vegetation in south-western Australia, allowing those species that persisted locally to expand in distribution and abundance, and re-introducing populations of native mammals that have become locally extinct since the 1930s (Bailey 1996). There are proposals to introduce the Bilby to François Péron NP and Fitzgerald River NP, and re-introduce it to Dragon Rocks NR, Karroun Hill NR, Lake Magenta NR and Stirling Range NP (CALM 1999). Bilbies were re-introduced to Dryandra Woodland in May and June 2000. These actions will test the hypothesis stated above.

Translocations of the Bilby into the extensive area of State Forest marked on Figure 2 should also be considered, with initial priority given to the Perup forest. If these re-introductions succeed, the translocated animals should breed, disperse and eventually occupy all suitable habitat. Figure 2 predicts the extent of this distribution and thus the hypothesis proposed in this paper for the original distribution of the Bilby can be tested.

Further Research

A search of the compilation of accounts of early explorations published by Cross (1833) did not yield any records of Dalgytes. It was beyond the scope of this study to read the numerous exploration diaries held in Battye Library. These record observations made during the exploration of south-western Australia in the period 1829 to 1871 (listed by Jackson 1982: 187–195; mapped in Jarvis 1979). Diaries and letters of colonists may also produce additional records. One looks forward to the day when these items, together with colonial newspapers, are electronically scanned and the information contained in them is more readily accessible via searchable databases. Hopefully this paper will stimulate further historical research into circumscribing in more detail the southwest range limits of the Bilby.

Throughout this paper I have used the term 'apparent extinction' rather than 'extinction'. The recent rediscovery of *Potorous gilbertii* at Two Peoples Bay (Sinclair *et al.* 1996) and the re-appearance, after

only one year of Fox baiting, of species thought to have become 'locally extinct' at Lake Magenta NR (Morris *et al.* 1998) demand a more cautious approach to declaring species extinct. Although there was a population crash of Bilbies across regional south-western Australia, a few local populations appear to have persisted into the 1940s, 1950s, 1960s, 1970s and 1980s, almost at random. Why did these and not other populations persist? W.H. Butler (in Bannister 1969) did not locate Bilbies in the southwest localities investigated. Nor did Kitchener *et al.* (1980) locate Bilbies in 23 wheatbelt reserves studied in detail in the period 1971–6. Is there a slim possibility that a Bilby population still exists somewhere in south-western Australia?

The apparent persistence of the Bilby in south-western Australia for nearly 50 years after the last specimen was collected has an interesting implication for 11 other mammal species that were last collected in south-western Australia last century or early in the 1900s. These species, with their last year of collection and the collector, are: *Notomys longicaudatus*, *N. macrotis*, *Pseudomys fieldi*, *P. nanus*, *Rattus tunneyi* and *Chaeropus ecaudatus* (1840s, John Gilbert); *Potorous platyops* (1875, William Webb); *Lagorchestes hirsutus* (1896, John Tunney); *Perameles bougainville* and *Lagostrophus fasciatus* (1906, Guy Shortridge); and *Onychogalea lunata* (1908, John Tunney). In addition, *Bettongia lesueur* was last collected in south-western Australia in 1942 (by Norman Hall). Is it possible that some or all of these species remained undetected in south-western Australia for several decades after the last specimen was collected? If so, it would reinforce the concept, propounded above for the Bilby, that extinction can be a drawn out process to which a number of factors can contribute, and for which the primary factor may differ from species to species.

ACKNOWLEDGEMENTS

I thank: CALM officers A. Annels, R. Brazell, R. Fremlin, M. Graham, G. Liddelow, K. Low, N. Marchant, D. Mell, K. Morris, R. Round-Turner, L. Silvester, R. Smith, M. Stukely, K. Wallace, D. Ward, I. Wilson and T. Wood for suggesting contacts; the interviewees named in the text or listed in Tables 2 and 3 for their willingness and patience in answering my questions; J. Schinzig for his efforts in gathering three additional reports; A. Batt, S. Dennings, P. Leighton, D. Ride, E. Riley, A. Sanders, R. Stan-Bishop, C. Trotter, H. Turnbull and M. White for suggesting contacts; the residents of the southwest listed in Table 3 for providing important information about where the Bilby was not recorded; H. Smith for GIS-cartography; C. Fisher for the records from Gilbert's MSS; A. Wills for information about W.A. Wills' collecting for Taronga Zoo; N. Cooper and M. Triffitt and their

staff at WAM for allowing me access to specimens, catalogues and letter archives; the Australian Museum (per S. Ingleby) and Museum of Victoria (per J. Dixon) for allowing me to include, at no cost, specimen information from their mammal collections; D. Ride for providing details of specimens collected by Shortridge and others; M. Carleton, P. Horton, D. Lunde, and M. Rutzmoser for details of specimens in the National Museum of Natural History (Washington DC), South Australian Museum, American Museum of Natural History (New York), and Museum of Comparative Zoology (Cambridge MA), respectively; CALM librarian L. Wright for making available her 'bibliography' (bibliography of references to *M. lagotis*); and A. Baynes, N. Burrows, P. Christensen and K. Morris for helpful criticism of the manuscript.

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Appendix 1

Chronological synopsis of information about the Bilby in southwestern Australia, based on observations in the period 1837–1935. The original spellings in the quoted documents have been retained.

Information	Reference
<p>"...called by the natives <i>Dalghheit</i>, and by the colonists the <i>Rabbit</i>...A friend of Mr. Gould's residing in Western Australia, states that these animals are found beyond the mountains of Swan River in the district of York. They feed upon large maggots and the roots of trees, and do considerable damage to the maize and potato crops by burrowing. A specimen kept by him in confinement became in a few days very docile, but was irritable, and resented the slightest affront or ill usage".</p>	Reid, 1837
<p>"The animal called <i>Dolgitich</i> by the natives...burrows in the ground, and except in its tail, has a good deal the appearance of the European <i>Rabbit</i>".</p>	Drummond, 1839 [Hooker, 1840: 362]
'dalgert'	Ogle, 1839: 63
'Dulgyte'	Armstrong, 1841
<p>"Some of the smaller animals, such as the <i>dal-gyte</i>...an animal about the size of a weasel, burrow in the earth; these the natives surprise when they are feeding, or dig them from their burrows".</p>	Grey, 1841, vol. 2: 291
<p>"Dol-gyt...has no incisores or cutting teeth...opening of the pouch is from below instead of from above...burrows in the ground".</p>	Moore, 1842 (see Moore, 1884: 23)
'...Dalgyte holes'.	Gilbert, 9.10.1842 [Wagstaffe & Rutherford, 1954: 499]
<p>"Dol-goitch...is a burrowing animal, living in pairs, and choosing spots where there is loose soil; its burrows are in general several feet in depth, and often of very great extent, and its powerful claws enable it to burrow with astonishing rapidity, which renders it anything but easy to capture; it often occurs that while the native is digging along its burrow, the animal becomes alarmed, and commences burrowing upwards from the extremity of its long burrow and thus makes its way out, generally unperceived by the man while employed digging. The Dolgoitch in a state of nature seems to be almost exclusively an insect feeder, and one of its most favourite morsels apparently is the larva of a species of <i>Cerambyx</i>, found in the roots of the Jam-wood (<i>Acacia</i>) this grub too is eaten with great avidity by the Natives, who never fail to cut it out from an exposed root where the Dolgoitch has been unsuccessful. The P[erameles] lagotis is tolerably abundant over the whole of the grass district of the interior where it is exclusively confined. The flesh is extremely delicate, and when boiled greatly resembles that of the common rabbit".</p>	Gilbert, c. 1839–43 [Whittell, 1954b: 110]
<p>"Dal-goitch. Aborigines of the York districts'. This is followed by text similar to that quoted above from Whittell 1954b. The major difference is 'Although I have used the term Dalgyte, as it is in general use among the settlers the proper and correct word of the Natives is Dal-goitch".</p>	Gilbert, 1843a
<p>"Dol-goitch. Aborigines generally". This is followed by text almost identical to that quoted above from Whittell 1954b. Note the following variation: "is tolerably abundant over the whole extent of the sandy districts of the interior of Western Australia."</p>	Gilbert, 1843b
<p>"There were several burrows like boudy holes, inhabited by animals whose tracks resembled those of the dalgite, in these plains, the earth around and thrown out..." [August 1854, c. 80 km southeast of Mt Magnet]</p>	Austin, 1856: 243
<p>Gilbert's remarks about distribution paraphrased as "the grassy districts of the interior of the Swan River colony".</p>	Gould, 1863

Information

Reference

"I have not forgotten the dinner which we had on our return, for it was an exceptional one on a bush animal called a *dolghite*... The *dolghite* proved, as we had expected, so exceedingly like a rabbit when cooked that we could detect no difference in taste...if the *dolghite* is cut up as for a fricasee the slight difference in the shape of the two animals is unperceived, and the flesh of both being white the deception is complete. The parallel, however, does not extend to their disproportions, for the confidence of a *dolghite* is so difficult to obtain that my husband piqued himself not a little in persuading one, that was given him as a pet, to be on terms of even distant civility with us" [1863-9, at York].

Millett, 1872: 169

'dulgate' [1869, c. 30 km southwest of Mt Singleton. Two Aborigines encountered with many animals carried in a net bag].

Forrest, 1875: 64

'dolgite [1870s, ?Dandaragin]

Lovat, 1914: 175

'dalgaitch' [Southwestern Australia]

D.M. Bates, 1904-10 [White, 1985: 368]

"The dalyite runs on four legs like the rabbit, and is very light blue in colour with a long black tail with two inches of white on the end. His nose and mouth are very much like a pig. His ears which are large are about the size of a rabbit. His back feet are the same shape as the boody and his forehands are long with four long sharp nails which are especially adapted for digging. He is a grain eating animal but his chief food is bardies, grubs or insects. He lived in a burrow in the ground but would only make the one single burrow. The dalyite was the means of showing us where to sink for water in the summer time. If you come to a burrow going almost straight down on a sandy patch and there was moisture in the sand which he had dug out of the burrow, you could bet your life he was going down after water and many a good soak has been found through following the dalyite. They were plentiful until the rabbit poison was laid out and I have not seen one in this district since 1935, and he was a dead one. Someone had run over and killed him".

Haddleton, 1952: 98-99

"...makes a larger and deeper burrow than *Bettongia [lesueur]*; the entrance also is almost perpendicular for about two feet and then takes a side turn at right angles. Like a badger, it is difficult to dig for, and will often burrow as fast as a man can dig ...its tail during life has a peculiar downward curl, although possessing no prehensile power. Nocturnal. Not saltatorial, resembling a rabbit in its movements. Tail tipped with a small sharp pointed horny spur rather like that of *Onychogale* ...widely distributed throughout the South-West (except near the coast)...Most plentiful in the inland districts of the South-West, rather frequently caught in traps set for rabbits along the rabbit-proof fence..."Dalgite"...of natives [of southwestern Australia]".

Shortridge, 1910: 831-3

'Dalgoo'

Bolam, 1927: 27

"The Dalgite...a little larger and taller than the Boodie lived like it in burrows, though these were not so extensive as those made by that expert digger. The Dalgite also scatched out its burrows in similar types of soil, but these were generally in open country, often on cleared land, and not right up against rocks or under them. Aborigines say that it was almost impossible for their women to dig out Dalgites...because as soon as they commenced to do so the fugitives did likewise, and burrowed deeper into the ground. By about 1899 they had practically all gone from the Eastern Wheatbelt, but in 1918 after three very wet years, they returned and rapidly increased in numbers, and interfered with rabbit traps who inadvertently caught many of them. At one period their population was dense, and shortly afterwards these numbers decreased rapidly, and by 1929 they disappeared again, and have not returned. ...invariably twins were found in a Dalgite's pouch. Mainly carnivorous, they used to scratch holes straight down to obtain the cream coloured bardies...found in the roots...particularly those of the acacias, and this family of trees was certainly the Dalgite's favourite."

Leake, 1962: 50-1

Information**Reference**

"Despite its attractive colour and softness Dalgite fur was not popular with the trade, partly because the pelts were very tender and partly because of a persistent musty odour. In 1926 rabbits were still scarce in the Northam district and the first fox was exhibited...about a year later. By contrast the burrows of the Dalgite...were quite common in the bush and could sometimes be found in cultivated paddocks. In the early days of settlement the Dalgite was plentiful in what is now the Wheatbelt and no entirely satisfactory explanation has yet been presented for the population crash which occurred about 40 years ago [i.e. 1934]. Dalgites were quite common around Northam in 1926 and their scratchings in search of food could often be seen under jam trees and she-oaks. These scratchings could be distinguished easily from those of rabbits by their conical shape and depth. Although Dalgites fed mainly in the bush their scratchings and burrows were not uncommon in cultivated paddocks and in consequence most farmers regarded them as pests. The Dalgite burrow has but one opening and usually descends in a spiral, often to a depth of about five feet...I obtained a fine specimen which I kept for some time...It refused [to eat apples, grains of wheat, lucerne, lucerne roots, sods of green grass and in fact all the things which it was supposed to damage on the farm] but it did eat bread and milk...Mice and insects were relished, but earthworms were also acceptable, and when natural food was scarce, raw meat was a satisfactory substitute. About that time another pet Dalgite was being kept by L. Glauert...These two individuals were, as far as I am aware, the last South-west Dalgites to be kept in captivity... ..the final disappearance of the Dalgite was probably hastened by the spread of the rabbit...Undoubtedly wholesale clearing and perhaps the arrival of the fox played a part, but by the early 1930's rabbits were assuming plague proportions in many areas and massive control campaigns were enforced. These included not only property netting and poisoning with pollard and phosphorus (probably harmless to the Dalgite), but also burrow fumigation and warren ripping. Anything that looked like a rabbit burrow was treated and so the harmless Dalgite was a frequent, if unintended, victim."

Jenkins, 1974

Appendix 2

List of suspect observations of the Bilby in southwestern Australia, 1963–79. Information paraphrased from CALM file 015178F3807. Omitted are records of obviously misidentified animals or records based solely on supposed burrows of Dalgytes. Listed in chronological order.

Locality and year	Observer	Evaluation
1 mile from Prevelly Park, towards Margaret River (town), July 1963. Resighted in c. 1964 or 1965.	A. Pell saw an animal with long ears, long tail with white crest and ungainly locomotion at 5 pm in stunted peppermint scrub at the side of the road, part of a reserve.	Possible on geographical grounds. The animal was identified from the illustration in Troughton's book (Letter by Hon. Warden E.V. Teede in CALM file 015178F3807). Mr Pell was connected with the Prevelly Park Wildlife Sanctuary. Could the animal have been an escaped pet?
'Mosgiel', Tenterden, c. 1966	H. Wornum. Trapped on private property near a rabbit burrow and released.	Possible on geographical grounds. No description provided.
Near Millars Point, Pallinup Estuary, 1967	H.T. St Jack, W.J. Allwood & J.K. St Jack. Letter mentions Dalgyte, Pinky and Boody Rat as though these names apply to the one species.	Possible on geographical grounds. No description.
Farm at east Kondinin, c. 1967	L.S. Willey. One seen.	Possible on geographical grounds. No description provided.
Little Grove area, Albany, before March 1969	Const. Fitzgerald. Sighted on a number of occasions.	Improbable on geographic grounds. Identified from the illustration in Troughton's book. Scats collected and scrapes and burrows were investigated by J.L. Bannister, Curator of Mammals, WAM, but were determined as being referable to the Rabbit. Could these sightings have been of an escaped pet Bilby?
Little Grove area, Albany, April and May 1969	J. White. c. 1 month after big fires. 9–10 p.m. Animal seen crossing road and described as having long pointed nose, long ears. Tail not seen	Improbable on geographical grounds.
Little Grove area, Albany, September 1969	C. Ostle (Inspector, Dept of Fisheries and Fauna). One seen crossing road, 8 a.m.	Improbable on geographical grounds. I interviewed Colin Ostle in 1999, but he could not recall this sighting. Could this sighting have been of an escaped pet Bilby? (Compare observations cited above for the same locality.)
Near Tenterden, 1969	A. Spratt. Sighted.	Possible on geographical grounds. No description provided.
East Chorkerup (Plantagenet Location 3263), 1970	A.F. Lawrence. One seen.	Improbable on geographical grounds. No description provided.
c. 3 km northeast of Collie, Ewington area, 1971	I. Milroy, reporting observation of one animal by an unnamed neighbour.	Just possible on geographical grounds. No description provided. Secondhand report.
c. 9 km east of Busselton, Sussex Location 7, on Layman [?South] Rd. 1972	A. Selve. One sighted. He reported that he had seen this species in recent years in the Mordalup area east of Manjimup and had caught dozens of them many years ago when they were plentiful in the southwest.	Improbable on geographical grounds. Possible on basis of experience of observer.
c. 19 km southeast of Borden (Kent Location 1233), 1973	R.G. Smith (reported)	Possible on geographical grounds. No description provided.
Buniche siding, 1979	R. Wilson, reported to J. Stevens. In burrow. Like a young rabbit, with a pig's nose and a long tail. Poor quality photograph on file.	Possible on geographic grounds. ?Misidentified rabbits.