

A modern record of the New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse, 1843) (Muridae: Rodentia) on the western slopes of New South Wales, Australia

Michael J. Murphy

NSW National Parks and Wildlife Service (now part of the Department of Environment and Conservation)
Northern Threatened Species Unit. Locked Bag 914 Coffs Harbour New South Wales 2450 Australia

Email: michael.murphy@npws.nsw.gov.au

ABSTRACT

The modern known distribution of the New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse, 1843) (Muridae: Rodentia) in coastal and near-coastal southeastern Australia excludes historical and subfossil records on the western slopes of the Great Dividing Range. A recent record from the Torrington area, in the western part of the New South Wales New England Tablelands bioregion, is documented. The specimen record comprised an intact fresh skull and was distinguished from other rodent species on the basis of dental and cranial characters. This record is significant as one of the first modern records of *P. novaehollandiae* from the western slopes of the Great Dividing Range, lending credence to historical western records and suggesting that the current assessment of the species as secure in New South Wales with minimal reduction in range since European settlement should be reconsidered.

Key words: New Holland Mouse, *Pseudomys novaehollandiae*, Australian native rodent, New South Wales western slopes, range extension, conservation status.

Introduction

Rodents comprise approximately one fifth of Australia's native mammal fauna and occupy a wide range of environments from arid deserts and alpine boulder fields to rainforest treetops and aquatic habitats (Watts and Aslin 1981; Strahan 1995; Menkhorst and Knight 2001). A few species, such as the Long-haired Rat *Rattus villosissimus* and Grassland Melomys *Melomys burtoni*, can sometimes be an obvious component of the local mammal fauna (McDougall 1944; Carstairs 1976). Most Australian native rodents, however, are seldom detected in the wild except by specialised and intensive field survey methods such as the use of Elliott-type traps or analysis of hair from predator scats or hair sampling tubes (e.g. Triggs *et al.* 1984; Norton 1987; Lunney *et al.* 1990; Barker *et al.* 1994; Wilson and Roede 1995; Meek and Triggs 1997; Murphy 1998). Nevertheless, valuable observations concerning these species can occasionally be made opportunistically.

In New South Wales (NSW), native rodents constitute the mammal group of greatest conservation concern (Dickman *et al.* 2000). Of 28 species present in NSW at the time of European settlement, 10 species are presumed extinct in that state and 10 have declined and are considered threatened, using the categories and current listings under the NSW *Threatened Species Conservation Act* 1995 (TSC Act). Declines and extinctions in NSW have been greatest among conilurine rodents, with 19 out of 20 species (95%) affected. In contrast, none of the other 'old endemic' species (1 species of *Hydromys* and 2 species of *Melomys*) and only 1 out of 5 (20%) of the 'new endemic' *Rattus* species are currently considered threatened in NSW. The one

conilurine rodent native to NSW that is not currently listed as threatened or presumed extinct in NSW under the TSC Act is the New Holland Mouse *Pseudomys novaehollandiae*.

Pseudomys novaehollandiae is one of the species to have returned from presumed extinction (Watts and Aslin 1981). A single live animal opportunistically collected by hand in December 1967 in Kur-ring-gai Chase National Park near Sydney, by NSW National Parks and Wildlife Service officer Geoff Spencer, proved to be the first record of the species since 1886 (Mahoney and Marlow 1968). Two months later the species was found to be locally abundant at a site at Port Stephens on the NSW lower north coast (Keith and Calaby 1968). *Pseudomys novaehollandiae* was subsequently found to occur in scattered coastal and near-coastal localities from south-east Queensland to Victoria and north-east Tasmania (Seebeck and Beste 1970; Posamentier and Recher 1974; Hocking 1980; Van Dyck and Lawrie 1997).

Habitat assessments and ecological studies have indicated that the habitat of *P. novaehollandiae* is dry heathland or eucalypt forest/woodland with a well-developed heathy leguminous understorey, typically on sandy soils, with populations reaching highest densities in areas which are in early to mid stages of regeneration following disturbance such as fire (Posamentier and Recher 1974; Wilson 1991). In these areas *P. novaehollandiae* establishes burrows for daytime refuge and feeds at night, primarily on seeds (particularly legumes) as well as leaves, flowers, roots, mosses, fungi and insects (Watts and Aslin 1981; Kemper 1995; Seebeck *et al.* 1996).

Until recently, the modern known distribution of *P. novaehollandiae* excluded historical records west of the Great Dividing Range (Kemper 1977; Watts and Aslin 1981; Menkhorst and Knight 2001). The species was originally described from specimens collected near Scone in the upper Hunter Valley, NSW (Waterhouse 1843). Gould (1863) described the species as occurring on plains and stony ridges on both sides of the Great Dividing Range in northern NSW. Fossil and subfossil records are also known from several localities on the western slopes of central and southern NSW, including near Orange, Yass and Yarrangobilly (Kemper 1977). The slopes and plains of NSW west of the ranges have undergone extensive land clearing and modification since European settlement to become a major pastoral and agricultural region, coinciding with a significant reduction in the regional diversity of native vertebrate fauna species (Barrett *et al.* 1994; Paull and Date 1999). Watts and Aslin (1981) suggested that *P. novaehollandiae* may have been among the suite of native species lost from the western slopes.

This paper reports on a fortuitous recent record of *P. novaehollandiae* from the western part of the New England Tablelands bioregion, on the upper western slopes of the Great Dividing Range in northern NSW. This record is significant as one of the first modern records from the western, inland portion of the species' historical distribution.

Collection and Locality details

A single mouse-size rodent skull was noted and collected from the surface of an ant nest in dry open forest in the Torrington area north-west of Glen Innes during the course of a herpetofauna survey in March 1997. The skull

(Fig. 1) was identified as that of a *Pseudomys* species on the basis of size and the absence of the notch in the upper incisors diagnostic of the House Mouse *Mus musculus* (Watts and Aslin 1981). The specimen was lodged in the Australian Museum (AM specimen M33380), where closer examination identified it as *P. novaehollandiae* (S. Ingleby Aust. Museum pers. comm. 1997). The specimen was re-examined in 2004 and identification as *P. novaehollandiae* confirmed (F. Ford CSIRO pers. comm. 2004). Ford (pers. comm. 2004) provided the following comments on identification:

The skull possesses dental and cranial characters typical of *P. novaehollandiae*, such as bulbous anteriolabial cusps on the M1, and broad zygomatic plate. The bullae are significantly smaller than those of *Pseudomys patrius*, and the M1 lacks an accessory cusp typical of both *P. patrius* and *Pseudomys delicatulus*. The molar row, particularly the M1, is less elongate than both those species. The skull is larger than those of *P. delicatulus*, and is almost identical to an Australian Museum *P. novaehollandiae* voucher from the Apsley Falls area. *Pseudomys pilligaensis* is morphologically analogous to *P. delicatulus*, and is almost certainly a junior synonym of that species on the basis of genetic and morphological characters, and the Torrington specimen is clearly not that "species".

The collection site (151° 36' E, 29° 20' S) (Fig. 2) was located on a low rocky ridge north of the Beardy River, just outside the southern boundary of Torrington State Recreation Area and approximately 12 km north of the village of Emmaville. The Beardy River is within the



Figure 1: Skull of New Holland Mouse (Australian Museum specimen M33380) collected near Torrington in 1997. This opportunistically collected specimen lends credence to statements by John Gould and John Gilbert that the distribution of the New Holland Mouse in the 19th Century extended to the western slopes, and suggests that the current assessment of the species as secure in NSW with minimal reduction in range since European settlement should be reconsidered. Photograph courtesy of Fred Ford.

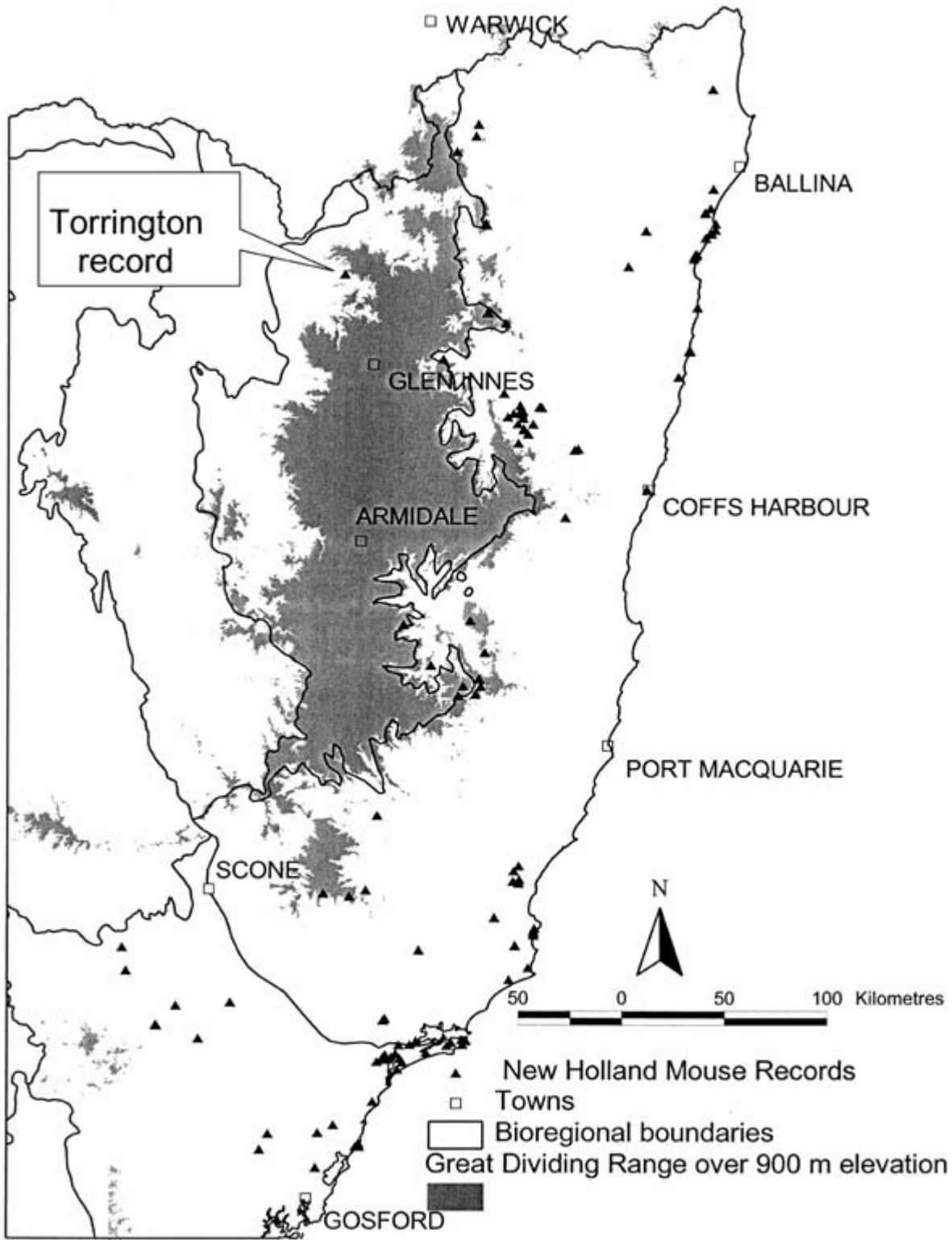


Figure 2: Modern records of the New Holland Mouse in northern New South Wales. The record in the Torrington area is significant as the only one west of the Great Dividing Range watershed. Source: DEC Atlas of NSW Wildlife database. Bioregional boundaries follow Thackway and Creswell (1995).

McIntyre River catchment area in the north-east part of the Murray-Darling basin. The site was at an elevation of 820 m AHD, with a 10° slope and westerly aspect, and was approximately 170 km from the coast on the upper western slopes of the Great Dividing Range.

The vegetation at the site was dry low open eucalypt forest dominated by *Eucalyptus dealbata* and an unidentified Stringybark *Eucalyptus* sp. *Eucalyptus melliodora*, *Eucalyptus prava*, *Callitris endlicheri* and *Angophora floribunda* were also present. Tree height was between 12 and 20 m and

tree DBH (diameter at breast height) was between 10 and 30 cm. Canopy cover was approximately 55%. A well-defined shrub layer dominated by *Olearia elliptica* was present. Other shrubs present included *Cassinia quinquelifolia*, *Melichrus urseolatus*, *Acacia nerrifolia* and *Acacia cheelii*. The ground cover comprised tussock grasses and herbs (about 45% of ground surface), scattered rocks and fallen timber (40%) and leaf litter (15%). The substratum was a sandy soil derived from granite of the Mole Granite formation.

Discussion

The occurrence of *Pseudomys novaehollandiae* on the upper western slopes of the Great Dividing Range reported here indicates a western extension of the species' known modern range. Menkhorst and Knight (2001) described the species as occurring up to 100 km inland and at elevations up to 600 m AHD in northeast NSW and southeast Queensland. The present record extends this by another 70 km inland and 220 m elevation. Other modern records of the species in the New England Tablelands bioregion (Fig. 2), whilst relatively close, are all located along the eastern escarpment within coastal river catchments. The last record of *P. novaehollandiae* on the western side of the Great Divide in northern NSW was by John Gould's collector John Gilbert, who recorded it as abundant near the Gwydir River in the 1840s (Gould 1863).

Troughton (1957), conjectured that the absence of modern records of *P. novaehollandiae* might be due to confusion with the introduced *Mus musculus*, urged readers east or west of the Great Dividing Range to forward specimens to the Australian Museum. Following the subsequent rediscovery of the species in coastal areas, Mahoney and Marlow (1968) voiced doubt over the accuracy of Gilbert's western records, noting that no *P. novaehollandiae* specimens from the Gwydir River area could be found in Museum collections and further noting early confusion and misidentification between *P. novaehollandiae* and other species such as the Sandy Inland Mouse *Pseudomys hermannsburgensis* and Gould's Mouse *Pseudomys gouldi*. Posamentier and Recher (1974) made no mention of historical western records in describing the status and distribution of *P. novaehollandiae*. Watts and Aslin (1981) noted that the modern conception of the species' distribution and habitat differed from that of Gould (1863), and suggested that either the historical western records may have been due to confusion with *M. musculus*, or that the species may have since disappeared from its western distribution as a result of habitat changes caused by pastoral development. Fossil and subfossil records (summarised by Kemper (1977)) confirm that the distribution of *P. novaehollandiae* did indeed extend to the western slopes of NSW in pre-European times. The Torrington record reported here further supports Gould's (1863) statements concerning the continued occurrence of the species on the western slopes into the 19th Century.

Further substantiation of the western slopes occurrence of *P. novaehollandiae* was provided by the recent discovery of the species in Goobang National Park, about 20 km east of Parkes in the northern part of the NSW South Western Slopes bioregion (Faulkner *et al.* 1997). Ford

(pers. comm. 2004) confirmed the identification of the Goobang specimens as *P. novaehollandiae*. Specimens were captured in Elliott-type traps in open forest with a closed heath understorey at a number of different sites in the park in March/April 1997 (W. Faulkner NSW DEC pers. comm. 2002).

Comparison of the Torrington *P. novaehollandiae* site with modern coastal and near coastal habitats of the species indicates broad similarities. In common with the descriptions of preferred coastal habitat (Keith and Calaby 1968; Posamentier and Recher 1974; Wilson 1991; Kemper 1995), the Torrington site had a sandy soil substratum supporting a well-developed shrub or heathy layer under an open forest overstorey. Leguminous flora species recorded at the Torrington site include *Acacia nerrifolia* and *A. cheelii*. A diverse range of leguminous flora species has been recorded in the nearby Torrington State Recreation Area. The description of the Goobang *P. novaehollandiae* sites as open forest with a heath understorey is similarly consistent with descriptions of coastal habitats for the species.

Lee (1995) assessed the national conservation status of *P. novaehollandiae* as secure, with a national decline in distribution estimated as less than 10%. Nevertheless, the species is considered to be of conservation concern in both Victoria and Tasmania. It is currently listed as endangered in the Victorian *Flora and Fauna Guarantee Act* 1988, on the basis of rarity and demonstrable decline (Seebeck *et al.* 1996), and as endangered in the Tasmanian *Threatened Species Protection Act* 1995, on the basis of rarity and unprotected habitat (DPIWE 2004). The status of the species in NSW was regarded by Dickman *et al.* (2000) as secure. However, the confirmation of the species' historical and modern occurrence on the western slopes of NSW indicates that its conservation status in NSW should perhaps be reconsidered.

The western slopes bioregions of NSW are among the most extensively modified areas in Australia. In the New England Tablelands bioregion, 74% of the original vegetation has been cleared since European settlement, 45% of the bioregion is devoted to intensive agricultural or pastoral production and only 2% of the bioregion has been set aside for conservation purposes, while the corresponding figures for the NSW South Western Slopes bioregion are even more dire, with 80% cleared, 55% under intensive production and 1% conserved (State of the Environment Advisory Council 1996). For comparison, in the NSW North Coast bioregion, which supports the greatest number of known populations of *P. novaehollandiae* in NSW, 37% of the bioregion has been cleared, 21% is under intensive production and 8% is conserved (State of the Environment Advisory Council 1996). Given the extent of habitat clearing and fragmentation and the general scarcity of native rodents in the western slopes bioregions in NSW, surviving western populations of *P. novaehollandiae* should be considered to be of conservation concern, and may warrant listing as endangered populations at a bioregional scale under the TSC Act. Managers of western slopes conservation reserves, state forests, crown reserves and

other public lands known or considered likely to support *P. novaehollandiae* should consider conservation actions including field surveys to determine presence of the species, population and habitat monitoring, vouchers and tissue sampling for taxonomic studies, control of feral predators in key areas, and fire management strategies appropriate to the ecological requirements of the species.

The record of *P. novaehollandiae* documented in this paper, like the first modern record of the species in 1967, was the result of acting on a fortuitous opportunity. Both records

demonstrate the value of critical observation in the field and the importance of supporting significant observations with voucher specimens lodged in Museum collections. The status of *P. novaehollandiae* on the western slopes of northern NSW remains largely unknown. Further investigation of the Torrington locality and other areas with potential habitat is urgently needed. In the interim, a precautionary approach should be taken, with western populations of the species afforded consideration and protection as bioregionally significant and at risk of extinction.

Acknowledgements

Thanks to Fred Ford, Sandy Ingleby and Alex Baynes for assistance confirming identification of the *P. novaehollandiae* specimen, Phil Spark for providing a description of vegetation at the Torrington collection site, Bill Faulkner and Murray Ellis for information concerning the Goobang *P. novaehollandiae*

records, Jill Smith for assistance preparing Figure 2, and Dan Lunney, Fred Ford, Catherine Kemper and an anonymous referee for comments on the original manuscript. The author would also like to acknowledge the credit owed to Geoff Spencer's initial interest in small rodents.

References

- Barker, J., Lunney, D. and Bubela, T. 1994. Mammal surveys in the forests of the Carrai Plateau and Richmond Range in north-east New South Wales. *Australian Mammalogy* 17: 19-29.
- Barrett, G. W., Ford, H. A. and Recher, H. F. 1994. Conservation of woodland birds in a fragmented rural landscape. *Pacific Conservation Biology* 1: 245-56.
- Carstairs, J. L. 1976. Population dynamics and movement of *Rattus villosissimus* (Waite) during the 1966-69 plague of Brunette Downs, Northern Territory. *Australian Wildlife Research* 3:1-10.
- Department of Primary Industries, Water and Environment 2004. Parks and Wildlife website [www.dpiwe.tas.gov.au/Parks & Wildlife/Threatened Species/Threatened Species Education Kit/Threatened Species-Mammals/New Holland Mouse](http://www.dpiwe.tas.gov.au/Parks%20&%20Wildlife/Threatened%20Species/Threatened%20Species%20Education%20Kit/Threatened%20Species-Mammals/New%20Holland%20Mouse). Updated 11 May 2004.
- Dickman, C. R., Lunney, D. and Matthews, A. 2000. Ecological attributes and conservation of native rodents in New South Wales. *Wildlife Research* 27: 347-55.
- Faulkner, W., Le Breton, M. and Ellis, M. 1997. *Fauna survey of Goobang and Nangar National Parks*. NSW National Parks and Wildlife Service internal report. NPWS, Hurstville NSW.
- Gould, J. 1863. *The Mammals of Australia*. Vol. III. The author, London.
- Hocking, G. J. 1980. The occurrence of the New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse) in Tasmania. *Australian Wildlife Research* 7: 71-77.
- Keith, K. and Calaby, J. H. 1968. The New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse) in the Port Stephens District, New South Wales. *CSIRO Wildlife Research* 13: 45-58.
- Kemper, C. 1977. The Biology of the New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse, 1843). PhD Thesis, Macquarie University, NSW.
- Kemper, C. 1995. New Holland Mouse. Pp. 611-12 in *The Mammals of Australia*, edited by R. Strahan. Reed Books, Chatswood, NSW.
- Lee, A. K. 1995. *The Action Plan for Australian Rodents*. Australian Nature Conservation Agency Endangered Species Program Project Number 130. Australian Nature Conservation Agency Canberra ACT.
- Lunney, D., Triggs, B., Eby, P. and Ashby, E. 1990. Analysis of scats of dogs *Canis familiaris* and foxes *Vulpes vulpes* (Canidae: Carnivora) in coastal forests near Bega, New South Wales. *Australian Wildlife Research* 17: 61-68.
- Mahoney, J. A. and Marlow, B. J. 1968. The rediscovery in New South Wales (Kur-ring-gai Chase National Park and Port Stephens) of *Pseudomys novaehollandiae* (Waterhouse, 1843) (Rodentia: Muridae). *Australian Journal of Science* 31(6): 221-23.
- McDougall, W. A. 1944. An investigation of the rat pest problem in Queensland canefields: 2. Species and general habits. *Queensland Journal of Agricultural Science* 1: 48-78.
- Meek, P. D. and Triggs, B. 1997. Extension to the range of the Eastern Chestnut Mouse, *Pseudomys gracilicaudatus*, to Jervis Bay, New South Wales. *Australian Mammalogy* 20: 123-25.
- Menkhorst, P. and Knight, F. 2001. *A Field Guide to the Mammals of Australia*. Oxford University Press. Melbourne Victoria.
- Murphy, M. J. 1998. Mammal survey of Seven Mile Beach National Park and Comerong Island Nature Reserve on the south coast of New South Wales. *Australian Zoologist* 30: 419-25.
- Norton, T. W. 1987. The effect of trap placement on trapping success of *Rattus lutreolus velutinus* (Thomas) (Muridae: Rodentia) in north-east Tasmania. *Australian Wildlife Research* 14: 305-10.
- Paull, D. C. and Date, E. M. 1999. Patterns of decline in the native mammal fauna of the north-west slopes of New South Wales. *Australian Zoologist* 31: 210-24.
- Posamentier, H. and Recher, H. F. 1974. The status of *Pseudomys novaehollandiae* (the New Holland Mouse). *Australian Zoologist* 18(2): 66-71.
- Seebeck, J. H. and Beste, H. J. 1970. First record of the New Holland Mouse *Pseudomys novaehollandiae* (Waterhouse, 1843) in Victoria. *Victorian Naturalist* 87: 280-87.
- Seebeck, J. H., Menkhorst, P., Wilson, B. and Lowe, K. W. 1996. *New Holland Mouse Pseudomys novaehollandiae*. Action Statement No. 74. Department of Natural Resources and Environment, Victoria. 8 pp.
- State of the Environment Advisory Council. 1996. *Australian State of the Environment 1996*. CSIRO Publishing, Collingwood, Victoria.

- Strahan, R. (ed.) 1995.** *The Mammals of Australia*. Reed Books, Chatswood, NSW.
- Thackway, R. and Creswell, I. D. 1995** (eds.) *An Interim Biogeographic Regionalisation for Australia: a Framework for Establishing the National System of Reserves, Version 4.0*. Australian Nature Conservation Agency, Canberra. 88 pp.
- Triggs, B., Brunner, H. and Cullen, J. M. 1984.** The food of fox, dog and cat in Croajingalong National Park, south-eastern Victoria. *Australian Wildlife Research* **11**: 491-99.
- Troughton, E. 1957.** *Furred Animals of Australia* (6th edition). Angus and Robertson, Australia. 376 pp.
- Van Dyck, S. and Lawrie, B. 1997.** The New Holland Mouse *Pseudomys novaehollandiae* (Rodentia: Muridae), an addition to the mammal fauna of Queensland. *Memoirs of the Queensland Museum* **42**(1): 367-76.
- Waterhouse, G. R. 1843.** Description of two new species of the genus *Mus*. *Proc. Zool. Soc. Lond.* **1842**: 145-6.
- Watts, C. H. S. and Aslin, H. J. 1981.** *The Rodents of Australia*. Angus and Robertson, Australia. 321 pp.
- Wilson, B. A. 1991.** The ecology of *Pseudomys novaehollandiae* (Waterhouse, 1843) in the eastern Otway Ranges, Victoria. *Wildlife Research* **18**: 233-47.
- Wilson, B. A. and Roede, R. 1995.** Identification of New Holland Mouse, *Pseudomys novaehollandiae*, populations using hair sampling tubes. *Australian Mammalogy* **20**: 135-38.