The Victorian Naturalist

Volume 121(5)

October 2004





Published by The Field Naturalists Club of Victoria since 1884

Distribution, habitat preferences and conservation status of reptiles in the Albury-Wodonga region

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Abstract

Records of reptiles from scientific literature, wildlife atlas databases, unpublished reports, verbal accounts and extensive regional surveys were reviewed and collated to produce a comprehensive list of species known to occur in the Albury-Wodonga region. In total, 52 species of reptile (91 %), from a possible 57 expected species based on current literature, have been recorded within the region and 28 (49 %) occur within the Albury-Wodonga Local Government Area (LGA). Considering zoogeographical distributions and habitat requirements an additional three species may occur within the LGA, and five within the region. Thirty-eight species (73 %) reach limits of their zoogeographical ranges in the region and 14 (27 %) occur ubiquitously in both Eyrean and Bassian regions. Twenty-eight species (54 %) are restricted in range, 17 (33 %) are localised in occurrence and 7 (14 %) are widely distributed across the region. Fifteen species (29 %) are commonly encountered, 20 (39 %) are uncommon and 17 (33 %) are considered rare. Five species recorded in the region are listed under State or National threatened species legislation: the Pink-tailed Worm-lizard *Aprasia parapulchella*, Woodland Blind Snake *Ramphotyphlops proximus*, Lace Monitor *Varanus varius*, Eastern Bandy Bandy *Vermicella annulata* and the Murray/Darling Carpet Python *Morelia spilota metcalfei. (The Victorian Naturalist* 121 (5), 2004, 180-193)

Introduction

South-eastern Australia contains a rich and diverse assemblage of reptiles with representatives from ten out of the twelve Australian terrestrial families (Wilson and Swan 2003). As the study of herpetology advances, phylogenetic relationships will become clearer and additional species will be recognised, whilst others will be recorded in new locations. Much of the continent has at some time been superficially surveyed by herpetologists or collectors working for museums. However many parts of Australia remain poorly surveyed or studied (Brown and Bennett 1995). Although distribution maps and accounts of general habitat preferences exist for most species (Cogger 2000, Wilson and Swan 2003), a vast amount of anecdotal information and faunal sightings remain unpublished (Greer 1989). Locating and identifying reptiles in the field can be difficult and time consuming to the inexperienced. This, coupled with the stigma that reptiles carry, can be disadvantageous to the study of herpetology and may even prevent valuable observations from being made, published or reported to the relevant departments. Not surprisingly, there is a dearth of information regarding the composition and status of reptiles inhabiting the Albury-Wodonga region. With little published information available to land managers, developers and environmental consultants regarding the conservation of reptiles in the region, many species may become increasingly pressured by threatening processes such as the incremental loss of habitat and may continue to experience contractions in range or suffer population declines.

The south-west slopes of NSW represent an area of zoogeographical transition from the inland Eyrean region towards the mesic, Bassian region in the east. The concept of dividing the Australian continent into subregions, such as the northern Torresian, south-eastern Bassian and an inland Eyrean region, is based on broad climate patterns and was first reported by Spencer (1896). These regions have been found to accurately reflect major biogeographic distributions in Australian fauna such as reptiles (Cogger and Heatwole 1981, Keast 1962). A high frequency of species changeover can be expected to occur near these transitional zones (Caughley and Gall 1985). Hence, a diverse assemblage of reptiles could be expected to occur in the Albury-Wodonga region. However, aside from a small number of unpublished local fauna surveys (Bos and Lockwood 1996; Davidson 2000; Klomp et al. 1995, 1996, 2001) few detailed herpetological studies have been conducted in the region. Four studies have focused on the south-west slopes of NSW (Sass 2003, Annable 1995; Caughley and Gall 1985; Lemckert 1998) and one examined the Murray River region (Brown 2002). Some species

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can be considered widespread and common in south-eastern Australia (e.g. Marbled Gecko Christinus marmoratus and Boulenger's Skink Morethia boulengeri, Bennett et al. 1998) and others may have increased in number (e.g. Garden Skink Lampropholis guichenoti and Eastern Brown Snake Pseudonaja texilis), or adapted to urbanisation (e.g. Carnaby's Wall Skink Cryptoblepharus carnabyi and Common Blue-tongue *Tiliqua scincoides*). However, some are rare and others are at risk of becoming locally extinct. A complete inventory of reptiles known to inhabit the Albury-Wodonga region has never been published. Therefore, this paper aims to: (1) document all reptile species known to occur within the Albury-Wodonga Local Government Area (LGA) and within a 50 km radius of the LGA boundary; (2) assess the likelihood of rare, threatened or extra-limital species occurring within the LGA and region; and (3) increase the understanding of reptile distributions, habitat requirements and conservation status within urban and rural environments in this region.

Study Area

The cities Albury and Wodonga, with a combined population of approximately 90 000, are positioned within the south-west slopes bioregion of New South Wales and north-eastern Victoria (Figure 1), at approximately 35° south, 147° west and at an altitude of 180 m above sea level. They straddle the Murray River floodplain and are bordered by low foothills covered in grassy and shrubby woodland and intergrading foothill forest vegetation communities. Remnant vegetation across the landscape is highly fragmented in lowland areas and is predominately confined to elevated ridges and hilltops. The climate for the region has been described as temperate, continental and submesic (Annable 1995), and the area experiences an average annual rainfall of 765 mm. Winters are usually mild with frequent frosts and summer is typically hot and dry with occasional thunderstorms. The average annual temperature ranges from 12°C - 30°C in the summer and 0°C - 12°C in the winter (Commonwealth Bureau of Meteorology 2003). The geology of the region is complex Ordovician and has undergone 450 million years of sedimentation and volcanic activity to produce high-grade phyllite, conglomerates, slate, schist, gneiss and granite outcrops (Joplin 1944).

Vegetation communities vary across the region in relation to moisture, aspect, elevation and soil type. These communities include: (1) plains open woodland dominated by Grey Box *Eucalyptus microcarpa* and White Cypress Pine Callitris glaucophylla in the west; (2) riparian woodland dominated by River Red Gum E. camuldulensis on the floodplain and creek systems; (3) grassy woodlands dominated by White Box E. albens, and the endangered community White Box, Yellow Box E. melliodora, Blakely's Red Gum E. blakelyi woodland, throughout the valleys and slopes; (4) wet and dry forest in the south and east dominated by Peppermint species E. robertsonii, E. dives and Eurabbie E. *bicostata*; (5) shrubby woodland dominated by Long Leaf Box E. goniocalyx, Red Stringybark E. macrorhyncha, Currawang Acacia doratoxylon, Black Cypress Pine C. enderlicheri and Drooping Sheoak Allocasurina verticillata on the less fertile, elevated, rocky sites (Stelling 1994, 1998).

Methods

Records of reptiles occurring in the Albury-Wodonga LGA and surrounding region were obtained from a number of sources which included: (1) the wildlife atlas of New South Wales National Parks and Wildlife Service, Museum Victoria and Atlas of Victorian Wildlife (Department of Sustainability and Environment), (2) unpublished reports conducted by local environmental consultants and the author, (3) personal communications from local naturalists and an extensive network of local landholders and (4) personal observations from selected survey locations within the region since 1997.

Personal observations were made in NSW and Victoria and covered a range of climatic conditions and seasons and were conducted in areas deemed suitable for reptiles over a sixyear period. Survey sites were chosen to represent the broad range of environments and vegetation types reptiles were expected to inhabit in the region. Reptiles were actively searched for beneath suitable cover such as logs, rocks, corrugated iron, leaf litter, behind bark slabs or within rock crevices.

Survey sites include locations such as: (1) in Albury: Nail Can Hill, Black Range, Mungabareena, Eastern Hill, One Tree Hill, Wonga Wetlands; (2) in Wodonga: Huon Hill, McFarlanes Hill and Bear's Hill; (3) in NSW: Gerogery Range, Morgan's Ridge, Tabletop Mountain,

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Fig. 1. Location of Albury-Wodonga study area in south-eastern Australia

Woomargama National Park and Benambra National Park and (4) in Victoria: Mount Granya, Mount Lawson, Chiltern-Mount Pilot National Park and the Baranduda Ranges. Additionally, riparian areas, travelling stock reserves, road and rail reserves and remnant vegetation on private property were surveyed in both states.

An area radiating 50 km from the LGA boundaries was chosen to define the region, roughly bordered by the towns of Culcairn, Granya, Beechworth, Eldorado and Corowa (36° 35′ north, 147° 35′ east, 35° 35′ south, 146° 20′ west). This area was chosen to highlight the diversity of species within a relatively small area, and to assess the likelihood of particular species occurring within the Albury-Wodonga LGA.

An assessment of the local conservation status of reptiles was based on species' presence and abundance at 55 representative survey locations in the study area. Survey sites varied in remnant patch size from 10 - 1000 ha within the LGA to over 10000 ha within the region. Therefore, the survey effort at each site varied but reflected the size of the patch being surveyed. For example, most sites were relatively small (< 1000 ha) and were surveyed on several occasions for a minimum of two hours each period. However, larger sites such as Nail Can Hill and Tabletop Mountain, were surveyed on more than ten occasions and encompass more than 50 hours of active search time.

Within the selected survey locations records of reptiles were obtained from the relevant wildlife atlas database or unpublished reports and supplemented with personal observations. Species recorded from 5 or less locations (< 9 % of sites) were termed 'restricted', between 6 and 27 sites (10 - 49 %) 'localised' and from more than 28 sites (> 50 %) species were considered 'widespread'. Rare species are known from less than 10 records, uncommon species from 11-50 records and common species from more than 50 records across the region. In addition to variation in search area and survey effort, many species may be more common than documented due to their fossorial, nocturnal or cryptozoic behaviour. In the future such species may prove to be more common than currently recognised. Specimens were identified using Cogger (2000) and expected species were included based on the locations in Coventry and Robertson (1991), Swan et al. (2004) and the broad distribution maps provided by Cogger (2000) and Wilson and Swan (2003). An additional nine species not covered in these guides have been included from other sources (author's unpubl. data, Museum Victoria database, NSW NPWS atlas database). Taxonomy and nomenclature in this paper follow Cogger (2000) and zoogeographical preferences were based on Caughley and Gall (1985).

Results

Based on the published literature a possible 57 species of reptile were expected to occur in the Albury-Wodonga region. Of these, 52 species (91 %) from 39 genera and nine families (plus one introduced family) have been recorded within the region. Twenty-eight species (49 %) from 25 genera and eight families have been recorded within the Albury-Wodonga LGA and 23 (40 %) inhabit the Nail Can Hill range in Albury (Appendix 1). Based on habitat preferences and proximity to regional records it is likely that three undetected species occur within the LGA: (1) Broad-shelled Turtle Chelodina expansa, (2) Red-throated Skink Bassiana platynota and (3) Bougainvilles's Skink Lerista bougainvilli and five undetected species may occur within the region: (1) Broad-shelled Turtle, (2) Thick-tailed Gecko Underwoodisaurus milii, (3) Striped Legless Lizard Delma impar, (4) Blotched Blue-tongue Tiliqua nigro*lutea* and (5) Little Whip Snake Suta flagellum.

The study area contains predominantly Bassian species (46 %) followed by 14 Eyrean species (27 %) and 14 ubiquitously distributed species (27 %, Table 1). At least 24 species (46 %) approach zoogeographical limits in the region and show a clear preference for either a western or eastern pattern of distribution. Due to the size of the study area a number of life-forms are present. However, terrestrial species (54 %) form the dominant group, followed by fossorial species (13 %), terrestrial/arboreal species (10 %) and terrestrial/saxicolous species (8 %). Only two species are aquatic and three species are arboreal in the region (Table 1).

The conservation status of reptiles in the region is variable and includes: (1) six widespreadcommon species (12 %), (2) one widespreaduncommon species, (3) nine localised-common species (17 %), (4) eight localised-uncommon species (15 %), (5) 10 restricted-uncommon species (19 %) and (6) 18 restricted-rare species (35 %, Appendix 1).

Species Composition

Chelidae (Two species)

The Eastern Long-necked Turtle Chelodina longicollis is common in localised areas such as

the Murray River, adjacent ephemeral wetlands and farm dams and is frequently observed crossing roads after heavy rain. The Macquarie Turtle Emydura macquarii is largely restricted to permanent water systems, including the Murray River and adjacent wetlands (e.g. Wonga Wetland), and some large artificial dams, (notably a dam on One Tree Hill, Albury) where it can achieve high densities. The Broadshelled Turtle is expected to occur in the region based on the literature and has been recorded depositing eggs near Yarrawonga (100 km west of the LGA, M Herring 2001 pers. comm.). It has also been recorded in Wagga Wagga (Annable 1995) and may be a resident and even nest in the Albury-Wodonga region.

Agamidae (Three species)

The Jacky Lizard Amphibolurus muricatus and Eastern Bearded Dragon Pogona barbata are uncommonly encountered around fallen timber in open woodlands, farmland and occasionally in urban gardens where logs and fence posts are favoured perch sites. The Nobbi Dragon Amphibolurus nobbi has been recorded from Benambra National Park and Mt. Lawson National Park and was first recorded on Nail Can Hill in Albury in September 2003 during a local community biodiversity survey. Twelve individuals, including eleven adults and one juvenile, were found basking on fallen timber along a westerly-facing, well-vegetated, rocky ridgeline. Because of its excellent camouflage and cryptic behavior, the Nobbi Dragon may be relatively common in localised areas within the region and may be confused with the Jacky Lizard.

Gekkonidae (Three species)

The Marbled Gecko is widespread and common in woodlands, urban areas and farmlands across the region. Juvenile Marbled Geckos are frequently encountered beneath ground debris, whereas adults are particularly abundant on large, mature eucalypts with exfoliating bark, such as River Red and Blakely's Red Gums, Apple Box *E. bridgesiana* and Yellow Box. The Eastern Stone Gecko *Diplodactylus vittatus* is common in localised areas especially beneath ground debris in open woodland and dry forests and is particularly abundant where large expanses of exposed bedrock and surface rock occur together. The Southern Spiny-tailed Gecko *D. intermedius*, whilst not expected to occur, reaches

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| Eyrean Species | Ubiquitous Species | Bassian Species |
|---|--|---|
| Emydura macquarii (AQ) Amphibolurus nobbi (TA) Christinus marmoratus (AS) Diplodactylus intermedius (A) Aprasia parapulchella (F) Cryptoblepharus carnabyi (A) Menetia greyii (T) Morethia boulengeri (T) Tiliqua rugosa (T) Varanus gouldii (TA) Morelia spilota metcalfei (A) Ramphotyphlops proximus (F) Furina diadema (T) Suta dwyeri (T) | Chelodina longicollis (AS) Pogona barbata (TA) Diplodactylus vittatus (TS) Delma inornata (T) Lialis burtonis (T) Ctenotus robustus (T) Egernia striolata (AS) Tiliqua scincoides (T) Varanus varius (TA) Ramphotyphlops nigrescens (F) Demansia psammophis (T) Notechis scutatus (T) Pseudonaja textilis (T) Vermicella annulata (F) | Amphibolurus muricatus (TA) Bassiana platynota (T) Bassiana duperreyi (T) Carlia tetradactyla (T) Ctenotus taeniolatus (TS) Egernia cunninghami (TS) Egernia saxatilis (TS) Egernia saxatilis (TS) Egernia whitii (T) Eulamprus heatwolei (T) Eulamprus heatwolei (T) Eulamprus decresiensis (F) Lampropholis delicata (T) Lampropholis delicata (T) Lampropholis guichenoti (T) Lerista bougainvilli (F) Nanoscincus maccoyi (F) Niveoscincus coventryi (T) Pseudomoia pagenstrecheri (T) Pseudomoia pagenstrecheri (T) Pseudomoia spenceri (TAS) Saproscincus mustelinus (T) Austrelaps ramsayi (T) Drysdalia coronoides (T) Rhinoplocephalus nigrescens (T) Pseudechis porphyriacus (T) |
| TOTALS 14 | 14 | 24 |
| (AQ = aquatic, S = saxicolous, A = | arboreal, $F = fossorial$ and $T = terre$ | estrial) |

Table 1. Zoogeographical distributions and life forms of reptiles in the Albury-Wodonga region.

it geographical limit in the region and has only been recorded from Lonesome Pine State Forest (50 km north-west of the LGA, NSW NPWS atlas database) and Galore Hill Nature Reserve (100 km north of the LGA, pers. obs.) where it is found behind the bark of exfoliating Cypress Pine trees Callitris spp. It may also occur in Kentucky State Forest and other areas in the region, which contain mature stands of Cypress Pine. The Thick-tailed Gecko could be expected to occur (Swan et al. 2004). However, there are few records south of the Murrumbidgee River in NSW (NSW NPWS atlas database) or in north-eastern Victoria, although it has been recorded approximately 80 km south-west of Wodonga (Museum Victoria).

Pygopodidae (Three species)

The Olive Legless Lizard *Delma inornata* is uncommonly found across the region in both grassy and shrubby woodland, grasslands dominated by Canary Grass *Phalaris aquatica* and grazed pastures, providing adequate cover from rocks or logs is available. Burton's Snake-lizard *Lialis burtonis* is uncommon in rocky, shrubby woodland and was first recorded on Nail Can Hill in Albury in June 2002 (pers. obs.) and again in September 2002 (G Datson 2002 pers. comm.). It has also been recorded from McFarlanes Hill, and recently (March 2004) from a back garden adjacent to the Baranduda Ranges in Victoria (Museum). This species appears to be relatively abundant in the Victorian area (G Johnson 2001 pers. comm.). Although not expected to occur in the region, the Pink-tailed Worm-lizard Aprasia parapulchella was first recorded on Goombargana Hill in 2000 during a NSW National Parks Association community biodiversity survey and subsequently on Nail Can Hill in August 2002 (pers. obs.) and September 2003 (pers. obs.). The Albury population was found beneath slightly embedded small rhyodacitic rocks in open grassy woodland and is likely to occur in similar areas within the LGA and region.

The Striped Legless Lizard *Delma impar* is expected to occur in the region; however it is a habitat specialist and has been recorded only from relatively undisturbed native grasslands 70 km south of the LGA (Museum Victoria atlas database) and 110 km north-east of the LGA (NSW NPWS atlas database). Some relatively small remnant native grassland areas occur in the study area (e.g. Bonegilla), which warrant further investigation for the presence of this species.

Scincidae (Twenty-six species)

The Red-throated Skink is restricted to grassy woodland and dry forest in the south and east of the region and has not been recorded west of Mt. Granya or Woomargama National Park (NSW NPWS atlas database). The Eastern Three-lined Skink Bassiana duperreyi, Black Rock Skink Egernia saxatilis, White's Skink E. whitii, Southern Water Skink Eulamprus tympanum, Maccoy's Skink Nannoscincus maccoyi, Southern Grass Skink Pseudomoia entrecasteauxii, Spencer's Skink P. spenceri and Weasel Skink Saproscincus mustelinus are predominantly restricted to Victoria in the south and east of the region (Museum Victoria). However, the Eastern Three-lined Skink is known from the Tumbarumba region (Lemckert 1998) and may occur in Woomargama National Park and Mt. Granya because of the similarity in habitat and climate. The Southern Rainbow Skink Carlia tetradactyla is widespread and common in open grassy woodland, edge habitats, farmland and disturbed areas, especially where leaf litter and fallen branches have accumulated beneath trees. Carnaby's Wall Skink is common in localised areas and can be found in both disturbed and intact woodland, edge habitats, farmland and urban areas. It can reach high densities on dead trees and urban structures such as walls and fences.

The Eastern Striped Skink Ctenotus robustus is widespread in most vegetation communities including disturbed areas and occasionally in dry foothill forest where it is encountered in grassy areas near fallen timber and scattered rock. The Copper-tailed Skink C. taeniolatus is localised in shrubby woodland and dry forest predominantly east of Tabletop Mountain and Nail Can Hill where it is locally common, especially where large expanses of exposed bedrock and scattered surface rock occur together. Cunningham's Skink Egernia cunninghami reaches its western geographical limit in the region on the Black Range in Albury, occurring as a small isolated population along Bungambrawatha Creek, but it penetrates further inland in Victoria. It is predominantly localised in the south-

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east of region and can be relatively abundant on granite outcrops in farmland, woodland and dry forest. The Tree Skink *E. striolata* is locally common in open woodland and dry forest and is closely associated with rocky outcrops, exfoliating bark and crevices formed in mature or stressed eucalypt trees. Only a few arboreal populations persist in the region and it could be considered predominantly saxicolous in lowland parts of the study area.

The Yellow-bellied Water Skink Eulamprus heatwolei is relatively common in Wodonga (Museum Victoria), particularly along the Murray River and House Creek (G Slade 2002 pers. comm.). It favours the creek systems and adjacent woodland and forest habitats and penetrates further west into Victoria via the Murray River. Within the region the Three-toed Skink Hemiergis decresiensis is found predominantly east of the Hume Highway in woodland, dry forest and farmland where it can be extremely abundant beneath fallen timber and surface rocks. The Delicate Skink Lampropholis delicata occurs in the grassy, dry forest in the east and has not been recorded west of Mt. Granya. The Garden Skink L. guichenoti also occurs predominantly in the eastern half of the region but has been recorded from the summit of Tabletop Mountain (pers. obs.). Bougainville's Skink is extremely localised within the region and has been recorded only from Woomargama National Park and Gerogery Hill in NSW, but is relatively common in the Victorian dry foothill forests in the south and east of the region. Because it is fossorial and belonging to a specialized burrowing group of lizards, its distribution in the region may reflect a preference for a specific soil type.

Grey's Skink *Menetia greyii* is restricted to the open grassy woodlands west of Albury and the Old Olympic Highway where it has been recorded from Hamilton Valley, Howlong, Walbundrie and Walla Walla (pers. obs.). Because of its small size it can be difficult to detect and may turn out to be relatively common along well-vegetated roadsides in the north and west of the region. Boulenger's Skink *Morethia boulengeri* occurs widely across the region and in most vegetation communities, including low elevation dry forest where it can be extremely abundant around fallen timber. Coventry's Skink *Niveoscincus coventryi* is known to occur in the region only from a survey conducted in Benambra National Park by NSW State Forests in the late 1970's (B Plunket 2001 pers. comm.). It is unclear whether this species actually occurs within the region, as it typically prefers wet forests east of the study area (Bennett 1997). Similarly, the Tussock Skink Pseudomoia pagenstrecheri is known only from a record near the township of Granya (Museum Victoria) and is typically associated with native grasslands (Bennett 1997). The Eastern Blue-tongue is widespread across the region in grassy woodlands and farmland and can reach high densities in urban areas. Although not expected in the region, the Shingleback Tiliqua rugosa is known from a specimen recorded on private property near Morven in NSW (35 km north of the LGA, P Herriot 2002 pers. comm.) and another specimen from Eldorado in Victoria (Museum Victoria) but is predominantly absent in the region (Swan et al. 2004, Wilson and Swan 2003). The occasional vagrants that appear in urban areas are undoubtedly escaped captive specimens.

No other scincids are expected; however, it is likely that Bougainville's Skink, recorded only 20 km north-west of Albury (pers. obs.) may occur within the LGA, and the Blotched Bluetongue, recorded 75 km east of Wodonga (pers. obs.) may occur within the region.

Varanidae (Two species)

The Lace Monitor Varanus varius occurs as two color morphs and is widely distributed but uncommonly encountered across the region. It is usually observed along well-timbered roadsides and large areas of remnant vegetation, especially where mature, hollow bearing trees and fallen timber occur. Occasional individuals are seen on Nail Can Hill and one specimen was even retrieved from a shop door on the main street of Albury during 1997 (M Basler 1997 pers. comm.). The Sand Goanna V. gouldii is poorly documented in the region, but known to occur on a property 15 km west of the LGA (S Lucas 2002 pers. comm.). There are also historical records from Tabletop Mountain, 25 km north of the LGA (R Patterson 2002 pers. comm.) and from Talgarno in Victoria (Museum Victoria). However, the absence of recent reliable records tends to indicate that the species has declined dramatically in the region and now occurs at such low densities that a sustainable population is unlikely.

Boidae (One species)

The Murray/Darling Carpet Python Morelia spilota metcalfei is presumed to no longer occur within the LGA but is still uncommonly encountered in the region near rocky outcrops, heavily timbered woodlands and occasionally in the rafters of rural buildings. Anecdotal evidence suggests pythons from Queensland (possibly the subspecies M. s. macdowelii) have been introduced to some properties near Gerogery during the early 1900s to control rodents (J. Nagel 2001 pers. comm.) and specimens from the NSW south-west slopes bioregion were taken and introduced to the Griffith irrigation areas. However, there have been no confirmed records of subspecies other than M. s. metcalfei in the region.

Typhlopidae (Two species)

The Woodland Blindsnake *Ramphotyphlops* proximus is rare in the region and has only been identified at two localities in Albury, (Hamilton Valley and Mount Budginigi). Both specimens were found beneath deeply embedded, granite rocks in open woodland and on relatively humid days after heavy winter rain (pers. obs.). Another species of Blindsnake *R. nigrescens* is often unearthed during agricultural activities in the region and can also be found beneath embedded rocks, particularly in the dry forests in the east and south of the region. It is yet to be recorded within the LGA (Museum Victoria atlas database).

No other typhlopids are expected to occur in the region, however, due to the fossorial and cryptic nature of these reptiles. Additional species or undescribed forms may be detected in the future.

Elapidae (Ten species)

The Highlands Copperhead Austrelaps ramsayi, Eastern Small-eyed Snake Rhinoplocephalus nigrescens and White-lipped Snake Drysdalia coronoides are restricted to the cooler dry forests in the east and south of the region, where they have been recorded infrequently in the past and from few locations (Museum Victoria atlas database). Although not expected, the Yellow-faced Whip Snake Demansia psammophis has been recorded once from Tabletop Mountain (R Patterson 2002 pers. comm.) and twice since 2001 near Talmalmo in the northeast of the region (S Hartvigson 2002 pers. comm.). It may also occur in similar habitats in Victoria. Likewise, the Red-naped Snake is not expected to occur in the region but recently an individual was uncovered beneath debris west of Tabletop Mountain near Mullengandra (C Grabham 2004 pers. comm.) and another specimen was accidentally killed on a property adjoining Woomargama National Park in 2001 just outside the region (A Hicks 2003 pers. comm.). It is a cryptozoic species and has been recorded near Tumut (Swan *et al.* 2004) and Wagga Wagga (Sass 2003, Annable 1995), and may occur in low densities in the north of the region.

The Eastern Tiger Snake Notechis scutatus is uncommonly encountered on the Murray River floodplain and adjacent wetlands and appears to have suffered a dramatic decline because of changes in hydrology, habitat loss and human persecution (Shine 1991). The Red-bellied Black Snake Pseudechis porphyriacus is commonly encountered in riparian environments, woodlands and urban areas and The Eastern Brown Snake is common in grassy woodlands, farmland and occasionally in urban areas. Dwyer's Snake has been recorded beneath surface rocks in grassy woodland on Nail Can Hill on several occasions (I Davidson 2003 pers. comm.) and on Gerogery Hill in August 2003 (pers. obs.). This species may be relatively common in the region, and is possibly mistaken for juvenile Brown Snakes and consequently killed. The Eastern Bandy Bandy Vermicella annulata is only known from Chiltern-Mount Pilot National Park in the south-west of the region (Museum Victoria atlas database and Atlas of Victorian Wildlife). A specimen found in a soil mixer at the old Albury-Wodonga Development Corporation nursery (Wandoo) during the early 1990's (G Datson 2003 pers. comm.) may have been a local specimen.

Although expected, the Little Whip Snake has not been recorded south of Batlow in NSW (Lemckert 1998) or north of Tatong in Victoria (Museum Victoria), but may occur in low densities in the north-east of the region where suitable habitat and climatic patterns exist.

Colubridae

No species of colubrid are expected to occur in the region. However, a Green Tree Snake *Dendrelaphis punctulatus* was recorded from open woodland near the Hume Highway close to the township of Woomargama 50 km north-east of the LGA in 1995 (Klomp *et al.* 1995). This individual was possibly accidentally introduced during transportation of fresh goods along the Hume Highway or may have been an escaped or released captive specimen.

Discussion

With 52 species of reptile, from 39 genera and nine families, recorded within the region, reptile diversity reflects what is expected for the area according to the current literature. A total of 52 species has been suggested as occurring within the south-west slopes of New South Wales (Caughley and Gall 1985) and approximately 50 are expected, based on the broad distribution maps and point locations provided by field guides (Cogger 2000, Coventry and Robertson 1991, Swan et al. 2004, Wilson and Swan 2003). Comparatively, 48 species have been documented for the Wagga Wagga LGA (Sass 2003) and 18 species for the highland region surrounding Tumbarumba (Lemckert 1998). Nine species not mentioned for the study area by field guides have been recorded either within the LGA (e.g. Pink-tailed Worm Lizard and Nobbi Dragon) or near the periphery of the region (e.g. Southern Spiny-tailed Gecko, Delicate Skink and Yellow-faced Whip Snake), giving 57 expected reptile species for the region.

The five species expected in the region but not yet recorded include the Broad-shelled Turtle, Thick-tailed Gecko, Striped Legless Lizard, Blotched Blue-tongue and Little Whip Snake. It is possible that the paucity of records surrounding the study area for some of these species (Swan et al. 2004; Museum Victoria) in part reflects their secretive behaviours and specialised habitat requirements, and not a genuine absence from the region. Species such as the Thick-tailed Gecko, Striped Legless Lizard and Little Whip Snake can be cryptic and difficult to detect, but all three species have disjunct populations to the north and south of the region, suggesting that they may occur in the study area in low densities. Likewise, even though the Broad-shelled Turtle prefers deeper waters downstream from Albury, the numerous oxbow lakes and ponds created below the Hume Dam are known as important nesting sites for the other chelid species (Thompson 1993). However, the Blotched Blue-tongue, which prefers higher elevations and/or a cooler climate further to the east, may truly not occur in the region.

Some species have undoubtedly declined or become locally extinct within the LGA. For example, the Carpet Python was once recorded from Pemberton Park near Monument Hill in Albury during the early 1970s (M. Miles pers. comm.) but has not been recorded since within the LGA. This is surprising considering this species has adapted fairly well to urbanization in other areas of Australia such as Sydney and Brisbane (Fearn et al. 2001). The reasons for decline are unclear but are probably due to a combination of factors such as loss of habitat, increased predation by exotic predators and even theft (pers. obs). Also, a distressing phenomenon is that many offenders still shoot 'the odd monitor' on farmlands across the region (S Lucas May 2004 pers. comm.).

Eighteen species are considered restricted and rare in the present study. However, eleven of these are cool-temperate, Bassian species that are at the extreme western limits of their distributions within the region and prefer the cooler environments further east (Bennett 1997, Cogger 2000). Some of these species may not have experienced the same levels of environmental stress, that many ubiquitous and Eyrean species in the region might have suffered, because of differing disturbance histories and current agricultural practices associated with each region. Indeed, the wheat and sheep belt is a huge productive agricultural belt that encompasses many more Eyrean species than Bassian species in the region. Importantly, it is those species that naturally occur in low densities, occupy large home ranges, have restricted distributions or specialise in particular habitats that are of most concern in the region. Such species, which include the Nobbi Dragon, Southern Spiny-tailed Gecko, Pink-tailed Worm-lizard, Bougainville's Skink, Woodland Blindsnake, Lace Monitor, Red-naped Snake, Eastern Small-eyed Snake and Murray/Darling Carpet Python, may require further investigation.

Incremental loss of habitat is a threatening process that has been linked to declines in approximately 30 Australia reptile species, of which approximately 10 are found within open woodland habitats (Cameron 1993). This threatening process is regarded as being one of the most important issues in this region. Structurally important microhabitats which take a long time to recover or be replaced, such as native ground cover, the soil surface substrate,

fallen timber, surface rocks and dead trees are continuously being removed and destroyed, exacerbating the problem in rural areas (Brown 2001, Hadden and Westbrooke 1996). Therefore, many species and populations will be viable in the long-term only if structural complexity is conserved, habitats are restored, and species are able to move freely through the landscape. For example, many reptiles, including threatened species, are known to quickly utilise old fence posts that are introduced to grazed landscapes devoid of ground debris (Michael et al. 2004). With some alterations to the way the rural environment is managed and wildlife habitat is valued, biodiversity conservation and agriculture can be strategically integrated (see Bennett et al. 1998, Lindenmayer et al. 2003) with positive results to the human community, economy and environment.

Conclusion

With over 50 species of reptile persisting in the Albury-Wodonga region, the area is extremely important in terms of reptile diversity and threatened species conservation. This study has identified a diverse reptile fauna inhabiting the region, with specific trends in distribution patterns and habitat preferences. Some species are abundant and widely distributed, and have even coped with and adapted to urbanisation and the persistent levels of disturbance in woodland and agricultural areas. However, many species currently occur in localised areas with suitable habitat and may be genetically isolated from neighbouring populations. Remnant habitat exists predominantly on ridges and hilltops, whereas lowland areas are particularly depauperate. This disparate distribution of remnant habitats has implications for the distribution of specialist species, dispersal patterns and gene flow. The long-term viability of many species in rural areas will largely depend on changing attitudes to biodiversity conservation and sustainable land practices, and people's willingness to become pro-active in pursuing habitat restoration.

Acknowledgements

Thanks to the numerous landholders who allowed access to their properties and liberally shared their local knowledge with me. Also to Glen Johnson (Department of Sustainability and Environment) for providing departmental records, Nick Klomp and Ian Davidson for access to unpublished reports. To my partner Tracy for continuous encouragement and support during the numerous field excursions and to colleagues Matthew Herring, Craig Grabham and Mason Crane for field assistance and many shared discoveries. I would also like to thank Ian Lunt, Nick Clemann and an anonymous referee who greatly improved an earlier version of this manuscript, and Simon MacDonald for producing the location map.

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Received 13 November 2003; Accepted 1 July 2004

Research Reports



Pink-tailed Worm-lizard Aprasia parapulchella.



Eastern Stone Gecko Diplodactylus vittatus.

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| Appendix | |

| Common Name | Scientific Name | Study area Victoria | NSW | C'wealth | Nearest record to LGA | Sources |
|---|---|---|-----|----------|---|---|
| CHELIDAE Broad-shelled Turtle Eastern Snake-necked Turtle Macquarie Turtle | Chelodina expansa Chelodina longicollis Emydura macquarii macquarii | NA V Lc Ru | | RI | Yarrawonga Murray River Murray River | $1 \\ 1, 2, 3, 6 \\ 1, 2, 3, 6$ |
| AGAMIDAE Jacky Lizard Nobbi Dragon # Eastern Bearded Dragon | Amphibolurus muricatus Amphibolurus nobbi nobbi Pogona barbata | Lu Rr Lu | | | Nail Can Hill Nail Can Hill Nail Can Hill | 1, 2, 3, 6 1, 2, 3, 6 1, 2, 3, 6 |
| GEKKONIDAE Marbled Geeko Southern Spiny-tailed Geeko # Eastern Stone Geeko Thick-tailed Geeko | Christinus marmoratus Diplodacytlus intermedius Diplodacytus vittatus Underwoodisaurus milii | Wc Lc NA | | | Nail Can Hill Lonesome Pine Nail Can Hill Wagga Wagga | $\begin{array}{c} 1,2,3,6\\ 1,2,3,6\\ 8,2,3,6\end{array}$ |
| PYGOPODIDAE Pink-tailed Worm-lizard # Striped Legless Lizard Olive Legless Lizard Burton's Snake-lizard | Aprasia parapulchella Delma impar Delma inornata Lialis burtonis | Ru E NA E Lu Ru | >> | >> | Nail Can Hill Tarcutta 1 Nail Can Hill Nail Can Hill | 6 1, 2, 3, 6 1, 3, 6 |
| SCINCIDAE Eastern Three-lined Skink Red-throated Skink Southern Rainbow Skink Carnaby's Wall Skink Eastern Striped Skink Copper-tailed Skink Unite's Skink Three Skink White's Skink Volten-bellied Water Skink Southern Water Skink | Bassiana duperreyi Bassiana platynota Carlia tetradactyla Cryptoblepharus carnabyi Ctenotus robustus Ctenotus taeniolatus Egernia astriolata Egernia striolata Egernia whitii Eulamprus heatvolei Eulamprus tynpanum tympanun | Ru Ru Lc Lc C Kr Ru Kr | | | Mt Big Ben Mt Granya Nail Can Hill Nail Can Hill Nail Can Hill Nail Can Hill Black Range Mt Stanley Nail Can Hill Murray River Yackandandah | م م م م م م م ب م م م م م م م ب ب ب ب ب |

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|---|--|--|---|---|
| Nail Can Hill Mt Granya Nail Can Hill Gerogery Hills Nail Can Hill Nail Can Hill Mt Granya Benambra NP Mt Big Ben Granya area Mt Big Ben Tallangata Cudgewa Nth Nail Can Hill Morven | Bungowannah Nail Can Hill | Tabletop Mt | Burrumbuttock Nail Can Hill | Mt Big Ben Woomargama Mt Lawson Mullengandra Murray River Nail Can Hill Mt Lawson Nail Can Hill Mt Lawson |
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| Hemiergis decresiensis Lampropholis delicata Lampropholis guichenoti Lerista bouganvilli Morethia boulengeri Morrethia boulengeri Nannoscincus maccoyi Niveoscincus marceri Pseudomoia entrecasteauxii Pseudomoia entrecasteauxii Pseudomoia peneeri Saproscincus mustelinus Tiliqua nigrolutea Tiliqua rugosa asper | Varanus gouldii Varanus varius | Morelia spilota metcalfei | Ramphotyphlops nigrescens Ramphotyphlops proximus | Austrelaps ramsayi Demansia psammophis Drysdalia coronoides Furina diadema Notechis scutatus Pseudonija textitis Rhinoplocephalus nigrescens Suta dwyeri |
| Three-toed Skink # Delicate Skink # Garden Skink Grey's Skink Boulenger's Skink # Maccoy's Skink # Coventry's Skink # Southern Grass Skink # Tussock Skink # Spencer's Skink Blotched Blue-tongue Common Blue-tongue | VARANIDAE Sand Goanna Lace Monitor | BOIDAE Murray/Darling Carpet Python | TYPHLOPIDAE Blind Snake Woodland Blind Snake | ELAPIDAE Highlands Copperhead Yellow-faced Whip Snake # White-lipped Snake Red-naped Snake Eastern Tiger Snake Red-belled Black Snake Eastern Brown Snake Eastern Small-eyed Snake Dwyer's Snake |

Appendix 1 cont.

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| Appendix 1 cont. | | | | | | | |
|--|---------------------------------------|----------|----|---|----|------------------------|-----------|
| Little Whip Snake Eastern Bandy Bandy | Suta flagellum Vermicella annulata | NA Rr | nt | > | RI | Tumbarumba Mt Pilot | 4 1, 3 |
| COLUBRIDAE Green Tree Snake #* | Dendrelaphis punctulatus | NA | | | | Woomargama | 5 |
| Total number of species | 57 | 52 | | | | 28 (LGA) | |

W = widespread, L = localised, R = restricted, c = common, u = uncommon, r = rare. Victoria: FFG Act (1998) V = vulnerable, E = endangered, dd = data deficient, nt = near threatened; NSW: TSC Act (1995) and Commonwealth: EPBC Act (2000) V = vulnerable, RI = rare insufficiently known. NA =expected but not recorded, # = not represented in the region within current distribution maps in field guides, * = vagrant).

Sources:

- 1 Museum Victoria wildlife atlas database (2003) Bioinformatics wildlife atlas,

 - 2 NSW NPWS wildlife atlas database (2003),
 3 DSE (2003) Atlas of Victorian Wildlife,
 - 4 Lemckert (1998),
 - 5 Klomp et al. (1995),
- 6 DR Michael (unpubí. data 1997 2003), 7 Davidson (2000), 8 Annable (1995).