THE REPTILE FAUNA OF THE UPPER BILLABONG CREEK CATCHMENT AREA, SOUTHERN NEW SOUTH WALES

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ABSTRACT

The Upper Billabong Creek Catchment Area is centred on the rural town of Holbrook in southern New South Wales. The catchment has undergone significant changes over the past 120 years resulting in widespread clearing of native vegetation. Despite comprehensive research on birds, mammals and vascular plants throughout the region, the reptile fauna has received little attention in surveys within this fragmented landscape. Systematic surveys for reptiles in 2005-06 recorded 28 species and revealed differences in reptile distribution patterns across the catchment. A review of previous studies and records from the NSW Atlas of Wildlife database provide an additional 12 species, giving a total of 40 species known to be present in the Upper Billabong Creek Catchment. The presence of reptiles of conservation significance is discussed, including the recent detection of the Pink-tailed Worm Lizard (*Aprasia parapulchella*). This species is listed as endangered under both NSW and Commonwealth legislation and it is recommended that catchment-wide surveys to better understand their distribution be given high priority. This paper provides a comprehensive inventory of reptile fauna in the Upper Billabong Creek Catchment for natural resource managers.

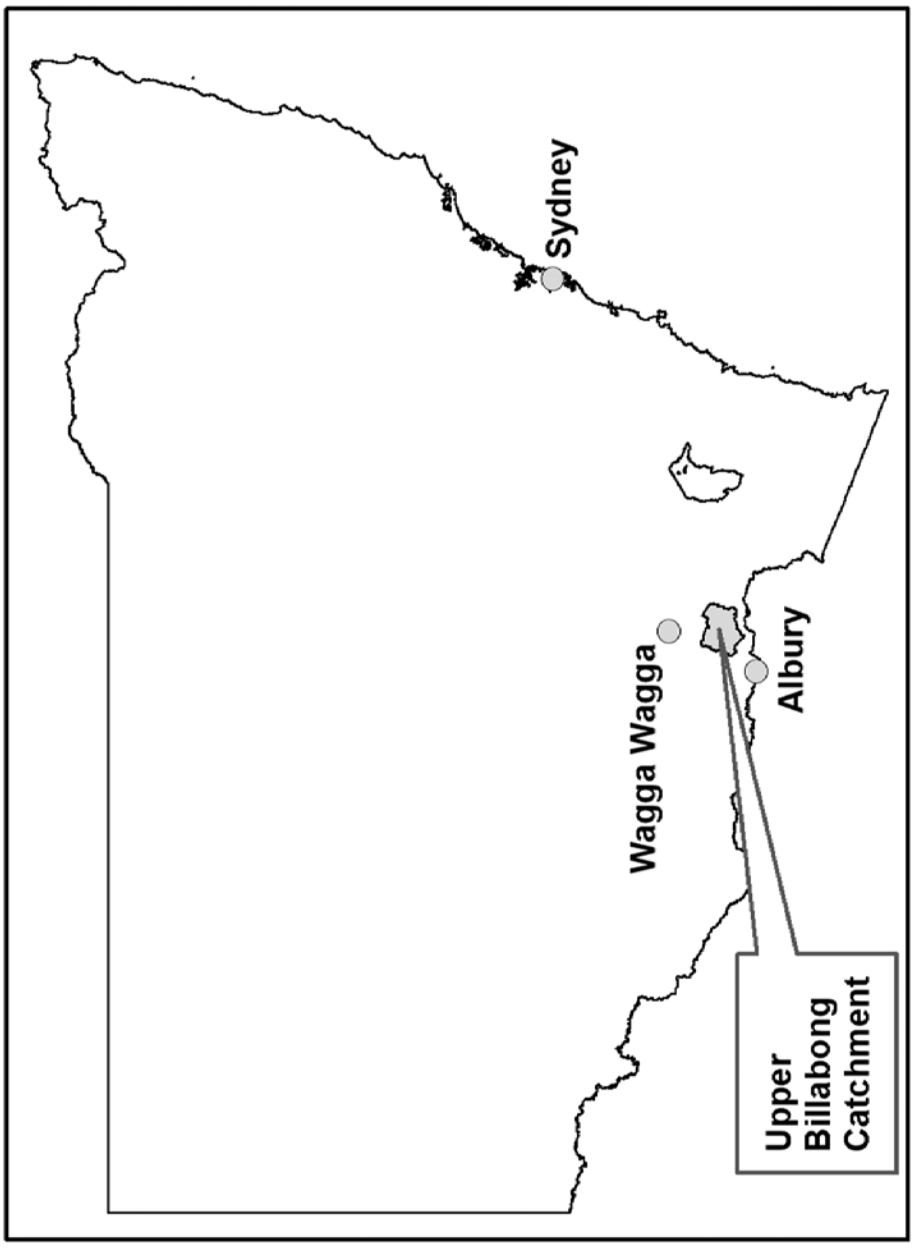
INTRODUCTION

The Upper Billabong Creek catchment area in southern New South Wales has undergone extensive clearing, much of which occurred some 120 years ago (Woodward, 1998). As a result, remaining native vegetation comprises many small fragments accounting for less than 10% of its original extent (Woodward, 1998). Many of these fragments are classified as grassy box woodland (also referred to as box gum woodland), an endangered ecological community recognised under Schedule 3 of the NSW Threatened Species Conservation Act 1995 and also the Commonwealth Environment Protection and Biodiversity Act 1999.

In recent years, several workers have provided general information on the status and distribution of herpetofauna across the wider south-west slopes region (Annable, 1995; Daly, 2004; Lemckert, 1998; Michael, 2004; Sass, 2003). Despite the ecological importance of the Upper Billabong Creek catchment community, few studies have specifically focussed on the reptile fauna within the area. However, with the upgrading of the Hume Highway to dual carriageway within this catchment, several environmental assessments have been undertaken during the past 12 months.

To better understand the reptile fauna of the Upper Billabong Creek catchment area and make informed decisions about their future management, a comprehensive inventory of these species is an important tool for natural resource managers. This paper documents the reptile fauna of the Upper Billabong Creek area recorded during a study undertaken in 2005/06 (see Sass, 2007) and reviews previous studies available in the scientific literature to develop a comprehensive inventory of reptile species for the catchment.

Figure 1. Location of the Upper Billabong Creek Catchment study area.



METHODS

Study area

The study area is located within the Upper Billabong Creek catchment in southern NSW (Figure 1). The catchment is around 80,000 hectares in area (Baker *et al*., 2001) and is located within the South Western Slopes Bioregion (Thackway & Creswell, 1995) bordered by the Riverina bioregion to the west and the South Eastern Highlands bioregion to the east. The study area occupies a transitional climatic region between the more mesic highland areas to the east and the drier plains to the west (Caughley & Gall, 1985). The mean annual rainfall is approximately 700 mm, however, this varies widely across the catchment with up to 900 mm in the far south-east to 550 mm in the west of the catchment (Bureau of Meterology, 2006; Caughley & Gall, 1985).

Vegetation types

The vegetation types within the Upper Billabong Creek catchment reflect the changing geology and climate of the region (Table 1). Dry foothill forests dominate the upper slopes and ridges of the east, while grassy box woodlands favour the lower slopes and rises in the central and western parts of the catchment (Costello, 2001). River red gum (*Eucalyptus camaldulensis*) dominates the riparian areas and floodplains, however, in the east, Blakely's red gum (*E. blakelyi*) occupies most riparian areas (Costello, 2001).

Elevation

The Upper Billabong Creek catchment has a wide elevation range which is likely to influence vegetation communities and faunal assemblages of the study area. The highest parts of the catchment occur in the upper slopes and ridges of the east peaking at 889 metres above sea level (asl), while the plains in the west are as low as 220 m asl (CSIRO, 2002).

Survey methods

Between September 2005 and January 2006 reptiles were surveyed across 43 sites which included 40 fragments ranging from 1 ha to 28 ha and three larger reference sites (between 115 ha and 2500 ha) using pitfall traps with drift fences over 1,144 pitfall trap nights and active hand searches for 92 person hours. Further details of survey methods are detailed in Sass (2007).

Searches of the DECC NSW Atlas of Wildlife database, Internet sites, journal paper data-

Table 1. A general description of the vegetation types within the study area

Vegetation type	General description
Dry foothill forest	A medium forest up to 15 m tall which is usually dominated by Red Stringybark *Eucalyptus macrorhyncha*. Other species of eucalypt that are co-dominant included inland Scribbly Gum *E.rossi*, Apple Box *E. bridgesiana* and Bundy *E.nortonii*.
Grassy box woodland	An open woodland community where the dominant overstorey species are White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and/or Blakely's Red Gum *E. blakelyi*.
Riverine forest/woodland	An open forest or woodland of up to 25 m tall dominated by River Red Gum *E. camaldulensis* that occurs on alluvial soils along watercourses in the west of the catchment, whilst Blakely's Red Gum *E.blakelyi* replaces this species in the east.

bases and consultations with researchers who have worked in the study area were undertaken to identify previous studies that included reptile surveys.

Nomenclature in this paper follows Swan *et al*. (2004) except for *Lerista muelleri* and *Cryptoblepharus carnabyi*. *Lerista muelleri* has recently been revised, and the species in New South Wales is now *Lerista rhodonoides* (Smith & Adams, 2007). Similarly, *Cryptoblepharus carnabyi* has also undergone revision, and the species in south-eastern New South Wales is now *Cryptoblepharus pannosus* (Horner, 2007).

Where no common name is provided, nomenclature follows the NSW Atlas of Wildlife database (DECC, 2007).

RESULTS

This study

Systematic surveys of the 43 study sites identified a total of 28 reptile species across the Upper Billabong Creek Catchment during this study (Table 2). Four species of reptile were recorded in the study area for the first time: *Egernia saxatilis intermedia, Egernia whitii, Pseudemoia entrecasteauxii* and *Tiliqua nigrolutea* (Sass *et al*., 2007). These species are typically associated with cool climates and moderate to high altitude areas in New South Wales (DECC, 2007; Swan *et al*., 2004). Only one individual of each of these species was recorded suggesting they occur in low densities.

Some reptile species were found only on the eastern side of the study area such as the small skinks, *Ctenotus taeniolatus, Hemiergis decresiensis talbingoensis, Lampropholis delicata* and the small dragon *Amphibolurus muricatus*. Conversely, some reptile species were found exclusively in the western or central portions of the study area such as the small skinks, *Ctenotus robustus, Cryptoblepharus pannosus* and *Lampropholis guichenoti*. Additionally, several species pairs within several genera were found to occupy separate areas of the study area with some overlap in the centre of the study area in the genus *Ctenotus* (Sass, 2007).

Other studies

A review of previous research or surveys conducted in the Upper Billabong Creek catchment revealed a total of seven technical reports and manuscripts that have included reptiles in their field surveys. Herring (2003) covered much of the study area in a survey of birds, mammals and reptiles as part of a catchment-wide biodiversity study. His study revealed 22 reptile species, many exhibiting commonality to this study with the exception of *Lerista bougainvillii, Menetia greyii* and *Parasuta dwyeri* (Herring, 2003). Three environmental assessment reports for proposed developments in the study area provide no additional reptile species other than previously recorded species (Klomp & Fairbridge, 1992; Klomp *et al*., 1995; Klomp & Marshall, 1995).

In more recent times, two technical reports have included reptile surveys as part of a larger environmental assessments for the upgrade of the Hume Highway to dual carriageway through the catchment (Parsons Brinkerhoff, 2007; SKM, 2006). These surveys identified two additional species to previous studies. The Pink-tailed Worm-lizard (*Aprasia parapulchella*) and *Ctenotus orientalis* were recorded between Yarra Creek and Holbrook (Parsons Brinkerhoff, 2007). Both surveys were confined to a narrow lineal strip that, in most parts, was adjacent to the existing highway.

DECC NSW Atlas of Wildlife Database

Searches of the NSW Atlas of Wildlife database for the study area identified an additional seven species not recorded in this study or in previous studies. These species were the dragon, *Amphibolurus nobbi*, four species of skinks (*Acritoscincus platynotus, Egernia cunninghami, Eulamprus heatwolei, Eulamprus tympanum*), one species of snake (*Ramphotyphlops proximus*)and one species of pygopod (*Lialis burtonis*) (DECC, 2007).

Table 2. Reptile species recorded in the Upper Billabong Creek Catchment Area (x = recorded, SWW = this study, PB = Parsons Brinkerhoff 2007, SKM = Sinclair Knight Mertz 2007, HER = Herring 2003, DECC = NSW Atlas of Wildlife Database

Scientific Name	Common Name	SWW	PB	HER	SKM	DECC
Gekkonidae						
Christinus marmoratus	Marbled Gecko	x		x	x	
Diplodactylus vittatus	Eastern Stone Gecko	x		x		x
Strophurus intermedius	Southern Spiny-tailed Gecko	x				
Pygopodidae						
Aprasia parapulchella	Pink-tailed Worm-lizard		x			
Delma inornata	Plain Snake-lizard	x		x		x
Lialis burtonis	Burtons Legless Lizard					x
Varanidae						
Varanus gouldii	Sand Goanna	x				
Varanus varius	Lace Monitor	x		x		
Agamidae						
Amphibolurus muricatus	Jacky Lizard	x		x		x
Amphibolurus nobbi	Nobby Dragon					x
Pogona barbata	Eastern Bearded Dragon	x		x		
Scincidae						
Acritoscincus platynotus	Red-throated Skink					x
Carlia tetradactyla	Southern Rainbow Skink	x		x		x
Cryptoblepharus pannosus	Carnaby's Wall Lizard	x		x	x	
Ctenotus orientalis	Eastern Striped Skink		x			
Ctenotus robustus	Robust Ctenotus	x		x	x	
Ctenotus taeniolatus	Copper-tailed Skink	x		x		x
Egernia cunninghami	Cunningham's Skink					x
Egernia saxatilis intermedia	Black Rock Skink	x				
Egernia striolata	Tree Skink	x		x		
Egernia whitii	White's Skink	x				
Eulamprus heatwolei	Yellow-bellied Water Skink					x
Eulamprus tympanum	Southern Water Skink					x
Hemiergis decresiensis talbingoensis	Three-toed Earless Skink	x		x		x
Lampropholis delicata	Garden Sun-skink	x				
Lampropholis guichenoti	Grass Sun-skink	x		x		x
Lerista bougainvillii	Southern Lerista			x	x	x
Lerista rhodonoides	Three-toed Lerista	x				
Menetia greyii	Grey's Skink			x		
Morethia boulengeri	Boulenger's Morethia	x		x		x
Pseudemoia entrecasteauxii	Woodland Tussock Skink	x				
Tiliqua nigrolutea	Blotched Blue-tongue	x				
Tiliqua scincoides	Eastern Blue-tongue	x		x		x
Typhlopidae						
Ramphotyphlops nigrescens	Blackish Blind Snake	x				x
Ramphotyphlops proximus	Woodland Blind Snake					x
Pythonidae						
Morelia spilota metcalfei	Carpet Python (Murray Darling form)	x		x		
Elapidae						
Parasuta dwyeri	Dwyer's Black headed Snake			x		x
Pseudechis porphyriacus	Red-bellied Black Snake	x		x		x
Cheluidae						
Chelodina longicollis	Long-necked Turtle	x		x		

Table 3. Reptile fauna recorded during this study and their distribution across the study area. (WESTERN = Only at sites on western side of Hume Highway, EASTERN = Only at sites on eastern side of Hume Highway, BOTH = At sites on both sides of Hume Highway, * = Recorded).

Scientific Name	Common Name	WESTERN	EASTERN	BOTH
Gekkonidae				
Christinus marmoratus	Marbled Gecko			*
Diplodactylus vittatus	Eastern Stone Gecko			*
Strophurus intermedius	Southern Spiny-tailed Gecko		*	
Pygopodidae				
Delma inornata	Plain Snake-lizard	*		
Varanidae				
Varanus gouldii	Sand Goanna	*		
Varanus varius	Lace Monitor			*
Agamidae				
Amphibolurus muricatus	Jacky Lizard		*	
Pogona barbata	Eastern Bearded Dragon			*
Scincidae				
Carlia tetradactyla	Southern Rainbow Skink	*		
Cryptoblepharus pannosus	Carnaby's Wall Lizard	*		
Ctenotus robustus	Robust Ctenotus	*		
Ctenotus taeniolatus	Copper-tailed Skink		*	
Egernia saxatilis intermedia	Black Rock Skink		*	
Egernia striolata	Tree Skink			*
Egernia whitii	White's Skink		*	
Hemiergis decresiensis talbingoensis	Three-toed Earless Skink		*	
Lampropholis delicata	Garden Sun-skink		*	
Lampropholis guichenoti	Grass Sun-skink	*		
Lerista rhodonoides	Three-toed Lerista	*		
Morethia boulengeri	Boulenger's Morethia			*
Pseudemoia entrecasteauxii	Woodland Tussock Skink		*	
Tiliqua nigrolutea	Blotched Blue-tongue		*	
Tiliqua scincoides	Eastern Blue-tongue			*
Typhlopidae				
Ramphotyphlops nigrescens	Blackish Blind Snake	*		
Pythonidae				
Morelia spilota metcalfei	Carpet Python (Murray Darling form)	*		
Elapidae				
Pseudechis porphyriacus	Red-bellied Black Snake			*
Cheluidae				
Chelodina longicollis	Long-necked Turtle			*

DISCUSSION

An important part of natural resource management is to improve our understanding of biodiversity across catchments and landscapes (eg, Sass *et al.*, 2005; Sass & Wilson, 2006). This study provides important information to natural resource managers on the distribution of reptiles across the Upper Billabong Creek catchment with a total of 28 species being recorded. A review of previous studies and database records increases the total number of reptile species for the study area to 40 (Table 2).

A number of species exhibited notable geographic trends in their distribution across the catchment (Table 3). The concept of faunal subregions within Australia has been widely discussed and is generally upheld to explain patterns of reptile distribution varying only slightly between families (Cogger & Heatwole, 1981). The south-west slopes bioregion, of which the study area is a part, is regarded as the natural boundary between species classified as Bassian and Eyrean (Caughley & Gall, 1985). The transitional zone between these classifications has not yet been identified, however, it could be said that the Hume Highway is situated in such a zone. This is due to the rise in elevation to the mountains on the eastern side of the route, while the western side of the highway generally has little topographic relief.

Two species pairs of skinks show complementary patterns in their occurrence: *Ctenotus taeniolatus* and *C. robustus,* and *Lampropholis delicata* and *L. guichenoti. Ctenotus robustus* is considered widespread, while *C. taeniolatus* is regarded as Bassian (Caughley & Gall 1985). Similarly, both species of *Lampropholis* are regarded as Bassian (Caughley & Gall 1985). The species pairs in *Ctenotus* and *Lampropholis* were only recorded in sympatry at one study site. The causes of this pattern of distribution require further investigation.

Amphibolurus muricatus, Egernia saxatilis intermedia, Egernia whitii, Hemiergis decresiensis talbingoensis, Pseudemoia entrecasteauxii and *Tiliqua nigrolutea* were only found on the eastern side of the Hume Highway, whereas *Cryptoblepharus carnabyi, Lerista rhodonoides* and *Varanus gouldii* were only found on the western side of the Hume Highway. These results suggest that the corridor of the Hume Highway within the Upper Billabong Creek catchment may coincide with the transition between Eyrean and Bassian faunal subregions. Similar patterns of distribution were also found in a recent study near Tumut (north-east of the study area) and were suggested to be influenced by contact between species inhabiting the Bassian and Eyrean fauna subregions (Fischer *et al.*, 2005).

Two species of conservation significance have been recorded in the study area: the Murray-Darling form of the Carpet Python (*Morelia spilota metcalfei*) and the Pink-tailed Worm-lizard (*Aprasia parapulchella*). One other species of conservation significance, the Striped Legless Lizard (*Delma impar*), has not been recorded in the Upper Billabong Creek Catchment area. but is also expected to occur in the study area given a recent record of its occurrence near Tarcutta (40 km to the north of the study area) (Ecology Partners, 2007; SKM, 2006). Suitable areas of habitat in the form of extensive areas of rock outcropping occur in the catchment and the species' absence is likely to be an artefact of its cryptic nature and difficulty in surveying.

One individual Murray-Darling form of the Carpet Python was recorded in the north of the study area near the township of Cookardinia (Sass, 2007). Although not listed as a threatened species under NSW or Commonwealth legislation, this species has long been regarded as being under threat in fragmented landscapes (Heard *et al.*, 2004; Damian Michael, pers. comm. 2007). The 12.36 ha woodland fragment from which this species was recorded had good quantities of fallen timber, numerous hollow bearing trees and small areas of rock outcropping, all of which meet the thermal and shelter needs for this species (Heard *et al*. 2004). The Yellow-

footed Antechinus (*Antechinus flavipes*) was frequently recorded in the pitfall traps during the survey, and also noted as present by other researchers working at the site (Terry Korodaj and Matt Herring, pers. comm., 2007), and is likely to provide a valuable food resource for this python species.

Five individual Pink-tailed Worm-lizards were found amongst granite outcrops east of the highway corridor below Morgan's Ridge (Parsons Brinkerhoff, 2007). This species is listed as endangered under the NSW Threatened Species Conservation Act 1995 and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Searches of a small number of rock outcrops across the study area (Sass, 2007) and by the senior author at Little Billabong for the proposed duplication of the Hume Highway (SKM, 2006) failed to detect this species despite extensive searches.

The Pink-tailed Worm-lizard has been recorded from similar granite outcrops near Albury in the south (Michael & Herring, 2005) and Tarcutta in the north (Jones, 2004). Weather and environmental conditions play an important role in detecting this species (Osborne & Jones, 1995), and the effectiveness of previous surveys for this species may have been limited by these factors. Considering their presence at other similar outcrops in adjacent catchments, it is possible that this threatened species occurs at other sites in the Upper Billabong Creek Catchment. Catchment-wide targeted surveys for this species are required to gain a greater understanding of its distribution across the catchment.

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