ACT PARKS and CONSERVATION SERVICE

THE REPTILE, AMPHIBIAN AND MAMMAL FAUNA OF THE STONY CREEK NATURE RESERVE, AUSTRALIAN CAPITAL TERRITORY

MARJO RAUHALA

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A list of other publications produced by the ACT Parks and Conservation Service is on page 62

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Stony Creek Nature Reserve was surveyed for the presence and distribution of frogs, reptiles and mammals in different vegetation types in the reserve. A variety of techniques, including pitfall trapping, hand-searching, spotlighting, harp and Elliott trapping were used to establish the presence of seven frog, 24 reptile and 24 mammal species. Several species of special interest were recorded, including the broad-palmed frog *Litoria latopalmata* and Burton's legless lizard *Lialis burtonis*, both species which, although geographically widespread, were known previously in the ACT on the basis of a few scattered records only.

The information presented provides a baseline against which future changes in distribution and abundance of species can be evaluated. It also identifies habitats and areas of particular significance in terms of species richness, or the presence of uncommon species, with recommendations for their management. This, along with information on habitat use, can assist managers in making decisions about land use and management practices, with a knowledge of the animals likely to be affected, and how adverse effects may be reduced or eliminated.

INTRODUCTION

The Murrumbidgee River Corridor (MRC) is a strip of land and water up to four kilometres wide along the full length (66 km) of the Murrumbidgee River in the Australian Capital Territory (ACTPCS 1992). The area is recognised as containing important aquatic and terrestrial ecosystems as well as significant geological, geomorphic and cultural features (NCDC 1981). It requires an integrated management strategy which encourages appreciation and enjoyment of these values by the community whilst also ensuring their protection and enhancement.

Research is identified in the MRC Draft Management Plan (1992) as an important component of effective management, with the provision of an information base on physical, biological and cultural resources of the MRC required. Information on the vegetation of the MRC is available in several documents and maps, including NCDC (1981), NCDC (1984), Hicks and Nethery (1974), and Ingwersen and Johnson (1992). The fauna of the MRC, however, has had very little specific attention, with the exception of birds (COG 1986, Lamm and Calaby 1950), and fish (Greenham 1981, NCDC 1981, NCDC 1984, ACT Parks and Conservation Service unpubl. data.)

The major source of information to date on reptiles, amphibians and mammals of the MRC is the Murrumbidgee River Ecological Study (NCDC 1981). However, it contains only limited information that is based on scientific investigation and largely draws together information from other wide-ranging and often superficial reviews of the ACT fauna (Department of the Interior 1968 and 1971). Thus in NCDC (1981), species occurrence for the MRC was predicted largely through extrapolation from other areas of the ACT with similar habitat.

AIMS

The present study is the first stage of a continuing program to document the reptile, amphibian and mammal fauna of the Murrumbidgee River Corridor. This first stage focused on Stony Creek Nature Reserve, one of the four Nature Reserves of the MRC.

The specific aims of this survey were to :

1. Document the terrestrial vertebrate fauna of the Stony Creek Nature Reserve, with the exception of birds;

2. Comment on habitat use by faunal groups and some species; and

3. Incorporate information on species occurrence into recommendations for the management of the reserve for nature conservation purposes.

STONY CREEK NATURE RESERVE

The Murrumbidgee River Corridor is divided into several components, including four nature reserves, several recreational reserves and a landscape conservation reserve. The four nature reserves; Woodstock, Stony Creek, Bullen Range and Gigerline were declared in May 1991 under the Nature Conservation Act (1980). These are considered areas of relatively undisturbed land and water, which contain ecologically significant communities and/or habitats.

The Stony Creek Nature Reserve is approximately 825 hectares in area and extends 13 kilometres along the Murrumbidgee River between the recreational reserves of Casuarina Sands and Uriarra Crossing in the Australian Capital Territory (ACTPCS 1992) (Figures 1 and 2). It is regarded as an area of ecological interest in the ACT (NCDC 1984), due to the vegetation communities it contains as well as its value for bird movements. The area also contains the location of the only known record of the painted honeyeater (*Grantiella picta*) in the ACT. NCDC (1988) identified areas of the reserve as containing sites of botanical and zoological significance, namely the Stony Creek gorge, a 1.8 km section of the river corridor downstream of Stony Creek and an area adjacent to the river near Mt McDonald.

Landform, geology and soils

The study area consists of a deeply entrenched river valley with moderate to steep dissected slopes along the river and gently undulating terrain in the surrounding areas. Altitude ranges from 440 metres to about 580 metres. Several creeks enter the river in the study area but most flow only after rain and normally are restricted to dry gullies with occasional pools (NCDC 1981).

Geologically the area is composed mainly of volcanic rock, with acid volcanics generally to the east of the river, and dacite lavas, tuffs and shale lenses to the west (NCDC 1981). Soils derived from these rocks are mostly shallow and skeletal on the steeper slopes but deeper pockets of soil occur in the surrounding terrain.

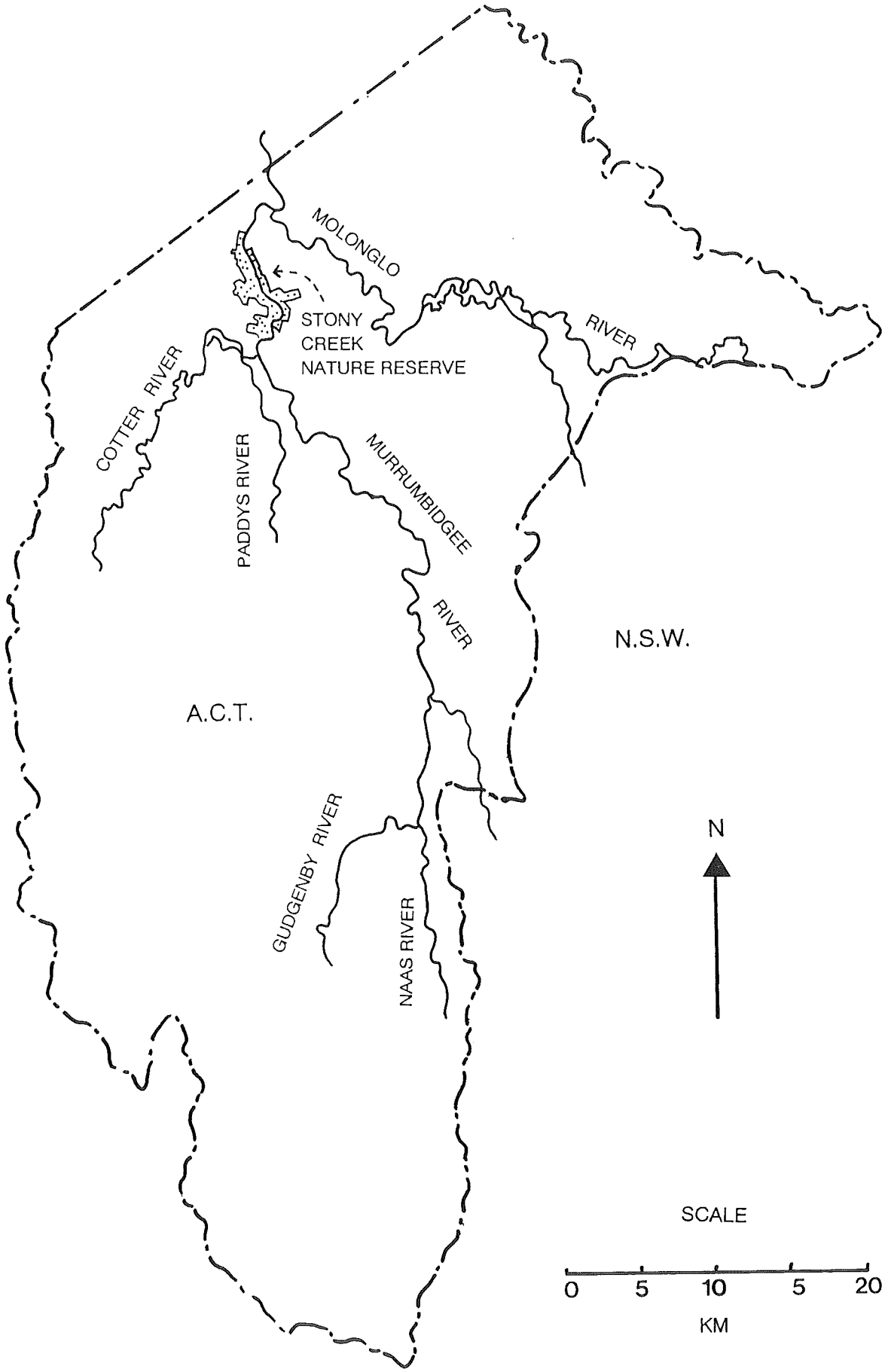

Figure 1. Location of Stony Creek Nature Reserve in the ACT.

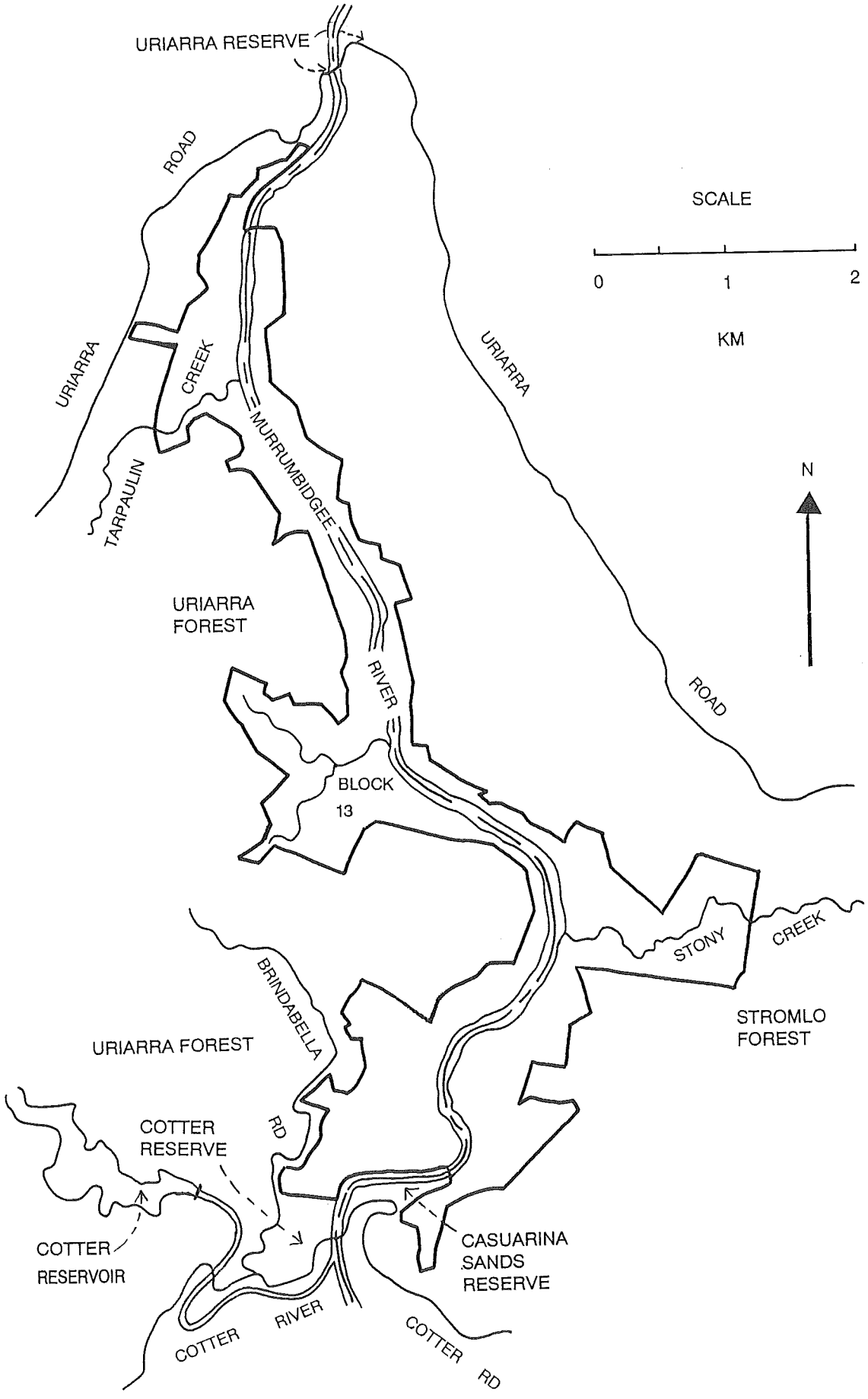

Figure 2. Stony Creek Nature Reserve. Boundary shown thus ———

Vegetation

The pattern of vegetation at the time of this study represents a mosaic formed by various stages of secondary succession and regrowth. This pattern reflects past land use in the area which has included clearing of woodland and some forest fringes for pasture, thinning of original forest to woodland, grazing, pasture improvement and cultivation.

The steep and often rocky and exposed slopes above the river are vegetated by dense thickets of tea-tree *Kunzea ericoides* and *Leptospermum brevipes*, and scattered stands of black cypress pine *Callitris endlicheri*, which occur in several locations, generally in the more sheltered, frost-free situations. Remnant open forest, mainly *Eucalyptus macrorhyncha - E. rossii* associations, also occur in patches and are most extensive on the relatively inaccessible steep slopes where they have been safeguarded inadvertently from rural land uses (NCDC 1981). These forests normally have a floristically diverse shrub and herb understorey and contain a number of species which are rare or uncommon in the ACT.

River oaks *Casuarina cunninghamiana* line both banks of the river and some lower creek lines. Silver wattle *Acacia dealbata* also often is found in this community along with introduced willows *Salix sp* and blackberry *Rubus fruticosus*.

The highly modified pastures of the undulating terrain away from the river escarpment support scattered eucalypts. Where livestock grazing has been intensive, the majority of trees are mature to senescing, with little natural regeneration. Where there has been little pasture improvement the grasslands are dominated still by native species such as *Bothriochloa*, *Stipa* and *Themeda*.

Climate

There is no long term climate data available specifically for the study area. The general pattern for the Murrumbidgee River, however, is similar to that of Canberra (NCDC 1981). The climate is characterised by hot summers and cold winters with rainfall distributed fairly evenly throughout the year with a slight spring peak. The annual average rainfall for the MRC ranges from 625 mm to 750 mm (NCDC 1981).

The entrenched nature of the Murrumbidgee River Valley results in variations in microclimate particularly according to relative exposure or protection from winds and the sun.

METHODS

Representatives of six of the most commonly occurring vegetation communities were selected for sampling as it was not practical or feasible to sample all vegetation communities or habitat types in the study area. It was intended that the distribution of animals throughout the Stony Creek Nature Reserve then could be predicted through careful application of the survey results to areas with similar vegetation.

Vegetation types sampled

Dry sclerophyll forests

Open forest dominated by one or more eucalypt species, including *Eucalyptus rossii*, *E. macrorhyncha* and *E. mannifera*. Shrub understorey varied considerably between areas, with mixed eucalypt (*E. macrorhyncha, E. rossii*) forest generally supporting a well developed shrub understorey including *Hibbertia obtusifolia*, *Dillwynia sericea*, *Pultenaea procumbens*, *Brachyloma daphnoides*, *Leucopogon aff. fletcheri*, *Lomandra longifolia* and *Xanthorrhoea australis*. The herb understorey was usually less well developed in this habitat type with *Danthonia* spp. being quite consistently present, but only rarely forming a significant component of the understorey. The single species stands of *E. macrorhyncha* examined supported very little understorey vegetation, and the forest floor was covered by little more than leaves, bark and woody debris.

Eucalypt woodland

Open woodlands of the study area were dominated by either *Eucalyptus blakelyi* on the river valley slopes or *E. macrorhyncha* on the more gently sloping terrain at the top of the escarpments. Shrubs were scattered throughout this community, *Bursaria spinosa* and *Cassinia* spp. being most conspicuous. A dense, well developed herb layer existed especially in the *E. blakelyi* woodland, supporting a rich complement of grasses, particularly native species including *Bothriochloa macra*, *Cymbopogon refractus*, *Danthonia* spp., *Poa* spp., *Stipa* spp., *Sorghum leiocladum* and *Themeda triandra*.

Tea-tree scrub

Kunzea ericoides, *Leptospermum brevipes* scrub occurred throughout the study area and extended over large areas, with considerable variation in the height and density of these scrub thickets. Grass cover was absent throughout much of this vegetation community and as a

consequence large areas of bare ground were a prominent feature. Other, smaller shrubs were uncommon, with occasional individuals of *Brachyloma daphnoides*, *Pomaderris angustifolia* and *Hibbertia obtusifolia* occurring in larger spaces within the stands.

Callitris forest

Open forest dominated by *Callitris endlicheri* occurred on the steeper slopes with scattered *Eucalyptus rossii*, generally increasing in abundance towards the top of the escarpment. Shrub understorey was usually sparse but consisted of a number of species including *Kunzea ericoides*, *Brachyloma daphnoides*, *Pultenaea procumbens* and *Leptospermum brevipes*. Grass cover was generally not a significant feature in these dry and exposed situations.

Casuarina forest

Occurred at the river's edge and along the lower creek lines. *Casuarina cunninghamiana* was the dominant tree species. Introduced willows *Salix* spp and blackberry *Rubus fruticosus* also were well established in these areas. Flood debris, generally woody material, was common along much of this river edge environment.

Mixed grasslands

Grassland communities in the study area were very much the result of past tree clearing and subsequent pasture improvement and grazing regimes. Native grasses were still present in unimproved or lightly grazed pastures, or those that had not been grazed for some time. The most common native grasses that remained included kangaroo grass *Themeda triandra*, redleg grass *Bothriochloa macra* and speargrass *Stipa* spp.

In improved pastures, introduced pasture grasses and weeds predominated over native vegetation. Some of the most widespread introduced species included hairgrass (*Aira* spp.), paspalum *Paspalum dilatatum*, cocksfoot *Dactylis glomerata*, fescue *Vulpia* spp. and Yorkshire fog grass *Holcus lanatus*. Weed species occurred to varying degrees in all grassed and timbered communities, the most conspicuous being thistles.

Various eucalypts occurred throughout mixed pastures, mainly as scattered individuals. Native shrubs including Australian blackthorn *Bursaria spinosa* and *Pomaderris angustifolia* grew more commonly in and around rocky outcrops.

Frogs

Frog call identification was used as the primary technique for frog survey in two creek systems of the study area (Block 13 and Stony Creek) and a section of the Murrumbidgee River, downstream of Casuarina Sands. Each creek system was surveyed on two occasions, after dark, to take into consideration the seasonality of breeding for different species. Survey involved walking along the creeks or river listening for frog calls and spotlighting for frogs not calling. Species present, an estimate of numbers and evidence of successful breeding (eggs or tadpoles) were recorded.

Additional information on the occurrence of frogs was gained through identification of frog calls heard opportunistically during the day. A small number of frogs was also found in pitfall traps and under rocks and logs whilst hand-searching for reptiles.

Reptile sampling

Reptile groups exhibit considerable variation in their preferred habitat, activity period and behaviour. The most effective reptile surveys take into consideration these inherent differences between species and accordingly employ a variety of appropriate survey techniques. In this survey, pitfall trapping, hand-searching, careful observation and opportunistic sightings were used to detect the presence of reptiles.

Pitfall trapping

Pitfall trapping was conducted at six sites (Figure 3), in two stages, the first from 11 November 1992 to 23 December 1992, and the second from 2 March 1993 to 31 March 1993. During the first stage of trapping, traps were checked on most days (39 out of the 44 day period). During the second stage (30 days) traps were checked every day. A description of each trapping site is given in Appendix 1.

Each pitfall site consisted of metal buckets (20 at four sites and 19 at two sites) sunk into the ground. Buckets (pits), were arranged in two lines of ten (or ten and nine) with a distance of about two metres between pits. Lines were approximately 25 metres in length, and were about 50 metres apart, usually one in an upper and the other in a lower position on a slope. Each bucket had an eleven litre capacity with a depth of 27 cm and a diameter of 22.5 cm. Small holes were punched with a screwdriver into the sides of the buckets approximately one centimetre from the bottom to enable accumulated water to drain out. Small rocks were

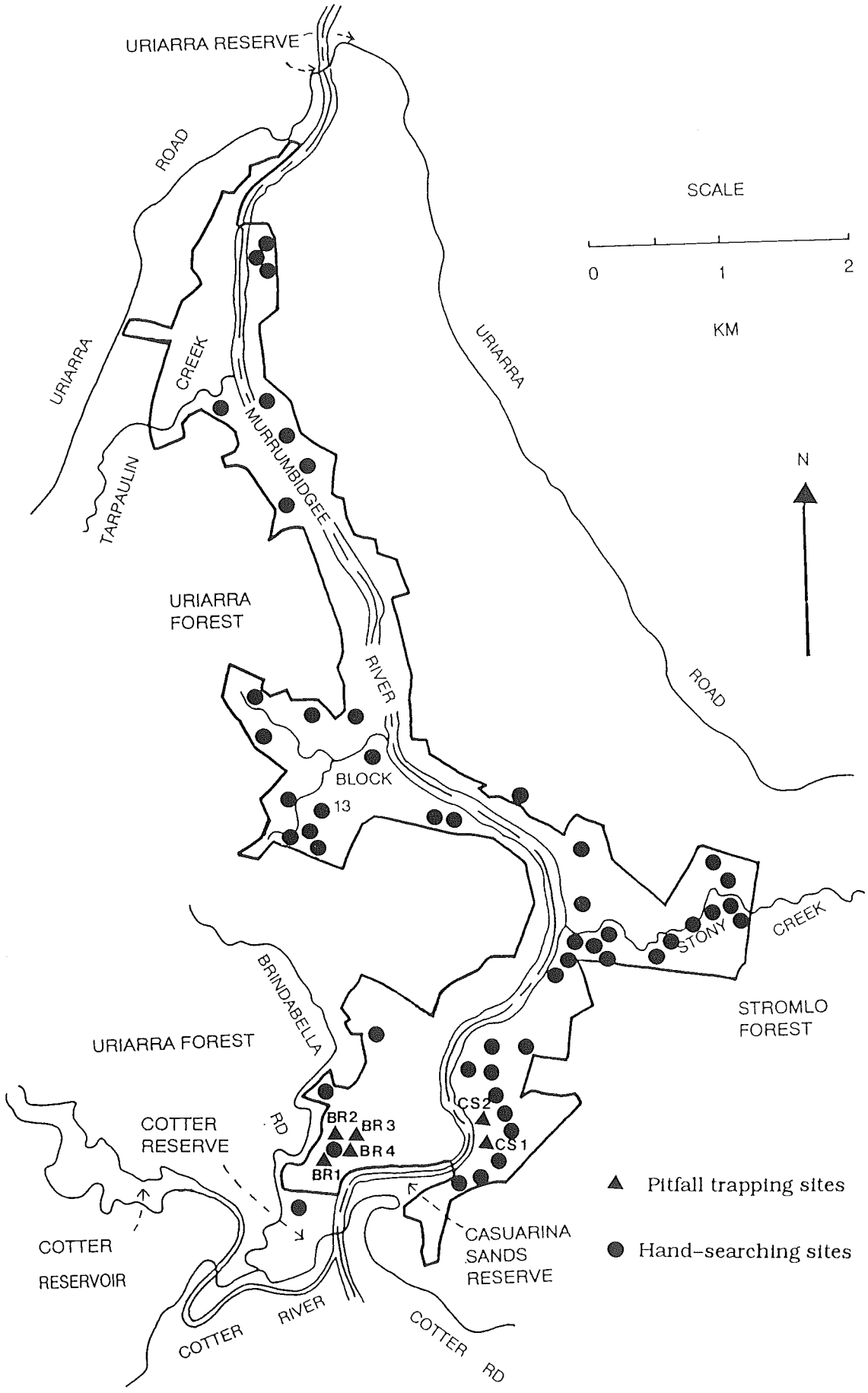

Figure 3. Location of pitfall trapping and hand-searching sites in Stony Creek Nature Reserve

placed into the buckets to provide animals with some cover and a means of climbing above accumulated water if necessary.

A drift fence was installed along each trap line to increase capture success. The drift fence passed uninterrupted from end to end of the trap line, through the centre of each pit. It consisted of a strip of shade cloth approximately 30 centimetres high, buried in the ground to a depth of about three centimetres and was held up along its length with bent wire spikes.

The following information was recorded for all reptiles captured in pitfall traps:

- Site name and pit number;
- Species;
- Age – whether juvenile, sub–adult or adult. This was subjectively estimated on the basis of size or the presence of breeding colouration;
- Sex – only readily determined for a few species on the basis of colouration or obvious gravid condition;
- Tail regeneration – whether the tail was entire and original or had a regenerating portion; and
- Comments on other features of interest.

All reptiles were marked with a small spot of green liquid paper and released within four metres of the pit in which they were captured.

Hand–searching

Searching was conducted at 51 sites throughout the Stony Creek Nature Reserve (Figure 3). The results of hand–searching carried out at 26 sites during the 1991 *Aprasia parapulchella* survey (Osborne and McKergow in prep.) are included in the present survey.

Most sites for hand–searching were selected on the basis of rock cover, i.e. sites having a cover of predominantly surficial or shallowly imbedded, medium sized rocks. Previous experience has shown that hand–searching is best confined to spring and early summer and that during warm, sunny days, searching is most productive in the mornings, before the rocks have warmed sufficiently for the reptiles to become active. Accordingly, during this survey, hand–searching was conducted in spring and confined where possible to mornings.

Hand–searching involved turning over all rocks and logs where possible, within a loosely defined search area, and capturing the reptiles sheltering underneath them. Species found

were identified and details such as age, sex and tail regeneration were noted. After inspection, all animals were released and rocks and logs replaced as closely as possible to their original position. The number of rocks and logs turned was counted for each site and searchers were careful not to turn any rock or log more than once.

Observation

This involved walking slowly and quietly through a specified habitat type searching for reptiles by sight. Particular attention was given to features which reptiles typically use for basking such as piles of woody debris, logs and boulders. Binoculars were used occasionally as an aid to species identification. The inclusion of this method was considered important for two reasons :

1. Some of the larger reptiles are rarely detected by pitfall trapping or hand-searching under rocks and logs.

2. Some areas were not suitable for pitfall trapping (due to rockiness of the ground) or hand-searching (due to lack of suitable, smaller rocks or logs).

In addition, during the course of the field work, reptiles were sighted occasionally by chance.

Mammals

Bats

Harp traps were used at six sites (Figure 4) for sampling bats. These were set across potential flight paths, such as tracks, narrow clearings and other situations where the vegetation formed a corridor or avenue likely to facilitate movement.

Harp traps were set at each site for three consecutive nights. On some occasions windy conditions caused the traps to fall, rendering them ineffective, or possibly allowing any captured bats to escape. If traps were blown over, additional nights of trapping were conducted with the aim of standardizing trapping effort across all vegetation types. Time constraints prevented additional trapping in *Callitris* dominated forest, after traps had blown over for three consecutive nights.

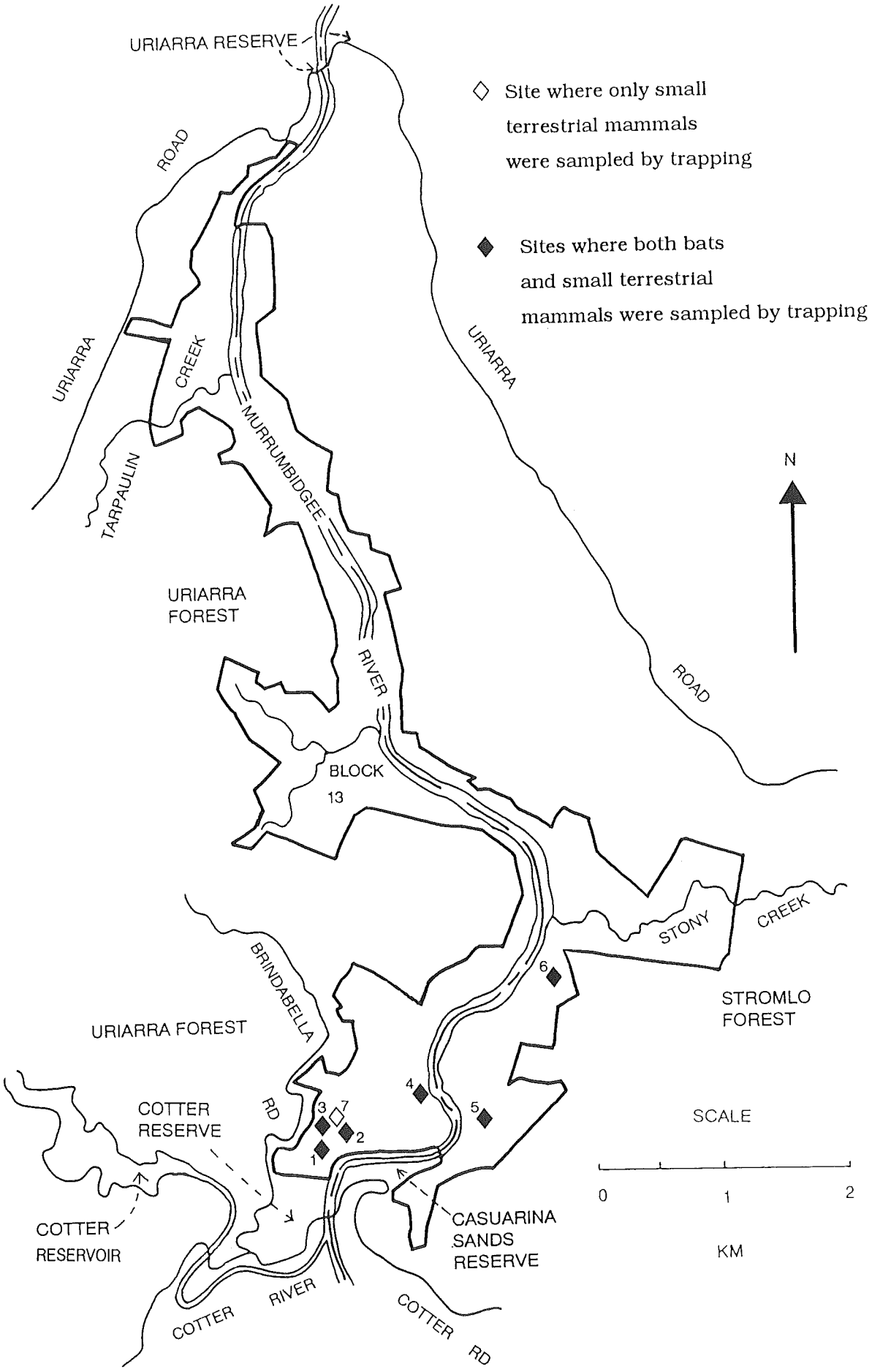

Figure 4. Trapping sites for bats and small terrestrial mammals in Stony Creek Nature Reserve

Traps were checked each morning and any captured bats were identified, sexed and marked with a small spot of liquid paper on the head to enable previously caught individuals to be identified. Bats were then released into a suitable tree hollow near the capture site.

Small terrestrial mammals

Seven sites (Figure 4) were selected for sampling with Elliott live-capture traps. Traps were baited with a mixture of rolled oats, peanut butter and honey and set roughly three to four metres apart within defined vegetation types. Specific placement was subjective and where rock outcrops and logs occurred, some traps were placed in and around them. Traps were set for no more than four consecutive nights and were checked before 9.00 am each morning.

Pitfall traps, although specifically set up for reptiles, provided an additional method for capturing small mammals during the survey.

Arboreal mammals

Spotlighting for arboreal mammals was carried out in five vegetation types. The weather conditions, phase of the moon and cloud cover (all important factors for the activity and sightability of arboreal mammals) were not replicated in all vegetation types. Approximately three hours was spent spotlighting in each vegetation type. A small number of records of the common brushtail possum were made from the observation of their characteristic scats.

Other mammals

No specific survey methods were employed to establish the presence or abundance of other mammals. Their occurrence was determined through incidental sightings and also by indirect evidence such as droppings, burrows and scratchings. A small number of records for Stony Creek Nature Reserve also were extracted from the ACT Vertebrate Atlas database.

RESULTS

1. Frogs

Seven species of frogs were recorded in the study area during the survey. These included two tree frogs (*Litoria latopalmata* and *L. lesueurii*), and five southern ground frogs (*Crinia signifera*, *C. parinsignifera*, *Uperoleia laevigata*, *Limnodynastes tasmaniensis* and *L. dumerilii*).

Hylidae (tree frogs)

Litoria latopalmata (broad-palmed frog)

Litoria latopalmata was recorded near deeper pools along the upper section of Stony Creek and the Block 13 creek system, as well as from both the east and west banks of the Murrumbidgee River. Individuals were also heard at a farm dam just outside the study area near Uriarra Road and the Stromlo pine plantation.

Males appeared to utilise solid rock bars and rock slabs within or adjacent to streams as calling sites. Rocky sections of the stream supported stronger choruses (up to ten frogs calling), with scattered individuals in other sections. Individuals were observed to call from depressions and hollows on these rocky surfaces, as well as calling from slight depressions in grassland. Frogs heard at the farm dam were calling from partially hidden positions in sedges and grasses within a metre of the pond edge.

Choruses were heard throughout December and January, and although the onset of calling was not specifically monitored, it was noted that the species was not calling at these breeding sites in late October. Metamorphs, averaging 20 mm snout-vent length (SVL) were observed in mid-March at Stony Creek, at which time no tadpoles or adults were seen or heard. This indicates that larval development in the field takes no longer than about 8 to 12 weeks.

Litoria lesueurii (Lesueur's stream frog)

Litoria lesueurii was recorded only along the banks of the Murrumbidgee River. Seven individuals were observed by spotlight, scattered along a one kilometre stretch of the river bank in mid-January. The specimens seen were sitting on rock slabs, sand banks and cobblestones near the river. No individuals were heard calling at this time.

Myobatrachidae (southern ground frogs)

Crinia signifera (common eastern froglet)

This species was recorded from a wide range of situations throughout the study area. They were captured in low numbers (Table 1) in pitfall traps at all sites (Figure 3), and detected through calls at many minor and all major creek systems, including along the banks of the Murrumbidgee River.

Crinia parinsignifera (plains froglet)

Crinia parinsignifera was recorded at Block 13 and Stony Creek. Large choruses (50 to 100 individuals) were recorded at some sites, particularly in the higher reaches of the Stony Creek system. In contrast to *Crinia signifera*, *C. parinsignifera* was not captured in pitfall traps.

Uperoleia laevigata (orange-groined toadlet)

Only one individual of this small terrestrial frog was recorded in the study area during the survey. It was located in a pitfall trap at trapping site BR 2 (Figure 3), a site covered by tea-tree *Kunzea ericoides – Leptospermum brevipes* scrub. The species was not recorded in the Block 13 and Stony Creek systems although it was heard calling on one occasion in another creekline nearby (D. Smillie pers. comm.) but its exact location was not determined. Also, it was recorded calling at a farm dam just outside the study area on Uriarra Road near the top of Stony Creek.

Limnodynastes tasmaniensis (spotted grass frog)

This species was recorded calling in low numbers at Stony Creek. Two individuals were caught in pitfall traps, one in *Eucalyptus blakelyi* woodland, and one in dry sclerophyll (*E. rossii, E. mannifera, E. macrorhyncha*) forest.

Limnodynastes dumerilii (eastern banjo frog)

A species which was found in low numbers along Stony Creek and the Block 13 creek system, and near the banks of the Murrumbidgee River. Individuals were captured at two pitfall trapping sites (Table 1) which were dominated by *Kunzea ericoides – Leptospermum brevipes* scrub and *Eucalyptus blakelyi* woodland. Moderately large choruses of this species (10 to 15

individuals) were heard in deeper pools in Stony Creek, whilst at Block 13, the presence of the species was detected from a few widely scattered, calling individuals.

Table 1. Number of frogs caught at each pitfall trapping site.

– indicates no captures.

	SITE					
SPECIES	CS1	CS 2	BR1	BR2	BR3	BR4
Crinia signifera (common eastern froglet)	1	2	4	2	7	4
Limnodynastes tasmaniensis (spotted grass frog)	1	–	1	–	–	–
Limnodynastes dumerilii (eastern banjo frog)	2	–	–	3	–	–
Uperoleia laevigata (orange-groined toadlet)	–	–	–	1	–	–
Total number of individuals caught	4	2	5	6	7	4

RESULTS (cont'd.)

2. Reptiles

General

Twenty-four species of reptiles from seven families, were recorded in the study area (Table 2). Nineteen of these were recorded from pitfall traps and all of these were recorded also by either hand-searching or observation. Four of the five remaining species were recorded by observation only and one species (one individual *Ctenotus uber)* by hand-searching only (Table 2). Notes on the occurrence of each species of reptile is provided in Appendix 2.

Mixed grassland and eucalypt woodland revealed the greatest number of reptile species (15 and 16 respectively), with *Callitris* and *Casuarina* dominated communities the least, each recording four species (Table 3). The most widespread species were *Ctenotus taeniolatus*, *Lampropholis delicata* and *Morethia boulengeri*, all found in five of the six habitat types surveyed (Table 3). *Lampropholis delicata* and *Ctenotus robustus* were the most abundant reptiles overall. They were found to have the highest densities during hand-searching (Table 5), as well as being the most frequently encountered species in pitfall traps (Table 4). A few species, including *Hemiergis decresiensis* and *Pseudemoia platynota*, occurred consistently in only one or two vegetation types (Table 3).

Pitfall trapping

Reptiles were caught at all pitfall trapping sites. The number of species per site ranged from six species at sites Brindabella Road (BR) 3 and BR 4 to 11 species captured at Casuarina Sands (CS) 1 (Table 4). The number of species caught at each site was not significantly different between sites, although there were significant differences in the total number of individuals per site (Table 4).

Five species (*Lampropholis delicata*, *Morethia boulengeri*, *Carlia tetradactyla*, *Ctenotus taeniolatus* and *C. robustus*) were captured frequently, with significant differences occurring between sites for each species (Table 4). Differences also occurred between sites in the number of *Pseudemoia platynota*, *Hemiergis decresiensis*, *Aprasia parapulchella*, *Amphibolurus nobbi* and *Lialis burtonis* captured, but numbers overall were too small for statistical analysis. Ten other species were captured in very low numbers, generally being recorded at a site on the basis of one or two specimens only (Table 4).

Table 2. Reptiles recorded in Stony Creek Nature Reserve, including type of record. O = Observation PT = Pitfall trap HS = Hand-searching

Family and species	Common name	Type of record		
Chelidae				
Chelodina longicollis	eastern snake-necked tortoise	O		
Gekkonidae				
Diplodactylus vittatus	stone gecko		PT	HS
Pygopodidae				
Aprasia parapulchella	pink-tailed legless lizard		PT	HS
Lialis burtonis	Burton's legless lizard	O	PT	
Agamidae				
Amphibolurus muricatus	jacky lizard	O	PT	
Amphibolurus nobbi	nobbi	O	PT	HS
Physignathus lesueurii	eastern water dragon	O		
Pogona barbara	bearded dragon	O	PT	
Scincidae				
Carlia tetradactyla	four-fingered skink	O	PT	HS
Ctenotus robustus	striped skink	O	PT	HS
Ctenotus taeniolatus	copper-tailed skink	O	PT	HS
Ctenotus uber	spotted ctenotus			HS
Egernia cunninghami	Cunningham's skink	O	PT	HS
Eulamprus heatwolei	warm-temperate water skink	O		
Hemiergis decresiensis	three-toed skink		PT	HS
Lampropholis delicata	delicate skink	O	PT	HS
Menetia greyii	Grey's skink		PT	HS
Morethia boulengeri	Boulenger's skink	O	PT	HS
Pseudemoia platynota	red-throated skink	O	PT	HS
Tiliqua scincoides	common blue tongue	O	PT	HS
Typhlopidae				
Ramphotyphlops nigrescens	blackish blind snake		PT	HS
Elapidae				
Pseudechis porphyriacus	red-bellied black snake	O		
Pseudonaja textilis	eastern brown snake	O	PT	HS
Suta spectabilis	black-headed snake		PT	HS

Table 3. Distribution of reptiles according to vegetation type. X indicates that the species was recorded in the vegetation type. Vegetation Types : DSF – Dry sclerophyll forest, W – Eucalypt woodland, TTS – Tea-tree scrub, CeF – *Callitris* forest, CcF – *Casuarina* forest, MG – Mixed grassland.

Scientific Name	Common Name	Vegetation Type					
		DSF	W	TTS	CeF	CcF	MG
Chelodina longicollis	eastern snake-necked tortoise					X	
Diplodactylus vittatus	stone gecko	X	X				
Aprasia parapulchella	pink-tailed legless lizard		X	X			X
Lialis burtonis	Burton's legless lizard	X	X				
Amphibolurus muricatus	jacky lizard	X	X	X			
Amphibolurus nobbi	nobbi	X	X	X	X		
Physignathus lesueurii	eastern water dragon					X	X
Pogona barbara	bearded dragon			X			
Carlia tetradactyla	four-fingered skink	X	X				X
Ctenotus robustus	robust skink		X			X	X
Ctenotus taeniolatus	copper-tailed skink	X	X	X	X		X
Ctenotus uber	spotted ctenotus						X
Egernia cunninghami	Cunningham's skink		X				X
Eulamprus heatwolei	warm-temperate water-skink					X	X
Hemiergis decresiensis	three-toed skink		X				
Lampropholis delicata	delicate skink	X	X	X	X		X
Menetia greyii	Grey's skink		X				X
Morethia boulengeri	Boulenger's skink	X	X	X	X		X
Pseudemoia platynota	red-throated skink	X					
Tiliqua scincoides	common blue tongue	X	X	X			X
Ramphotyphlops nigrescens	blackish blind snake	X	X				
Pseudechis porphyriacus	red-bellied black snake						X
Pseudonaja textilis	eastern brown snake	X	X				X
Suta spectabilis	black-headed snake	X					X
Number of species recorded		13	16	8	4	4	15

Table 4. Number of reptiles of each species caught in pitfall traps. CS = Casuarina Sands, BR = Brindabella Road – indicates no captures.

Scientific Name	Common Name	SITES CS1	CS2	BR1	BR2	BR3	BR4	Chi-square (df = 5)	Significance
Diplodactylus vittatus	stone gecko	–	1	–	–	–	–	NA	
Aprasia parapulchella	pink-tailed legless lizard	5	2	–	4	–	–	NA	
Lialis burtonis	Burton's legless lizard	3	11	2	–	2	–	NA	
Amphibolurus muricatus	jacky lizard	–	–	1	1	–	1	NA	
Amphibolurus nobbi	nobbi	4	5	3	3	4	–	NA	
Pogona barbara	bearded dragon	–	–	–	1	–	–	NA	
Carlia tetradactyla	four-fingered skink	61	41	16	–	–	2	163.1	P < 0.001
Ctenotus robustus	striped skink	97	57	–	–	–	–	340.1	P < 0.001
Ctenotus taeniolatus	copper-tailed skink	–	–	26	21	10	6	56.3	P < 0.001
Egernia cunninghami	Cunningham's skink	1	–	–	–	–	–	NA	
Hemiergis decresiensis	three-toed skink	9	3	–	–	–	–	NA	
Lampropholis delicata	delicate skink	54	61	23	8	5	9	114.9	P < 0.001
Menetia greyii	Grey's skink	1	–	–	–	–	–	NA	
Morethia boulengeri	Boulenger's skink	18	12	2	11	25	9	24.3	P < 0.001
Pseudemoia platynota	red-throated skink	–	–	13	–	–	1	NA	
Tiliqua scincoides	common blue tongue	–	–	–	1	–	–	NA	
Ramphotyphlops nigrescens	blackish blind snake	2	1	–	–	1	–	NA	
Pseudonaja textilis	eastern brown snake	–	–	1	–	–	–	NA	
Suta spectabilis	black-headed snake	–	–	1	–	–	–	NA	
Total number of reptiles trapped		255	194	88	50	47	28	2.8	P < 0.001
Total number of reptile species trapped		11	10	10	8	6	6	388.6	Not signif.

Large numbers of *L. delicata* and *C. tetradactyla* were present at sites on both the eastern and western bank of the Murrumbidgee River, although numbers were highest on the eastern bank at the Casuarina Sands sites. *Ctenotus robustus* and *H. decresiensis* were present in good numbers at the Casuarina Sands sites but were not recorded at all from the four Brindabella Road sites on the western bank. By contrast *C. taeniolatus* was trapped at all the Brindabella Road sites but not from pitfall traps at Casuarina Sands. *Pseudemoia platynota* was the only species caught commonly at only one site (BR 1).

Morethia boulengeri and *Lampropholis delicata* were the only species that were caught at all pitfall trapping sites. The most frequently captured reptile was *Lampropholis delicata* with 160 individuals trapped, followed by *Ctenotus robustus* and *Carlia tetradactyla* with 154 and 120 individuals respectively (Table 4). These three species comprised 65 per cent of all reptiles pitfall-trapped during the survey.

Hand-searching

Seventeen species were found by hand-searching beneath stones (Table 2). The most frequently encountered reptiles were *C. robustus*, *L. delicata*, *C. taeniolatus*, *A. parapulchella* and *M. boulengeri* (Table 5).

Mixed grassland yielded the highest average densities of all of the five most commonly found reptiles (Table 5). *Lampropholis delicata* was the most abundant reptile in this habitat type, whilst dry sclerophyll forest, mixed eucalyptus forest, eucalypt woodland, tea-tree scrub and callitris forest, all yielded comparatively low densities of reptiles using the hand-searching technique (Table 5).

Observation

Apart from pitfall traps and hand-searching under stones, most reptiles were also encountered by either opportunistic sightings or as a result of careful observation. Only seven of the 25 species recorded were not observed in the field. Four species (*Chelodina longicollis, Physignathus lesueurii, Eulamprus heatwolei and Pseudechis porphyriacus*) were recorded only by observation.

Table 5. Average densities of five of the most commonly found reptiles during hand-searching under stones in five vegetation types. Densities expressed as number of individuals per 100 stones examined. x = total number of sites examined, n = number of sites where the species occurred. – indicates no captures.

Species	Average density (density range)	Mixed grassland x = 30	Tea-tree in pasture x = 2	Eucalypt woodland x = 6	Dry sclerophyll forest x = 4	Callitris forest x = 4
Ctenotus robustus (striped skink)	1.5 (0.1 – 7.8)	1.75 n = 17	2.2 n = 1	0.12 n = 1	1.03 n = 4	0.5 n = 1
Lampropholis delicata (delicate skink)	1.4 (0.07 – 12.3)	3.2 n = 4	–	0.63 n = 4	0.54 n = 2	0.41 n = 2
Ctenotus taeniolatus (copper-tailed skink)	1.0 (0.05 – 7.7)	1 .3 n = 16	–	0.53 n = 3	0.3 n = 1	0.35 n = 3
Aprasia parapulchella (pink-tailed legless lizard)	0.95 (0.1 – 3.1)	1.0 n = 16	–	–	0.62 n = 3	–
Morethia boulengeri (Boulenger's skink)	0.59 (0.03 – 3.9)	0.65 n = 16	0.65 n = 1	0.76 n = 3	0.45 n = 4	0.34 n = 2

RESULTS (cont'd.)

3. Mammals

Twenty-four species of mammal, representing 13 families, were recorded in Stony Creek Nature Reserve (Table 6).

Bats

Seven species of bats (132 individuals), were captured in harp traps during the survey. The little forest eptesicus *Eptesicus vulturnus* was the most frequently captured species, with 88 individuals (66.7 per cent of all bats trapped). Most other species were trapped in comparatively low numbers, the large forest eptesicus *Eptesicus darlingtoni* and the little mastiff bat *Tadarida planiceps* being the least frequently recorded, with one and three individuals caught respectively (Table 7).

Dry sclerophyll forest had the highest number of bat captures, yielding 87 per cent of the total number of individuals caught across all habitats. Six of the seven species recorded overall, were trapped in this vegetation type. No bats were trapped in tea-tree scrub or the *Casuarina cunninghamiana* dominated riparian community (Table 7).

Small terrestrial mammals

Four species of small terrestrial mammals were recorded. Three species, the house mouse *Mus domesticus*, black rat *Rattus rattus* and bush rat *Rattus fuscipes*, were caught in Elliott traps, and one species, the common dunnart *Sminthopsis murina* was recorded only from pitfall traps. The introduced rodent *Mus domesticus* was the most frequently captured small mammal, with a total of 30 individuals caught at two sites, representing 86 per cent of all small mammals caught during the survey. *Rattus rattus* was recorded at two sites, with one individual at each, and *Rattus fuscipes* only once at one site (Table 8). *Sminthopsis murina* was captured in dry sclerophyll forest and tea-tree scrub, whilst *R. fuscipes* was caught in *Casuarina cunninghamiana* river edge forest only.

Arboreal mammals

Arboreal mammals were found to be relatively uncommon in the study area. Three species were recorded, the common brushtail possum *Trichosurus vulpecula*, common ringtail *Pseudocheirus peregrinus*, and sugar glider *Petaurus breviceps*. *Trichosurus vulpecula* was recorded from three habitat types through spotlight observation and droppings (Table 9). Both *Pseudocheirus peregrinus*, and *Petaurus breviceps* were uncommon in the sites surveyed and were recorded on the basis of one and two individuals observed during spotlighting (Table 9).

Other mammals

Three macropods were recorded during the survey. The eastern grey kangaroo *Macropus giganteus* was the most abundant macropod in the study area, recorded in several habitat types, but most frequently observed in mobs of 10 to 30 animals in mixed grassland and woodland. The eastern wallaroo *Macropus robustus* was observed in three habitat types. It was generally present in much lower numbers than the *M. giganteus* and was most commonly observed in the steep and rugged slopes near the confluence of Stony Creek and the Murrumbidgee River in dry sclerophyll (*Eucalyptus rossii, E. macrorhyncha*) forest and *Callitris endlicherii* dominated communities. This species was also observed feeding in mixed grasslands adjacent to an exotic pine plantation, into which it retreated when disturbed. The swamp wallaby *Wallabia bicolor* was observed frequently as single animals in dry sclerophyll forests, *Eucalyptus blakelyi* woodland and *Callitris endlicheri* forest (Table 9).

The common wombat *Vombatus ursinus* was widespread throughout the study area. Evidence of its presence (burrows and droppings) were particularly conspicuous in the deeper, moist, sandy soils in the *Casuarina cunninghamiana* riparian community and the moist, sheltered creeklines adjacent to the river (Table 9).

The water rat *Hydromys chrysogaster* and platypus *Ornithorhyncus anatinus* were both recorded once in the study area. *Hydromys chrysogaster* was observed feeding on the river bank near the Casuarina Sands toilet block. *Ornithorhyncus anatinus* was also recorded once during the survey, upstream of the junction of Stony Creek and Murrumbidgee River. Both species are confined to the river and adjacent habitats however, it is not appropriate to comment on their likely abundance in the study area (Table 9).

Table 6. Systematic list of mammals recorded in the Stony Creek Nature Reserve

Family Tachyglossidae	
Short-beaked echidna	*Tachyglossus aculeatus*
Family Ornithorhynchidae	
Platypus	*Ornithorhynchus anatinus*
Family Dasyuridae	
Common dunnart	*Sminthopsis murina*
Family Phalangeridae	
Common brushtail possum	*Trichosurus vulpecula*
Family Petauridae	
Common ringtail	*Pseudocheirus peregrinus*
Sugar glider	*Petaurus breviceps*
Family Vombatidae	
Common wombat	*Vombatus ursinus*
Family Macropodidae	
Eastern grey kangaroo	*Macropus giganteus*
Wallaroo	*Macropus robustus*
Swamp wallaby	*Wallabia bicolor*
Family Molossidae	
Little mastiff bat	*Tadarida planiceps*
Family Vespertilionidae	
Lesser long-eared bat	*Nyctophilus geoffroyi*
Gould's wattled bat	*Chalinolobus gouldi*
Chocolate wattled bat	*Chalinolobus morio*
King river eptesicus	*Eptesicus regulus*
Little forest eptesicus	*Eptesicus vulturnus*
Large forest eptesicus	*Eptesicus darlingtoni*
Family Muridae	
Water rat	*Hydromys chrysogaster*
Bush rat	*Rattus fuscipes*
Black rat	*Rattus rattus*
House mouse	*Mus domesticus*
Family Leporidae	
European rabbit	*Oryctolagus cuniculus*
Family Canidae	
Fox	*Vulpes vulpes*
Family Felidae	
Cat	*Felis catus*

Table 7. Number of bats of each species recorded at six sites in Stony Creek Nature Reserve. The vegetation at each trapping site and number of trap nights is shown.

Vegetation types: DSF= Dry sclerophyll forest, TTS = Tea–tree scrub, W = Eucalypt woodland, CcF = Casuarina forest, CeF = Callitris forest. x = Number of harp trap nights, – indicates no captures.

Scientific name	Common name	(1) DSF x = 18	(2) DSF x = 18	(3) TTS x = 18	(4) CcF x = 24	(5) W x = 10	(6) CeF x = 17	Number of individuals
Tadarida planiceps	little mastiff bat	3	–	–	–	–	–	3
Nyctophilus geoffroyi	lesser long–eared bat	4	4	–	–	1	1	10
Chalinolobus gouldi	Gould's wattled bat	8	2	–	–	–	–	10
Chalinolobus morio	chocolate wattled bat	8	1	–	–	–	–	9
Eptesicus darlingtoni	large forest eptesicus	–	1	–	–	–	–	1
Eptesicus regulus	King River eptesicus	9	2	–	–	–	–	11
Eptesicus vulturnus	little forest eptesicus	83	4	–	–	–	1	88
Number of individuals		115	14	–	–	1	2	132

Table 8. Small terrestrial mammals recorded in Stony Creek Nature Reserve

Vegetation Types:

DSF = Dry sclerophyll Forest
TTS = Tea-tree scrub
W = Woodland
CcF = *Casuarina cunninghamiana* forest
CeF = *Callitris endlicheri* forest

Species:

Mus domesticus (house mouse)
Rattus rattus (black rat)
Rattus fuscipes (bush rat)
Sminthopsis murina (common dunnart)

– indicates no captures.

Site	Vegetation type	Number of Elliott trap nights	Species & number	Number of pitfall trap nights	Species & number
1	DSF	200	–	1480	–
2	DSF	200	–	1480	*S. murina* 1
3	TTS	150	–	1406	*S. murina* 1
4	CcF	200	*M. domesticus* 18 *R. fuscipes* 1	–	–
5	W	400	*M. domesticus* 10 *R. rattus* 1	2960	*M. domesticus* 2
6	CeF	275	*R. rattus* 1	–	–
7	DSF	75	–	1406	–

One Echidna *Tachyglossus aculeatus* was encountered crossing the Cotter Road adjacent to *E. blakelyii* woodland in the study area. A quill was found in dry sclerophyll (*E. macrorhyncha*) forest and scratchings in ant mounds (thought to be those of the echidna) were observed in mixed grassland (Table 9).

Foxes *Vulpes vulpes* were observed across a range of habitat types in the study area but were sighted most frequently in open mixed grasslands. A family of cats *Felis catus*, (one adult and five kittens) were trapped in *E. blakelyi* woodland adjacent to Casuarina Sands, and destroyed.

Rabbits *Oryctolagus cuniculus* were widespread throughout the study area (Table 8). Their presence and activity was evident particularly in mixed grassland adjacent to tea-tree scrub and woodland. In these situations local grazing impact appeared to be high, with extensive rabbit browsed "lawn" being evident near the edge of some tea-tree thickets.

Table 9. The occurrence in different vegetation types of mammals, other than bats and small terrestrial mammals

Vegetation Types:

DSF = Dry sclerophyll forest;
TTS = Tea-tree scrub;
W = Eucalypt woodland;
CeF = *Callitris endlicheri* forest;
CcF = *Casuarina cunninghamiana* forest;
MG = Mixed grassland

Species	Vegetation type DSF	TTS	W	CeF	CcF	MG
Trichosurus vulpecula (common brushtail possum)	X		X		X	
Pseudocheirus peregrinus (common ringtail)					X	
Petaurus breviceps (sugar glider)	X					
Macropus giganteus (eastern grey kangaroo)	X			X		X
Macropus robustus (wallaroo)	X			X		X
Wallabia bicolor (swamp wallaby)	X		X	X		
Vombatus ursinus (common wombat)			X		X	X
Hydromys chrysogaster (water rat)					X	
Ornithorhynchus anatinus (platypus)					X	
Tachyglossus aculeatus (short-beaked echidna)	X		X			X
Vulpes vulpes (fox)	X	X	X			X
Felis catus (cat)			X			
Oryctolagus cuniculus) (european rabbit)	X	X	X			X

DISCUSSION

1. Frogs

Among the seven species that were recorded in Stony Creek Nature Reserve five, (*Crinia signifera, C. parinsignifera, Uperoleia laevigata, Limnodynastes tasmaniensis, L. dumerilli*) are considered widespread and common in the ACT. *Litoria lesueurii* and *L. latopalmata*, however, are species that are uncommon in the region and about which relatively little is known.

Crinia signifera (the common eastern froglet) and *Crinia parinsignifera* (the plains froglet) are very similar in size and appearance. However, they appeared to select different breeding habitats in the study area. *Crinia parinsignifera* was heard calling only along the larger creeks which provide at least some permanent water throughout much of the year, whilst *C. signifera* was common in a variety of habitats ranging from creeks, the rivers edge and other moist, low lying areas as well as dry sites in dry sclerophyll forest, tea-tree scrub and woodland. Both species occurred in large numbers along the larger creeks and were particularly active and vocal after rain.

The spotted grass frog *Limnodynastes tasmaniensis* and eastern banjo frog *L. dumerilli* were widespread in the study area, although not particularly abundant in any one location. The orange-groined toadlet *Uperoleia laevigata* was found to be very uncommon during the survey and may reflect the absence of flooded grassy depressions, swamps or ponds which are most commonly used by this species for breeding (Barker and Grigg 1977).

Litoria lesueurii (Lesueur's stream frog) was restricted in occurrence in the Stony Creek Nature Reserve to sections of the Murrumbidgee River, where it was observed in small numbers. The one occasion on which this species was located does not give a good indication of abundance, or the extent of distribution along the river, particularly as the species was not calling at that time. Although the distribution of this frog in the ACT is poorly known (Osborne 1992), it has been recorded along the Cotter River, Bendora Reservoir, Googong Reservoir and the Queanbeyan River (M. Lintermans pers. comm.). There are two genetically distinct forms of this species in the ACT, with extensive hybridization along the Murrumbidgee River. Further surveys for this species, including the two forms, have been recommended for a better understanding of its habitat, distribution and conservation status (Osborne 1992).

Prior to this survey, *Litoria latopalmata* (the broad-palmed frog) was known in the ACT from just a few isolated records. The survey of Stony Creek Nature Reserve revealed several areas where the frogs occurred in large numbers. Breeding populations were found at Stony Creek and the Block 13 creek system, and along the edge of the Murrumbidgee River. It was also heard calling at a farm dam near the top of Stony Creek, just outside the study area. This species was most commonly associated with rocky sections of the large creeks and river, and it is likely that it is distributed in suitable sections along the length of the Murrumbidgee River in the ACT and that it extends up many creek lines and into nearby farm dams.

It is worthwhile to consider why the *L. latopalmata* was so poorly known in the ACT prior to this survey. One possible explanation is that these breeding areas were never visited, let alone surveyed in the past by competent herpetologists during the breeding season of this frog, which appears to begin considerably later than that of most other ACT frogs (W. Osborne pers. comm.). It is also possible that this species may be increasing in abundance in the region.

Some inadequacies of the frog survey should be pointed out, as they may have affected the number of species and number of individuals detected. To sample effectively all species at a breeding site, surveys should be carried out in all seasons and on several occasions (Hone *et al.* 1992) as daily fluctuations in weather conditions (temperature and moisture) have a marked effect on activity and calling in many species (Osborne 1985). During this survey, it was not possible to survey every potential frog breeding site or repeatedly to assess the selected sites in ideal conditions.

DISCUSSION (cont'd)

2. Reptiles

General

The twenty four species of reptiles recorded in the Stony Creek Nature Reserve, compares favourably with reptile diversity in other areas of the ACT with similar habitats. Kukolic (1990) identified 20 species from the Mt Ainslie, Mt Majura and Black Mountain reserves. Species present in these reserves were predominantly ones which also were recorded in Stony Creek Nature Reserve. A few species in both areas, however, were not represented in the other. Osborne and McKergow (1993) in a survey of twelve Canberra Nature Park units throughout Canberra, found 19 reptile species.

All but two of these (*Phyllodactylus marmoratus* and *Delma inornata*) were recorded also during the present survey.

Faunal surveys which cover a wider altitudinal range, however, typically identify higher reptile species richness. An ecological study of the Mt Tennent - Blue Gum Creek area (Gilmour, Helman and Osborne 1987) revealed 34 species of reptile, and Lintermans (1993), in a review of the vertebrate fauna of the Gudgenby region listed 29 species known to be present and expected in the area. The species that are present in these areas include many of the reptiles also found in Stony Creek Nature Reserve. Most of the additional species are those that are confined to mid to high altitude habitats (above 1000 metres).

The Murrumbidgee River Ecological Study (NCDC 1981) listed 24 species of reptile for the Murrumbidgee River Corridor. Only eight of these, however, were listed as a result of observation. The others were classed as "likely to occur" although not observed. The present survey confirms the presence of 12 species which were predicted to occur and adds a further five species (*A. nobbi, A. parapulchella, M. greyii, M. boulengeri* and *C. uber*) which were not identified in the NCDC (1981) report. Four predicted species were not located in the present study.

Ctenotus taeniolatus, *Morethia boulengeri* and *Lamprophotis delicata* were the most widely distributed reptiles in the study area, followed by *Amphibolurus nobbi* and *Tiliqua scincoides*. The occurrence of these reptiles across a range of habitats is not surprising as all except *A. nobbi* are generally considered widespread and common throughout their range. The most restricted species, in terms of habitats utilised, were considered to be those which were found consistently in reasonable numbers in only one or two habitat types. *Pseudemoia platynota* and *Hemiergis decresiensis* both occurred in only one habitat type. *Pseudemoia platynota* was found in dry sclerophyll forest in sites with abundant leaf litter and woody debris and *H. decresiensis* was found only in woodland with a dense grassy understorey. The occurrence of these species can be considered to reflect true habitat specificity.

Other reptiles were also found in only one or two habitats (e.g. *M. greyii, P. barbata, C. uber, S. spectabilis*). The numbers observed were so low, however, that it is impossible to ascertain whether this reflects true habitat specificity or is simply an indication of low abundance or even trap shyness.

Reptile species richness – comparison between habitats

Reptile species richness in a particular habitat, to a large extent, can be attributed to the structural and vegetative diversity of the habitat (Heatwole and Taylor 1987). More diverse environments provide a greater number of microhabitats, accommodating the requirements of a greater variety of reptile species.

The larger number of reptile species found in the eucalypt woodland, to some extent, can be related to the environmental heterogeneity of this cover type. The woodland examined during this study occurred on moderate to steep north-west and north facing slopes, with numerous boulder and rock outcrops, scattered rock and woody debris among predominantly native grasses and shrubs. The reduced canopy cover over large areas provided maximum exposure to the sun, providing basking opportunities for a large number of reptiles.

A relatively large number of reptiles were found also in dry sclerophyll forest. This similarly could be related to the number of microhabitats available. Some important differences in the nature of this habitat, however, were apparent. These included a heavier canopy cover (with less exposure to the sun), a comparatively poor grass understorey and an increased leaf and woody litter component.

The unexpectedly high reptile species richness of the structurally simple mixed grassland warrants further examination. Of the 15 species identified in this habitat type, four (*Physignathus lesueurii, Eulamprus heatwolei, Pseudechis porphyriacus and Egernia cunninghami*) were associated with specific microhabitats such as water or large boulders with substantial crevices. Their presence, therefore, in this habitat type was probably determined by these features rather than the vegetation type *per se*. This aside, eleven other species were found within the mixed grassland. Although the vegetation provided relatively little structural diversity, sites for hand-searching were selected on the basis of rock cover (sites with rocky outcrops or scattered shallowly embedded and surficial rock). Therefore, sampling was biased for areas with enhanced (improved) structural diversity. Although areas without rock were not examined, it can be assumed that rocky areas within this habitat type are vital in providing shelter and basking sites, as well as habitat for ants, termites and other arthropods that are essential food resources for many reptiles.

The small number of reptile species found in both *Callitris* and *Casuarina* forest probably reflects a survey deficiency. No pitfall trapping or hand-searching was

conducted in the *Casuarina* forest, and subsequently all records were the result of observation only. Nevertheless, the unpredictable nature of the river edge environment, including fluctuating water levels, and periodic inundation, would appear to restrict this habitat to those species that are suitably adapted to these conditions. In *Callitris* forest only a limited amount of hand-searching and observation was carried out, and although observation was the primary method of survey in this vegetation type, this method was particularly effective due to the good visibility in large areas devoid of ground cover (a characteristic of the *Callitris* forest floor). The small number of reptile species observed was probably a feature of this vegetation type. Dry, exposed conditions and sparse shrub and grass cover probably contributed to the low species richness through complex interactions affecting arthropod diversity.

The moderately high species richness in tea-tree scrub is quite surprising, considering the apparent lack of structural and vegetative diversity, lack of ground cover and the density of tea-tree canopy. One likely explanation is that the tea-tree scrub site examined during pit-fall trapping does not accurately reflect the reptile fauna deep within more extensive and dense tea-tree stands, such as occurred throughout the study area. The tea-tree scrub pitfall trapping site was located close to the interface between tea-tree and dry sclerophyll forest and is relatively accessible from adjacent areas. It is possible, therefore, that the reptiles caught may represent individuals that strayed in from the adjacent habitat or animals that may be utilizing the fringe of sub-optimal habitat due to population pressures in their preferred habitat.

Pitfall trapping

The Casuarina Sands sites (CS 1 and CS 2) were the most productive of all pitfall trapping sites in terms of the total number of reptiles caught. This result, however, is largely due to just three species, *Carlia tetradactyla, Ctenotus robustus* and *Lampropholis delicata*, which were trapped in large numbers at these sites. It is apparent that for at least these species, the woodland sites provided better habitat than the sites in the dry sclerophyll forest and tea-tree scrub on the western side of the river. These three species were also the most frequently captured reptiles overall, demonstrating their capacity to exploit successfully suitable habitats.

Hand-searching

Hand-searching yielded similar information to that for pitfall trapping in terms of the species caught. *Ctenotus robustus, L. delicata, C. taeniolatus* and *M. boulengeri* were

amongst the most abundant reptiles. *Aprasia parapulchella* also frequently was encountered using hand-searching. This result may reflect survey bias as a large number of the sites were searched during the 1991-92 *A. parapulchella* survey and accordingly, potentially suitable habitat for this species was targeted.

The hand-searching results indicated that mixed grassland supported higher densities of five of the most frequently encountered reptiles, than either dry sclerophyll forest, eucalypt woodland, tea-tree scrub or *Callitris* forest. However, this result may not reflect true differences and, as mentioned above, may be due to the small number of sites searched in these other communities.

Evaluation of methodology

Pitfall trapping proved to be the most successful method of detecting reptiles in terms of the number of species recorded (19 species, or 79 per cent of all species recorded). Although a large proportion of species were revealed through this technique, it was only practical at sites with relatively easy access and which were not obvious to the public. More remote areas, or those frequented by the public, were surveyed using either hand-searching or observation, or a combination of both. These methods revealed an additional five species, four by observation only and one by hand-searching only. This illustrates the importance of utilising alternative approaches to survey, when a preferred method is not practical or possible. It can be concluded that a combination of survey techniques is required to record the fullest complement of species possible.

The pitfall trapping results provided useful quantitative information on reptile abundance at different sites. Weather conditions, trap effort (number of trap days) are comparable across sites and results can be assumed to reflect real differences. Pitfall trapping lends itself well to an evaluation of habitat use by many reptiles, particularly those captured in moderate and high numbers. However, it should be noted that some reptiles may be either under- represented or absent in a pitfall trapping sample. For example, larger bodied snakes and lizards as well as geckos were found infrequently in pitfall traps, reflecting trap avoidance or an ability to escape from the traps.

Turning over rocks by hand allows a large number of widely-distributed and remote locations to be sampled. The information obtained, however, is biased towards those species which use rocks for shelter. Species that shelter in other situations such as grass tussocks, burrows, inside hollow logs or under peeling bark may not be detected as readily. Comparisons between sites and between habitats should be made with

caution, as variables such as time of day and weather conditions during the searching will have a considerable effect on the results.

DISCUSSION (cont'd)

3. Mammals

The mammal fauna of the Stony Creek Nature Reserve was found to be diverse, but on the whole (except for the river dwelling mammals) not unique to the river valley environments, most species being present in suitable habitats throughout the ACT.

Bats

The bats recorded during the study probably represent only a proportion of the total species which occupy or utilise the area at one time or another. The harp traps used during the survey only readily sample those species which occur in relatively large numbers and fly close to the ground whilst feeding. Bats which feed above the canopy were less likely to be captured by this method.

A number of confounding variables are likely to have affected the results of the bat survey, in terms of the species present and their abundance at different sites and habitat types. Bat activity is affected by weather. The most favourable conditions include hot nights with no moon, wind or rain (Reardon and Flavel 1987). During the survey, conditions varied considerably in relation to these variables. Trapping was conducted over three months during the summer. Seasonal activity patterns of bats may have shifted during this time and therefore the results may reflect changes in activity rather than actual differences between habitat types. Trap placement is a crucial factor in successful capture. Possible flight paths were selected subjectively but at times traps were set in less optimum positions, and therefore were essentially ineffective. The distributions of species in different habitat types indicated presence only, rather than providing a meaningful index of abundance, or different habitat utilisation.

Habitat components which are known to be important for bats include the availability of suitable roosting and maternity sites. The bats recorded during this survey are all known to utilise tree hollows, which are most often associated with mature and senescing trees. The abundance of insects is closely related to plants in flower and

therefore seasonal variation in habitat utilisation probably occurs to some extent, particularly as bats are highly mobile.

Small terrestrial mammals

The small mammal fauna of the study area is less diverse than many other areas of the ACT for which information is available (Kukolic 1990; Gilmour, Helman and Osborne 1987; Stewart 1979; Lintermans 1993). Two native mammals (*Sminthopsis murina* and *Rattus fuscipes*) were rarely caught, indicating their low abundance in the sites surveyed.

Rattus fuscipes was recorded on the basis of only one individual in the *Casuarina cunninghamiana* river edge community. This species is said to be associated most commonly with areas of dense vegetation such as sheltered gullies (Lunney 1983). Although not particularly densely vegetated, the site in which this species was recorded, was sheltered and moist, with an extensive scatter of jumbled piles of flood debris. The structural diversity provided by the debris is likely to cater well for the shelter requirements of this native rodent. It probably inhabits some of the moist, sheltered, well vegetated creek lines entering the river, which were not sampled during this survey.

Sminthopsis murina was found to be uncommon in the Stony Creek Nature Reserve, being recorded on the basis of two individuals only, which were trapped in tea-tree scrub and dry sclerophyll (*E. macrorhyncha*) forest. It has also been trapped in other parts of the ACT, generally in low numbers (Linnett 1988, Kukolic 1990, and Smillie In Prep). This species is known to benefit from periodic burning of its habitat, occurring in highest densities in areas which have been burnt in the previous two to four years (Fox 1983).

Mus domesticus is widely recognised as a highly adaptable and opportunistic rodent, capable of colonising a vast range of habitats. In the study area, its occurrence only in *Casuarina cunninghamiana* forest and *Eucalyptus blakelyi* woodland is somewhat surprising, but probably reflects soil type, moisture levels and cover characteristics at these sites. Newsome (1983) identified the suitability of soil for burrowing to be an important habitat component of this species, and the moist, sandy soils of the river oak forest as well as the soils supporting the eucalypt woodland and dense grassy understorey, may better cater for the requirements of this species. *Mus domesticus*, which is an adaptable feeder and capable of rapid reproduction and population increase under favourable conditions, probably inhabits other habitats in the study area

especially when favoured habitats become densely populated and resources diminish. Although mixed grasslands were not sampled, it is expected that *M. domesticus* occurs in them, due to the relatively rich soils and food resources.

Rattus rattus was captured on two occassions only, one in *Callitris endlicheri* forest, in a large hollow log and the other in a boulder and rock outcrop in *E. blakelyi* woodland. The results suggest that this species prefers such structures for its habitat, and that overall was uncommon in the study area.

Arboreal mammals

It is not possible or appropriate to comment definitively on the abundance or distribution of arboreal mammals in the study area. The species listed in Table 9 should be considered as an indication of presence only, with the three species possibly far more widespread across habitats. Nevertheless, the common brushtail possum appeared to be the most conspicuous and abundant component of the arboreal mammal fauna in the habitat types surveyed.

The availability of suitable tree hollows for sheltering is known to be an important limiting factor for most arboreal marsupials. All three arboreal mammals recorded in the study (*Trichosurus vulpecula*, *Pseudocheirus peregrinus* and *Petaurus breviceps*) utilise tree hollows. However, *P. peregrinus* is not as reliant on mature eucalypt forests and woodlands as *P. breviceps* and *T. vulpecula* because it is also capable of building nests (How *et al.* 1984) and known to feed on the foliage of a large number of plant genera (Pahl 1984). *Petaurus breviceps* is believed to require habitat which provides arthropods, plant and animal exudates and suitably sized tree hollows. The presence of acacias which produce gum appear to be important, particularly in southern populations (Henry and Suckling 1984).

On the whole, habitat characteristics that are thought to benefit arboreal mammals include mature forest with abundant tree hollows, a long period since the last severe fire, a floristic diversity that caters for the feeding requirements of the component species, and a high foliage nutrient status (Kavanagh 1984).

Other mammals

Macropus robustus and *Wallabia bicolor* appeared to rely more heavily on the timbered habitats of the study area, whilst *M. giganteus* utilised the cleared pastures and forest

edges to a greater extent. *Macropus robustus* is considered an uncommon species in the ACT (ACT Planning Authority 1992). However along the Murrumbidgee River and Stony Creek Nature Reserve it appeared moderately abundant. Forested habitats including *Callitris endlicherii* appeared to form an important habitat component of this species.

Vulpes vulpes (fox) and *Felis catus* (cat), although infrequently observed in the study area during the survey, are probably widespread across a range of habitats. Some native wildlife is undoubtedly consumed by these predators. As elsewhere in Australia, however, the introduced rabbit probably makes up a large proportion of their diet (Coman 1983 and Jones 1983).

The activity of *Oryctolagus cuniculus* (rabbit) was widespread in the study area. However, it was possibly most conspicuous in the cleared pastures, and other open situations adjacent to tea-tree scrub. During the survey no areas of particularly heavy rabbit infestation or damage was observed.

CONCLUSIONS AND RECOMMENDATIONS

General

The Stony Creek Nature Reserve supports a range of vegetation communities that provide habitat for at least 24 mammal, 24 reptile and 7 frog species. Although most of these animals are not restricted to this region and are known from other parts of the ACT, a large number of significant species are present in this relatively small area. Therefore, the Stony Creek Nature Reserve can be considered of ecological importance, both in terms of its taxonomic diversity as well as habitat value for significant species, that is, species which are regionally uncommon, geographically restricted, near the limits of their known range or nationally endangered.

Whilst all vegetation communities of the study area support wildlife populations, it is apparent that some areas are more significant in terms of species richness or the presence of uncommon species. The eucalypt woodland with a well developed native grass understorey, which is situated on the north-west facing hillslope adjacent to Casuarina Sands, has a particularly rich and interesting herpetofauna. It supports five species which are considered regionally uncommon or restricted (ACT Planning Authority 1992), and a nationally endangered legless lizard (*Aprasia parapulchella*). This site provides an ideal situation for organised and controlled public education and interpretation activities, as it is close to existing recreational facilities, carparks and the MRC headquarters. Over-use and possible degradation of the site does not appear to be a threat at this time, due to its steep slope, absence of walking trails and fenceline separating it from the heavily utilised river frontage. It is recommended that the largely native character of the vegetation at this site be protected and that weed infestation and exotic pasture species be controlled.

The Stony Creek and Block 13 areas support large breeding populations of *L. latopalmata* (the broad palmed frog), a species which until now was known in the ACT from only a few isolated records of individual non-breeding animals. In Block 13, cattle which are agisted in the adjacent pine plantation are able to move freely between the pines and largely cleared grassy slopes of the reserve. This area, with its cover of mixed exotic and native grasses and rocky outcrops, has a rich reptile fauna, including a good population of the endangered pink-tailed legless lizard and a breeding population of the broad palmed frog. Any possible further degradation of this area by livestock grazing should be prevented through careful management. Ideally, fencing should be established between the pine plantation and the reserve, enabling control of the extent

of grazing, although the cost of this option may be prohibitive and periodical reassessment of stocking rates may be adequate. A similar situation exists in the paddocks adjoining Stony Creek, another breeding site of *L. latopalmata* and the site of the only record in the study area of the regionally uncommon spotted ctenotus *Ctenotus uber*. Here the pastures have been highly modified by pastoral practices. Some areas have been degraded by weed invasion and erosion and the wildlife values of this area (particularly for reptiles and frogs) can be maintained and enhanced by a program of weed control and careful management of stocking rates to prevent degradation by overgrazing, trampling and nutrient enrichment of streams. The feasibility of implementing these recommendations on leased land needs to be addressed.

The largely fragmented patches of dry sclerophyll forest in the study area provide important remnants of the type of vegetation that was much more widespread prior to land clearance and subsequent vegetative changes. These forests provide important habitat for many species which rely on the various habitat attributes of a forested environment, such as tree hollows, foliage, and ground debris. Reptile species richness is perhaps a little lower than in the open woodland and mixed grasslands which supported the highest numbers of species. However, a number of uncommon species are found in this habitat type and one reptile species, the red-throated skink *Pseudemoia platynota*, was only found to inhabit dry sclerophyll forest.

The largely treeless, mixed grasslands of the study area support a surprisingly rich reptile fauna. Most of these pastures have had minimal pasture improvement in the past (L. Margules pers. comm.) and subsequently retain a rich complement of native grasses, forbs and shrubs. The rocky outcrops within these pastures that supported the greatest concentrations of reptiles could potentially be threatened by the spread of tea-tree scrub. The highly invasive properties of *Kunzea ericoides* has been documented, including the establishment of dense populations after relaxation of grazing by stock in the Tidbinbilla valley (Kirschbaum and Williams 1991). The dynamics of tea-tree in mixed pastures, as well as its relationship to past land management practices in the Murrumbidgee River Corridor, needs to be investigated. The potential of this vegetation to threaten important reptile habitat in mixed pastures, needs to be determined.

The Murrumbidgee River Corridor, including Stony Creek Nature Reserve, is recognised as an important wildlife movement corridor (ACTPCS 1992, NCDC 1981, 1984, 1988, ACTPA 1992). Movement in this context includes migration, diurnal or seasonal shifts in preferred habitat, temporary or long term refuge from disturbance and the potential

for gradual extension of a species range through a continuity of suitable habitats and conditions. The effectiveness of a corridor in facilitating movement depends on inherent characteristics of the species present, including their ecological, demographic, life history and mobility attributes. The shape, size, and width of corridors are known to influence their effectiveness (Soule and Gilpin 1991), narrow corridors generally being less effective as they are more prone to edge effects such as weed invasion, exposure to predators and other disturbances.

The maintenance of a mosaic pattern of vegetation communities, which are in some way connected to other areas with similar habitat, is a desirable conservation objective for the reserve. This approach will facilitate the maintenance of high species richness, as well as allowing for natural ecological processes to continue. This concept of a mosaic pattern in vegetation is also particularly relevant when considering fuel reduction burning. It is obvious that individual animals will be injured or perish, even during a low intensity fire as a result of injury, or subsequently from lack of food, loss of sheltering sites and increased predation. However, in the medium to long term, most species will re-establish into the community. This is particularly likely if a low intensity, mosaic pattern of burn is adopted. Low intensity fires are more likely to retain important refuge components (such as logs and tree hollows) and enable animals sheltering under rocks and in crevices to survive. Unburnt patches are essential for shelter and as a source of animals for recolonisation. Intervals between fires need to be sufficient to allow habitat recovery and the re-establishment on plant and animal communities.

Features which present a barrier to movement, vary between groups of animals, depending largely on their ability to move through inhospitable or inappropriate habitats and their ability to utilise sub-optimal habitats. In the Stony Creek Nature Reserve, extensive stands of tea-tree scrub occur throughout the area. In many places it forms seemingly inhospitable barriers for species which are unable to meet their requirements in this habitat, and in some areas isolates other vegetation communities into unconnected patches. Whilst this survey provides some information on the species which utilise the edge of tea-tree scrub, it does not reflect adequately the situation in extensive, dense stands of tea-tree. It is strongly recommended that further research be focussed on the faunal habitat value of tea-tree.

It is difficult to determine what, if any, wildlife habitat value, areas of extensive infestations of blackberry (such as that along Tarpaulin Creek) may have but it is certain that its control and subsequent rehabilitation would allow wildlife species to

recolonise from adjacent areas. Control of this, and other invasive weeds is recommended.

Potential effects of adjacent land uses

Grazing

The largely cleared pastures adjoining the reserve and associated grazing probably have minimal adverse effects on the fauna of the reserve, apart from creating barriers to movement for animals which rely on continuous vegetation or tree cover. This, however, applies only when co-operation between the rural lease holder and reserve manager facilitates the use of appropriate management practices. These include:

1. Sound stock-proof fencing which is maintained regularly;

2. Control of weeds on both sides of the fence, but avoiding broad-acre herbicides, particularly near creek lines as these may effect water quality and consequently fauna, e. g. frog breeding and spawning sites may be affected;

3. Pasture improvement conducted in such a way that fertilizers are applied and confined to the targetted paddocks; and

4. Stocking rates should remain conservative, particularly near creeks, to avoid excess runoff leading to frequent high flows, erosion and siltation of creeks. Trampling by stock and nutrient enrichment of creeks should also be avoided.

Pine plantation forestry

Activities associated with pine plantation forestry that potentially may affect the fauna of the reserve include increased sedimentation of creeks following extensive logging operations and fertilizer and herbicide applications which may have localised affects on native vegetation and effects on stream organisms such as frogs. These effects, however, probably largely are eliminated by the use of effective erosion control practices and the localised and appropriate application of chemicals.

Areas with potential for interpretative activities

The Casuarina Sands Woodland (Figure 5) is an area with a rich reptile fauna. It is close to existing recreational sites, car parks and MRC (ACTPCS) Headquaters. Activity should be carefully organised and controlled, with appropriate ecological and conservation messages strongly reinforced.

Dry sclerophyll forest, off Brindabella Rd (Figure 5) is an area, which includes an existing walking trail and has great potential for bat trapping. The type of night has a profound influence on capture success, however, so a warm, still, moonless nights should be targetted for maximum trap yield. Potential for interference with traps exists due to the walking trail and proximity of Brindabella Road.

The river bank, down stream of Casuarina Sands, although not rich in nocturnal fauna, is perhaps one of the most convenient and rewarding areas to view wombats, swamp wallabies, brushtail possums and perhaps the occasional ringtail possum. If one proceeds further along the river's edge to areas of river cobbles and solid rock outcrops, a number of frog species can be observed (or heard), during late summer, including Lesueur's stream frog *Litoria lesueurii* and the broad-palmed frog *Litoria latopalmata*. During warm summer days (particularly mid-morning), this stretch of river is excellent for viewing the conspicuous and spectacular water dragons *Physignathus lesueurii*

Recommendations for further research and monitoring

Detailed information was obtained on the occurrence of reptiles and frogs during this survey but for other groups, such as the arboreal mammals, is relatively scant. Further surveys of mammals are required and a more comprehensive effort of spotlighting and scat collection undoubtedly would yield further information on the utilisation of different habitats.

As mentioned earlier , the spread of tea-tree, its use by wildlife and potential to threaten other vegetation communities and reserve objectives, should be the focus of further research. Wildlife species potentially at risk need to be identified, the reality of that risk established.

The monitoring of frog populations along the river and the creek systems of the study area should proceed - with particular attention being given to the habitat requirements

of the broad-palmed frog *L. latopalmata* which is near the limits of its range in this region, and the restricted and uncommon Lesueurs' stream frog *L. lesueurii*.

In summary, the baseline information compiled in this report is important in several ways:

1. It provides a constant, against which future changes in distribution and abundance can be evaluated.

2. It allows other areas with similar habitat to be assessed in terms of their potential to support individual animal species or communities and particularly other areas along the Murrumbidgee River Corridor.

3. It identifies areas of particularly rich species diversity which have potential for interpretative activities for the public.

4. It identifies sites where uncommon and restricted species occur. This will enable populations and habitat quality to be monitored and management actions for their protection to be initiated.

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APPENDIX 1. Description of pitfall trapping sites.

CS 1 and CS 2 (Casuarina Sands 1 and 2)

These sites are located on a moderate to steep north-west facing slope, on the east bank of the Murrumbidgee River near Casuarina Sands (Figure 3). The slope is characterised by *Eucalyptus blakelyi* woodland with a well-developed grass and to a lesser extent, shrub understorey (for a more detailed vegetative description see page 6 - woodland). The area has numerous rocky outcrops, particularly towards the top of the slope, as well as scattered surficial and shallowly embedded rock, and a moderate amount of woody debris scattered throughout.

BR 1 (Brindabella Road 1)

This site is situated on the western side of the Murrumbidgee River, off Brindabella Road (Figure 3). The site was on a south-westerly aspect on a moderate slope supporting a dry sclerophyll (*E. rossii, E. macrorhyncha* and *E. mannifera*) forest, with a well developed shrub understorey (for a more detailed vegetative description see page 6 - dry sclerophyll forest). Rocky outcrops were present in the area along with scattered rock and woody litter.

BR 2 (Brindabella Road 2)

This site, just off Brindabella Rd (Figure 3) on a north-westerly aspect, has a moderate slope, dominated by tea-tree *Kunzea ericoides* and *Leptospermum brevipes* scrub (for a more detailed vegetative description see page 6 - Tea-tree scrub). Scattered small surficial rock was present over a predominantly bare soil surface.

BR 3 (Brindabella Road 3)

This site is situated approximately 100 metres east of BR 2 (Figure 3) and shares the same north-westerly aspect and soil characteristics. This moderate to steep slope supports an open *E. macrorhyncha* forest with tea-tree occurring as understorey along with other less conspicuous shrubs.

BR 4 (Brindabella Road 4)

This site is situated approximately 300 metres up-slope from BR 3, and is characterised by a gentle easterly slope, supporting a moderately dense stand of *E. macrorhyncha*. Understorey vegetation is virtually absent, with leaf, bark and woody litter the most conspicuous feature of the forest floor.

APPENDIX 2. Notes on the occurrence of each species of reptile recorded in Stony Creek Nature Reserve

Chelodina longicollis (eastern snake-necked tortoise)

The eastern long-necked turtle was recorded only once during the survey, in a small pool adjacent to the river. However, it is considered widespread along the Murrumbidgee River (Lintermans 1993) and is known to occur in farm dams and creeks (Jenkins and Bartell 1980). In the study area, absence of farm dams would restrict the species to the pools of the river and creek systems. The species can be considered localised in its occurrence to areas of suitable habitat associated with the river and creeks.

Diplodactylus vittatus (stone gecko)

This small nocturnal reptile was found in dry sclerophyll forest and woodland. The relative abundance of the species in the study area can not be estimated from the results of this survey.

Aprasia parapulchella (pink-tailed legless lizard)

This nationally endangered pygopodid is widely distributed along the Murrumbidgee River Corridor where it inhabits rocky slopes in open woodland or unimproved mixed grasslands that have a component of native grass (Osborne and McKergow 1993). Within Stony Creek Nature Reserve it was found at 21 of the 51 sites surveyed by hand-searching. Suitable habitat is relatively abundant in the study area and no immediate threats to the sites are evident. However, in the longer term, the spread of tea-tree scrub could jeopardise the survival of the species at many locations where they exist today. The current land status, management arrangements and policies facilitate the survival of the species. Nevertheless any changes to these, particularly pasture improvement, increased stocking rates or tree plantings, would be likely to have an effect on the habitat of this reptile.

Although previously known from the Murrumbidgee River Corridor, this species has never before been found in tea-tree scrub. Thus the capture of specimens in *Kunzea ericoides* - *Leptospermum brevipes* scrub at site BR 2 is of interest. Osborne *et al.* (1991), stated that the species presence was strongly correlated to presence of an extensive cover of partially buried rock, a cover of predominantly native grasses and little or no woody vegetation. The tea-tree scrub where the species was found during this survey had very little suitable rock cover, virtually no grass and an extensive cover of woody scrub. At a distance of about 100

metres up slope, there was a small area of exposed rock, with a sparse cover of grasses. This area, although considered only marginal for A. parapulchella may be the source for the lizards caught in the pitfall traps in tea-tree scrub. However, it is more likely that factors other than grass and rock may determine the presence of the species at this site, and indicates that some re-assessment of the habitat requirements of this species is warranted.

Virtually all records of *A. parapulchella* to date have resulted from hand-searching under stones where the animals were usually found just at the soil surface, often associated with ant burrows. The capture of this species in pitfall traps in this study provides important evidence of their above-ground movements and confirms the potential of pitfall trapping as an effective method for the study of populations and movements of the species.

Lialis burtonis (Burton's legless lizard)

Prior to this survey, the occurrence of *Lialis burtonis* in the ACT was known from just a few isolated records (Kukolic 1990; Gilmour, Helman and Osborne 1987; D. Roso pers. comm., W. Osborne pers. comm.). The pitfall trapping data for this species, although insufficient for statistical analysis, gives some indication of habitat utilisation and abundance of this species. The eucalypt woodland, with its dense, predominantly native grass understorey, appeared to be favoured, with considerably fewer records from the dry sclerophyll forest. It is likely that this pygopodid, which feeds almost exclusively on small skinks (Greer 1989) and uses an ambush style of feeding, is well catered for at these woodland sites with their varied and abundant skink fauna and dense ground cover. The difference in numbers of this species caught at the two woodland sites (Casuarina Sands 1 and 2) is somewhat puzzling due to their close proximity and the similarity of their vegetation cover.

Amphibolurus muricatus (jacky lizard)

This small dragon was uncommonly encountered during the survey either by pitfall trapping, hand-searching or observation. The low numbers recorded overall did not give an indication of abundance in different vegetation communities. The species was encountered in dry sclerophyll forest, woodland and tea-tree scrub. Pitfall trapping results indicate that the species is present in lower numbers than most other reptiles with which it occurs.

Amphibolurus nobbi (nobbi)

This uncommon species was recorded in a number of different vegetation communities including tea-tree scrub, dry sclerophyll forest, woodland and *Callitris* forest. It was found in all these habitat types in higher numbers than *A. muricatus* and *Pogona barbata.* Although moderate numbers of this species were found in pitfall traps, numbers were not large enough to allow statistical analysis or give firm evidence of differential habitat preference. The trapping of *A. nobbi* at so many sites is important because, although their occurrence along the MRC was known, habitat requirements were thought to be more specific and therefore their distribution far more localised.

Physignathus lesueurii (eastern water dragon)

There are two recognisable races of this species, 'lesueurii' and 'howittii'. The race which inhabits this region is the latter, and is commonly referred to as the Gippsland water dragon.

This agamid was found only in association with water and was common in *Casuarina* forest at the river's edge, as well as present along the two main creek systems of the Stony Creek Nature Reserve, which flow through mixed grasslands. During summer individuals were frequently observed basking on rocks and timber adjacent to these water courses and juveniles were particularly abundant in January and February.

Pogona barbata (bearded dragon)

This species appears to be uncommon in the study area with only two individuals found during the survey. Consequently, little can be said about its habitat preferences. The two individuals were both juveniles and were found within 100 metres of each other, one in tea-tree scrub and the other in a highly disturbed rocky area with a few regenerating eucalypts.

Carlia tetradactyla (four-fingered skink)

Carlia tetradactyla inhabited mixed grasslands, woodland and dry sclerophyll forest within the study area. It was most abundant in woodland with a dense grassy understorey. Sites with the species in mixed grassland were relatively uncommon and densities were low at sites where they occurred within this habitat type.

Ctenotus robustus (striped skink) and *Ctenotus taeniolatus* (copper-tailed skink)

The distribution and abundance of *C. robustus* and *C. taeniolatus* across pitfall trapping sites demonstrated an apparent divergence of habitat utilisation by two closely related species. *Ctenotus robustus* was abundant in the woodland habitats with a dense grass understorey whilst apparently absent from the dry sclerophyll forest and tea-tree communities successfully inhabited by *C. taeniolatus*. Conversely, *C. taeniolatus* were not found in pitfall traps at sites where *C. robustus* were common. Hand-searching revealed that the two species occurred in sympatry in some situations, most commonly in mixed grasslands.

Ctenotus uber (spotted ctenotus)

This regionally uncommon species which was recorded only once in the study area can be considered highly localised in distribution. The individual was located under a rock in mixed grassland, on a rocky slope adjacent to Stony Creek. *Ctenotus robustus* and *Ctenotus taeniolatus* both occurred on adjacent rocky outcrops and it is likely that *C. uber* occured together with these in some locations but is probably present in much lower numbers.

Egernia cunninghami (Cunningham's rock skink)

This rock crevice dwelling lizard was widespread in the study area and often was observed basking on large rock slabs or hiding in rock crevices. It was found in mixed grasslands and woodland, always in association with large rock and boulder complexes.

Eulamprus heatwolei (warm-temperate water skink)

Restricted in its occurrence to sections of *Casuarina cunninghamiana* forest at the river's edge and the lower sections of creeks adjacent to the river. It was moderately common and most often observed in the mornings of warm summer days. This species was only found through observation with no individuals recorded through hand-searching or in pitfall traps.

Hemiergis decresiensis (three-toed skink)

This small skink was restricted to eucalypt woodland with a dense grassy understorey where it occurred in relatively low numbers. Its restricted occurrence in this area is

surprising as it was generally considered common and widespread across a variety of habitat types in the southern highlands (Jenkins and Bartell 1980). It is possible that many of the habitats in the study area are too dry for this species, which generally occurs in moister areas of the ACT (W. Osborne pers. comm.).

Lampropholis delicata (delicate skink)

Lampropholis delicata was widespread in the Stony Creek Nature Reserve and was commonly encountered in a range of habitat types. It was captured at all pitfall trapping sites and was one of the most frequently found reptiles during hand-searching (Table 5).

Menetia greyii (Grey's skink)

A small skink which was restricted to mixed grassland and eucalypt woodland where it was encountered on a few occasions only. It appeared to be present in very low densities.

Pseudemoia platynota (red-throated skink)

This skink was restricted to dry sclerophyll forest where it was associated with sites that had rocky outcrops, abundant leaf and bark litter and woody debris. It was moderaely abundant at these sites and was found most commonly in association with *Carlia tetradactyle* and *Ctenotus taeniolatus*.

Tiliqua scincoides (common blue tongue)

Compared with most other skinks, this large skink was encountered infrequently in the study area. It was found in a range of habitats including tea-tree scrub, dry sclerophyll forest, woodland and mixed grassland, where it was observed most commonly near rocky outcrops.

Ramphotyphlops nigrescens (blackish blind snake)

This small nocturnal snake was found in woodland and dry sclerophyll forest. Numbers caught by pitfall trapping were low and it is not possible to determine which communities were preferred.

Pseudechis porphyriacus (red-bellied black snake)

This snake was only observed twice during the survey, once along a creek margin and once on a rocky hillslope in mixed grassland above the Murrumbidgee River. The association of this species with water courses, swamps and other water bodies is well known and it is more than likely that if more survey effort had been devoted to the river's edge, it would have been found in these locations.

Pseudonaja textilis (eastern brown snake)

A well-known snake observed in dry sclerophyll forest, woodland and mixed grassland. Large individuals are difficult to capture or retain in pitfall traps and it is likely that the species had a wider distribution and abundance than the results of the survey indicate.

Suta spectabilis (black-headed snake)

Found on two occasions only, this small snake appeared to be uncommon in the study area. The two individuals were recorded in mixed grassland and dry sclerophyll forest, one under a stone and the other in a pitfall trap.

APPENDIX 3. Species not recorded during this survey but thought to occur in the study area, based on records from adjacent areas.

Frogs

Neobatrachus sudelli (spotted burrowing frog)

This species was considered uncommon in the ACT (Osborne 1992). It only calls for a few nights after heavy rain and may have been missed inadvertently as a result of sampling irregularity. W. Osborne (pers. comm.) has recorded metamorphs of this species at a farm dam on the west bank of the Murrumbidgee River near Uriarra Crossing and it also occurred in a farm dam on Uriarra Road at the top of Stony Creek (personal observation).

Litoria verreaxii (the whistling tree frog) and *Litoria peronii* (Peron's tree frog)

These tree frogs may occur in the study area, possibly in the more wooded sections with deeper pools along Stony Creek or near the river. *Litoria peronii* was recorded in a well vegetated farm dam at the top of Stony Creek and a nearby woodland just outside the study area. The lack of natural ponds, swamps or farm dams is likely to affect frog species diversity in the study areas to some extent as many species are known to rely on these where other suitable breeding habitat is not available.

Reptiles

Delma inornata (inornate legless lizard)

This pygopodid has been recorded along the Murrumbidgee River Corridor, north of the study area near Shepherd's lookout (D. Roso pers. comm. and D. Williams pers. comm.) and south of the Stony Creek Nature Reserve at Pine Island (ACT Vertebrate Atlas). Mixed grasslands and woodland with some woody debris are likely to support the species in Stony Creek Nature Reserve, probably in low numbers.

Tiliqua nigrolutea (blotched blue tongue lizard)

There are several records of *T. nigrolutea* from the suburbs of Canberra. However, the species is far more common in the mountain ranges south and west of Canberra. It is possible that this reptile was present in the study area, although the lack of records indicated that much of the corridor was probably unsuitable (W. osborne pers. comm.).

Trachydosaurus rugosus (shingleback)

Individuals have been observed on Mt Majura, Mt Taylor and Mulligan's Flat in the ACT, although this species is very uncommon in the region. It has also been recorded on the Cotter Road, adjacent to the study area (T. Rutzou pers. comm. and P. Ormay pers. comm.), and therefore probably occurred in the Stony Creek Nature Reserve in very low numbers.

Lampropholis guichenoti (spotted grass skink)

The apparent absence of this species from the entire study area is surprising, considering that Barrer (1992) found it to be more abundant than *L. delicata* in the Lower Molonglo River Corridor, with a similar range of vegetation and habitats. Confirmation is required to ascertain that Barrer correctly identified this species.

Phyllodactylus marmoratus (marbled gecko)

This species has been recorded in the Lower Molonglo River Corridor (Barrer 1992) and is therefore likely to occur in the Stony Creek Nature Reserve. It utilises microhabitats such as leaf litter, decorticating bark and exfoliating rock, and absence of records during this survey may reflect lack of attention to these habitat features. Pitfall trapping is not considered effective for this gecko as their feet are well adapted to climbing and they would escape from a pit trap.

Egernia striata (tree skink)

This species has been recorded from Ginninderra Falls in New South Wales (W. Osborne pers. comm.) which is several kilometres north of the study area. It is possible that localised populations of this reptile occurred in the Stony Creek Nature Reserve, particularly in the steep, rocky slopes and cliffs which occurred along the river's edge and

support *Callitris endlicheri* forest. It is a species that resembles *Egernia saxatilis* and in rocky areas it shelters in rock fissures.

Varanus rosenbergi (Rosenberg's monitor)

This large goanna has been sighted at Ginninderra Falls in NSW (W. Osborne pers. comm.) and twice in West Belconnen in the mid 1980's (R. Bennett pers. comm). It is possible that it also occurred in very low numbers in the Stony Creek Nature Reserve.

Bats

The harp traps used during this survey only readily sample those species which occur in relatively large numbers and fly close to the ground whilst feeding. Bats which feed above the canopy that have been recorded in the ACT, including *Tadarida triandra* (the white-striped mastiff bat) and *Taphozous flaviventris* (the yellow-bellied sheathtail bat) may have been missed inadvertently. Other species which have been recorded in the ACT but were not detected during this survey include *Nyctophilus gouldi* (Gould's long-eared bat), *Miniopterus schreibersii* (the common bent-winged bat), *Falsistrellus tasmaniensis* (the great pipistrelle) and *Myotis adversus* (the large-footed myotis), a species which is closely linked to rivers and other water bodies where it feeds on aquatic insects. *Miniopterus screibersii* (the common bent-winged bat) has been reported to inhabit the tunnel for the pipeline from the Cotter Dam to the pumping station (Department of the Interior 1971). The shortage or lack of suitable caves and similar roosting sites in the study area may explain the absence of some of these species from the survey sample.

APPENDIX 4. Source of scientific and common names used in this report.

Taxonomic group	Scientific name	Common name
Reptiles	Cogger (1992)	ACT Vertebrate Atlas Ehmann (1992)
Frogs	Cogger (1992)	ACT Vertebrate Atlas
Bats	Reardon and Flavel (1987)	ACT Vertebrate Atlas
All other mammals	Strahan (1983)	ACT Vertebrate Atlas
Plants	Burbidge and Gray (1979)	Burbidge and Gray (1979)

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