006507
THE LIBRARY
DEPARTMENT OF CONSERVATION
& LAND MANAGEMENT
WESTERN AUSTRALIA

FISHERIES AND
WILDLIFE
17 DEC 1982
LIBRARY

FAUNA SURVEY

OF THE

ARGYLE DIAMOND PROJECT.

For

C.R.A.-EXPLORATION - ASHTON JOINT VENTURE.

By

GREGORY HAROLD

Written in consultation with

Alexander Baynes (Ph.D.,Zoology)

- consultant zoologist -

Edited by

Wolf G. Martinick (Ph.D.,Agric.)

- environmental co-ordinator -

August 1981

Pilbara Environmental Services,
P.O. Box 72, Como, W.A., 6152.

ON LIBRARY, KENSINGTON
006507
Fauna survey of the Argyle Diamond Project for C.R.A. Exploration, Ashton Joint Venture / by Gregory Harold, writter
in consultation with Alexander Baynes ;
IENT OF PARKS AND WILDLIFE

SUMMARY

The Argyle faunal survey area lies in the Ord River Basin in the semiarid zone in eastern Kimberley. It consists of the source rocky ranges and valley of Smoke Creek which drains north-eastward into the Ord, now dammed to form Lake Argyle. In the creek valley, habitats consist of riverine fringing woodland along the creek banks; savannas of bunch-grasses or spinifex with a sparse tree layer, usually of eucalypts, on the creek terraces, alluvial plains, and stony rises; and bunch-grass grasslands or savannas on the black soil plains. The rocky ranges carry open savannas and low tree steppe.

A diverse fauna of vertebrates was found in the survey area, comprising 15 native mammals, plus stock, 115 birds, 57 reptiles, and 14 frogs. All the described species have substantial distributions; a few are restricted to Kimberley, but the geographic ranges of most extend into north central or arid Australia. Some extensions of known range were established. Most of the species present, however, had been recorded in the Kimberley semiarid zone before. No unique faunas or relict populations of very rare species were detected.

More diverse faunas were found in the valley habitats. This may partly reflect more thorough sampling, because pit traps could be used in the valley substrates. The riverine woodland is very important as a dry season refuge for many birds.

Three species listed for protection under the Western Australian Wildlife and Conservation Act were found in the Argyle area. The Long-tailed ("Ingrams") Planigale was shown by additional survey work, using pit traps, to be common and quite widespread on the black soil plains of the region. The Peregrine Falcon and Grey Falcon are both widespread species.

The main effects of the proposed programme of mining development upon wildlife will be through the destruction of valley habitats, as the alluvial deposits along Smoke Creek are removed and treated. A mine on the kimberlite pipe will directly affect only a small area of rocky range habitat.

Recommendations are made on how the impact of the mining developments upon the local wildlife may be minimized.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PROPOSED MINING DEVELOPMENTS

The full programme of mining developments on the Argyle exploration leases along Smoke Creek and the AK1 kimberlite pipe at its source will consist of two, and possibly three, phases. These will have differing impacts upon the local habitats and the wildlife they support.

The first phase consists of mining the alluvia of the Upper Smoke Creek deposit (around Area 3, Map 1). This will be a small operation (some 30 ha over one to three years) and its impact will be mainly upon the area mined.

The next phase is the development of a mine on the AK1 pipe. A third possible development is the mining of alluvia from the extensive Lower Smoke Creek deposit (downstream of Area 3, Map 1). Both developments would be large operations which will have major impacts upon the environment of the Smoke Creek area. The effects will be indirect, through the building of associated services, such as a treatment plant, as well as the direct impact of the mines.

1.2 AIMS OF THE SURVEY

The aims of the survey were to obtain an inventory of the vertebrates present, and information on their abundances and habitat requirements. These were expected to reveal the presence or absence of species regarded as rare or endangered, and special habitats important for the regional survival of particular species.

The effects of the possible mining developments upon the local wildlife are assessed in this report, and recommendations made regarding the conservation of wildlife.

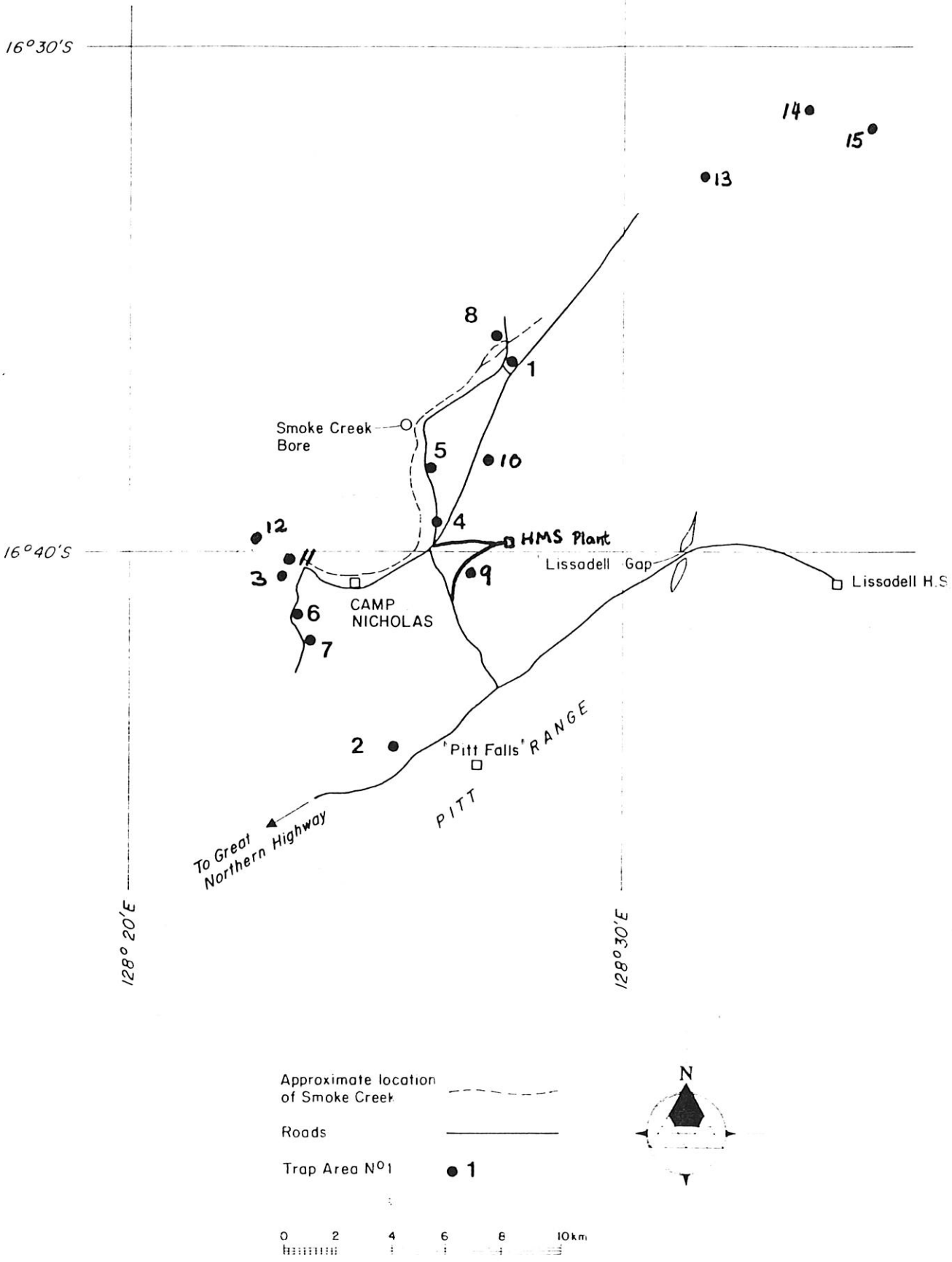
1.3 SURVEYS OF THE ARGYLE AREA

The fauna survey was carried out in three parts, each of which has been the subject of a separate report. The first survey (Harold, 1980) was made early in the dry season of 1980 (25 April - 7 May); it is referred to in this report as the "dry season survey". The second survey

(Martinick, 1980) was undertaken in October 1980 to obtain further information on the status of the rare small mammal Planigale ingrami, in the region around the Argyle project; it is referred to as the "planigale survey". The third survey (Harold, 1981) was made late in the wet season of 1980-81 (19 February - 12 March); it is referred to as the "wet season survey".

A flora survey was undertaken by Weston (1980), concurrently with the dry season fauna survey. Weston's vegetation classification is used as the basis for the ordering of habitat descriptions in section 2.2.

The total area over which the fauna surveys were carried out is referred to as the "Argyle survey area". In addition to the primary study areas designated for sampling by trapline (2.2), in the major habitat types, it includes other areas of habitat either unsuitable for trapping, such as the Smoke Creek gallery vegetation, or of limited extent, such as "Pitt Falls" and "Lissadell Gap" (Map 1), which were investigated using other methods (3.3). Since study of aerial photographs, and information from local residents, shows that Smoke Creek dries out completely during the dry season, the fish fauna of the creek was not investigated.



LOCATIONS OF TRAPLINE AREAS

MAP 1

2.0 HABITATS

2.1 INTRODUCTION

A total of 15 Areas (Map 1) were designated (and arbitrarily numbered) for sampling by traplines during the three surveys. Areas 1-8 were selected at the beginning of the first, dry season, survey, as representative of each of the major habitats which could be sampled by a trapline. It had been intended to sample the exact same sites during the wet season survey. However, it was found that mineral exploration work on the AK1 pipe had resulted in local clearances at Areas 3, 6 and 7, and waterlogged ground had rendered Areas 4, 5 and 8 inaccessible. A combination of the logistic problems and high summer temperatures also reduced the number of traplines which could be managed by the wet season survey team, without excessive trap deaths among the animals caught. Trapping was carried out at the original Areas 1 and 2, and in three new Areas, designated 9, 10 and 11, each of which lies in a different Weston (1980) vegetation complex. To avoid confusion the trapline study areas numbered 1-4 by Martinick (1980) are here designated Areas 12-15 respectively. Descriptions of the vegetation and soils of all the trapline Areas are included in section 2.2.

Because of the differing potential impacts of the proposed mining developments upon creek valley (particularly alluvial) versus rocky range habitats (1.1), the Areas are divided into valley (2.2.1) and range (2.2.2) habitats. Within these divisions the Areas are ordered using Weston's (1980) classification of the vegetation complexes they carry. Habitats representing all Weston vegetation complexes except the riverine complex were sampled with traplines.

2.2 TRAPLINE AREA DESCRIPTIONS

2.2.1 Creek valley habitats

2.2.1.1 Levee/terrace complex

Area 1 (Plate 1). Riverine flat near creek; just north of Site 2 of Weston (1980); in Weston's "baobab/rough-leafed cabbage gum low tree bunch-grass savanna" vegetation complex. Melaleuca nervosa, Lysiphyllum cunninghamii, Terminalia canescens and Brachychiton sp. to 6 m, less than 10% canopy cover, with emergent Adansonia gregorii to 8 m, over

Plectrachne pungens to 0.5 m, with sparse litter, on reddish loamy sand.

Area 3 (Plate 2). Small alluvial basin enclosed by hills; at Site 32 of Weston (1980); vegetation part of Weston's "baobab/rough-leafed cabbage gum low tree bunch-grass savanna". Mixed woodland of Lysiphyllum cunninghamii to 8 m, Gyrocarpus americanus and Dolichandrone heterophylla to 5 m, Acacia tumida and Hakea arborescens to 3 m, and Buchanania obovata, Carissa lanceolata and Santalum lanceolatum to 2 m, 30% canopy cover, over Heteropogon contortus, Dichanthium fecundum, and Plectrachne pungens to 1 m, 30% cover, on sandy clay loam with rocks.

Area 11 (Plate 3). Riverine flat near creek; vegetation part of Weston's "three-awn tall bunch-grass savanna". Emergent Adansonia gregorii to 8 m, and Eucalyptus confertifolia to 4 m, over Aristida ingrata and A. hygrometrica to 1 m, on reddish sandy loam.

2.2.1.2 Plains complex

Area 2 (Plate 4). On an undulating plain between the Pitt and Ragged Ranges; vegetation part of Weston's (1980) "silver-leafed box curly spinifex low tree savanna". Emergent Eucalyptus terminalis, E. brevifolia, and E. pruinosa to 5 m, over Acacia argyrea to 2 m, less than 5% canopy cover, over Cymbopogon bombycinus, Dichanthium fecundum, and Plectrachne pungens to 1 m, 60% cover, on hard reddish brown clay.

Area 4 (Plate 5). Alluvial flat near creek; vegetation part of Weston's (1980) "silver-leafed box curly spinifex low tree savanna". Woodland of Eucalyptus pruinosa, E. brevifolia, Melaleuca minutifolia, M. nervosa, Terminalia canescens, T. sp., Lysiphyllum cunninghamii, Carissa lanceolata, and Cochlospernum fraseri to 6 m, 20% canopy cover, over Hakea arborescens and Dodonea physocarpa, less than 20% cover, over Plectrachne pungens, Themeda australis, Cymbopogon bombycinus, Chrysopogon pallidus, Heteropogon contortus, and Aristida ingrata, 70% cover, on reddish-brown sandy clay loam.

Area 8 (Plate 6). Alluvial floodplain near creek; at Site 6 of Weston (1980); vegetation part of Weston's "soft spinifex low tree steppe". Emergent Adansonia gregorii to 12 m, and bloodwood Eucalyptus spp. to 8 m, over Triodia pungens and Aristida spp. less than 1 m, 60% cover between unvegetated and seasonally flooded scalds, on reddish-brown clay loam.

Area 15 (Plate 7). (Trapline 4 of Martinick, 1980). On small alluvial plain about 250 m from the edge of Lake Argyle. Unvegetated erosion surface adjacent to bunch-grass grassland, on sandy loam.

2.2.1.3 Black soil plains complex

Area 9. On an extensive black soil plain south-east of the exploration leases; vegetation probably part of Weston's (1980) "blue-grass/white-grass tall bunch-grass savanna". A diverse association of grasses on dark grey cracking clay.

Area 12 (Plate 8). (Trapline 1 of Martinick, 1980). On a small black soil plain surrounded by hills. Emergent Lysiphyllum cunninghamii and Eucalyptus dichromophloia, over sparse grasses, on dark grey cracking clay.

Area 13 (Plate 9). (Trapline 2 of Martinick, 1980). On an extensive black soil plain. Grassland dominated by Sehima nervosum and Aristida ingrata, on dark grey cracking clay.

Area 14 (Plate 10). (Trapline 3 of Martinick, 1980). On an extensive black soil plain. Grassland dominated by Sehima nervosum and Aristida ingrata, on dark grey cracking clay.

2.2.1.4 Hills complex

Area 5 (Plate 11). Alluvial flat near creek; at Site 29 of Weston (1980); vegetation a minnie-ritchie wattle thicket surrounded by "snappy gum curly spinifex low tree savanna". Emergent Eucalyptus brevifolia to 6 m, over Acacia lysiphloia, Calytrix exstipulata, Carissa lanceolata, Chrysopogon pallidus to 2 m, 70% canopy cover, over Plectrachne pungens of less than 0.5 m, 10% cover, on reddish-brown loam.

Area 10 (Plate 12). On a rise on the south side of Smoke Creek valley; vegetation a typical part of Weston's (1980) "snappy gum curly spinifex low tree savanna". Eucalyptus brevifolia to 5 m, 25% canopy cover, over Plectrachne pungens to 0.5 m, about 25% cover, on stony reddish sandy loam.

2.2.2 Range habitats

2.2.2.1 Mountain complex

Area 6 (Plate 13). Rugged scree slope; adjacent to Site 34 of Weston (1980), the vegetation is part of Weston's "Kimberley gum low tree steppe" which lies to the south of Site 34. Eucalyptus confluens, E. pruinosa, E. sp. (bloodwood), and Hakea spp. to 3 m, less than 5% canopy cover, over Heteropogon contortus, Triodia spp., Plectrachne sp. and Dodonea physocarpa of less than 0.5 m, less than 50% cover, on rocky hill slope.

Area 7 (Plate 14). Gentle scree slope; at Site 35 of Weston (1980); vegetation part of Weston's "bloodwood curly spinifex tree savanna". Sparse woodland of bloodwood Eucalyptus spp. and E. confertiflora to 5 m, less than 10% canopy cover, over Plectrachne pungens, on reddish clay with rocks.

2.3 HABITAT QUALITY

The Smoke Creek drainage is part of the Ord River Basin geomorphological subregion (Paterson, 1970). Together with the surrounding ranges, it is located on Lissadell pastoral station, on which cattle have been run for nearly a century (Stewart, 1970). The habitats of the Ord River Basin are known to have been adversely affected by poor pastoral practices (Beard, 1979), in particular overgrazing by cattle and feral donkeys and frequent fires. These have reduced ground vegetation cover, and changed its composition by encouraging the less palatable grasses, including some of the spinifexes. However, major structural changes in the vegetation appear to have occurred only in the most severely affected areas. The decrease in ground cover has led to soil erosion, particularly on flood plains and watercourse frontages as these generally supported the best stands of palatable grasses and they were close to drinking water.

Observations made during this survey, and by Weston (1980), show that, as expected, there has been greater pasture degradation and erosion in the valley habitats of the Smoke Creek drainage, than in the range habitats which are much less accessible to cattle. Gully and sheet erosion were very noticeable along both Smoke Creek and Flying Fox Creek.

Change in the vegetation of the habitats has probably been a contributing cause of changes in the local vertebrate fauna. Kitchener (1978) found evidence for the loss from the area since European settlement began of three species of mammal. He attributed this to the combined effects of overgrazing and predation by the feral Cat.

Plate 1: Area 1

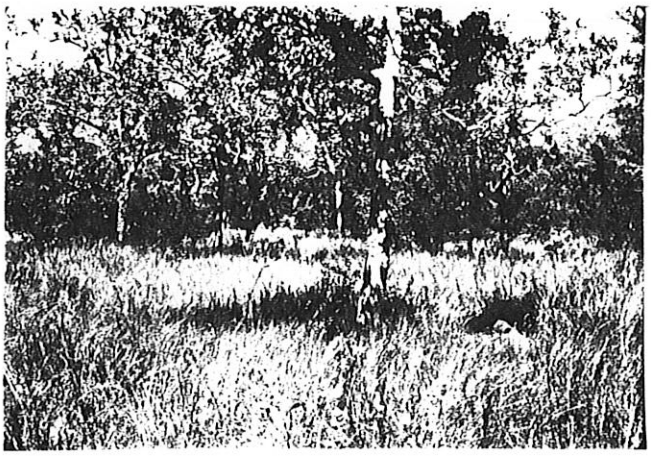


Plate 2: Area 3

Plate 3: Area 11

Plate 4: Area 2

Plate 5: Area 4

Plate 6: Area 8

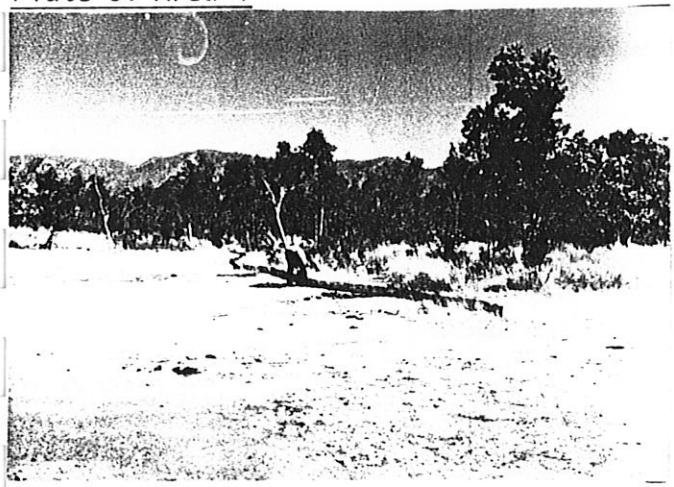


Plate 7: Area 15

For a description of the vegetation in plates 1 to 7 see pages 4 to 6.

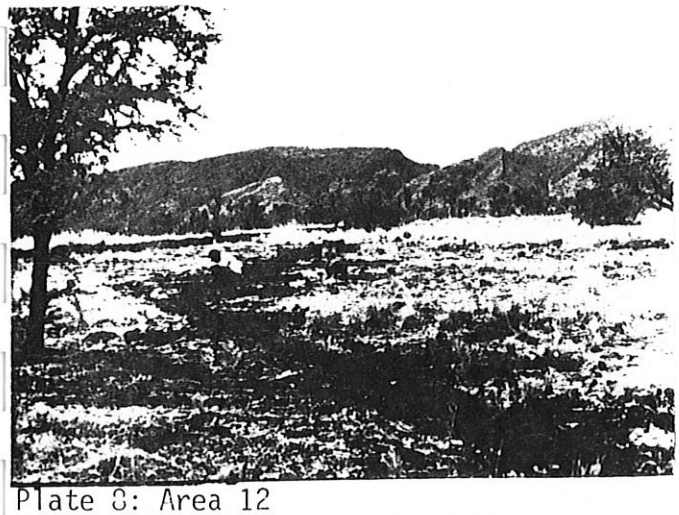


Plate 8: Area 12

Plate 9: Area 13

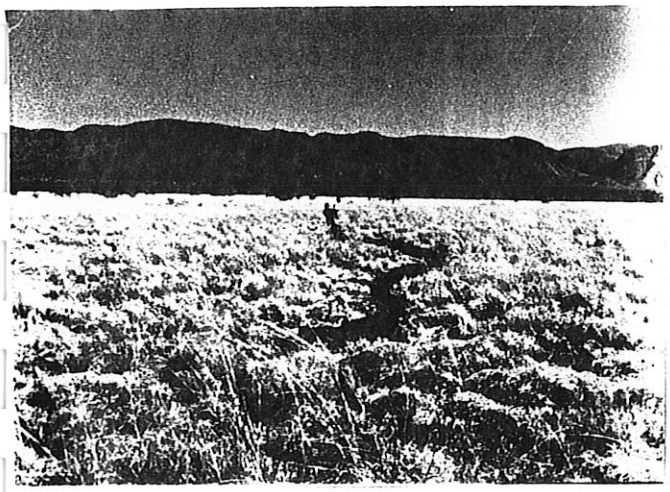


Plate 10: Area 14

Plate 11: Area 5

Plate 12: Area 10

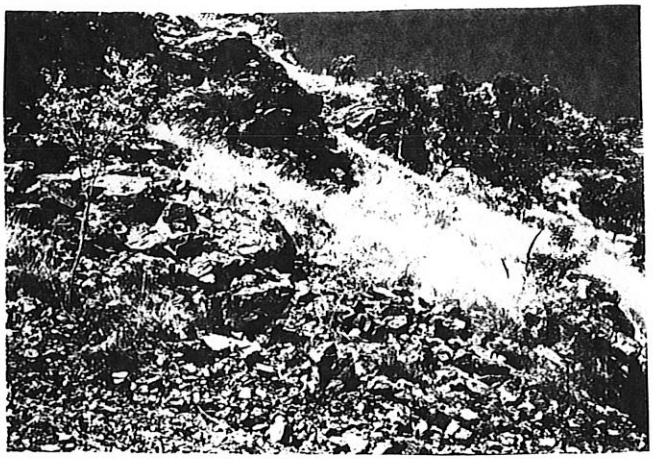


Plate 13: Area 6

Plate 14: Area 7

For a description of the vegetation in plates 8 to 14 see pages 6 and 7.

3.0 METHODS

3.1 DATA COLLECTION TECHNIQUES

The following standard techniques were employed.

Observation - Sightings of vertebrates and signs of their activity were recorded during traverses on foot, and by vehicle, both in daylight and with lights at nights.

"Headtorching" - During nocturnal searches, headtorches were used to reveal animals by their eye reflections. The animals were then observed and recorded or collected.

Litter search - A three-pronged fork was used to rake over and dig through plant litter to expose animals sheltering in the litter or in burrows beneath.

Stalking and stunning - Lizards which could run very fast were stalked and stunned by "shooting" with a heavy elastic band.

Spinifex burning - Isolated clumps of spinifex were burnt against the wind, causing animals sheltering inside to run into the open to be observed or collected.

Shooting - Shotguns with fine shot were used to collect bird specimens and to shoot bats illuminated by spotlight.

Mist netting - A five-tier nylon net with 3 cm mesh was set over water and across the mouth of a cave to catch bats.

Trapping - The following four types of trap, shown from left to right in Plate 15, were used.

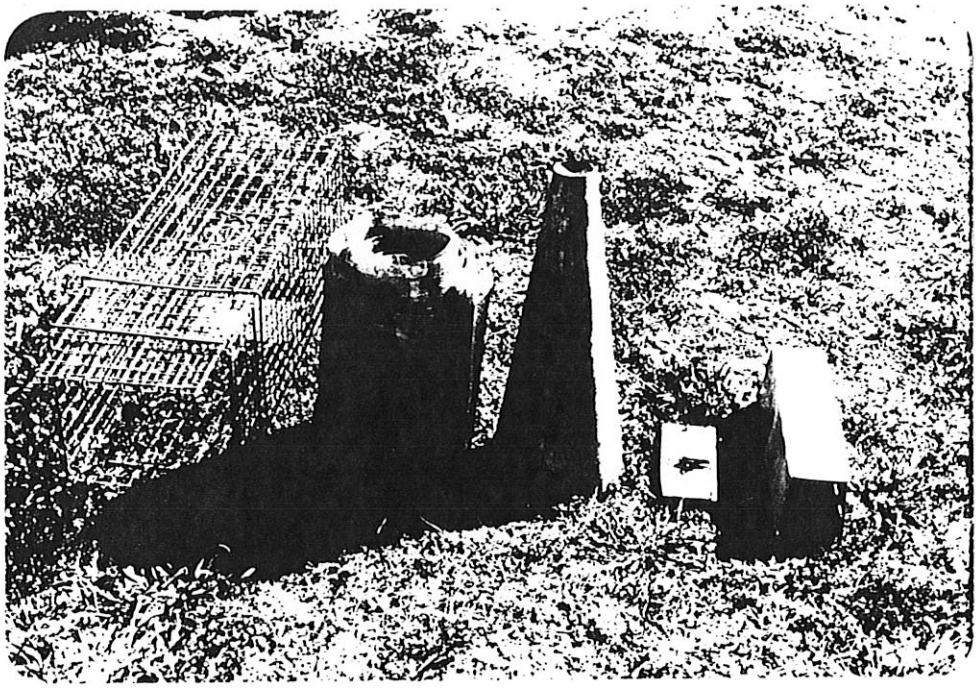


Plate 15.

Cage trap: a folding wire mesh box of dimensions 66 cm x 22 cm x 22 cm.

Drift fence and pit: a 25 cm high flywire drift fence set over metal cones of 45 cm depth and 20 cm base diameter inverted in the ground 6 m apart. (Several habitat plates in 2.2.2 show a set pit fence.)

Breakback trap: a wooden rat trap.

Elliott trap: a folding metal box of dimensions 33 cm x 9 cm x 10 cm.

Traplines: standard traplines of two kinds were used.

Pit fences: each consisting of a 60 m fence over 10 pits.

Combination lines: each consisting of 7 Elliott traps, 7 breakback traps and 3 cage traps. Traps were placed at a spacing of 10 m, with the smaller trap types alternated, and a cage trap in the middle and at each end.

3.2 IDENTIFICATIONS

The identifications of all animals collected as specimens were checked by the Western Australian Museum. Where necessary bird identifications were checked during field work using Slater's (1970, 1974) field guides.

3.3 EFFORT AND APPLICATION

A total of ninety-nine man-days of field collecting were carried out: on the dry season survey a three man team worked 25 April through 7 May 1980; on the planigale survey one man worked 5 through 20 October 1980; and on the wet season survey a two man team worked 19 February through 12 March 1981. Results were supplemented by observations made by W.G. Martinick, A.S. Weston, and C.R.A.-Exploration personnel.

Observational traverses were made through all major habitats, both by day and by night. During the dry season survey, effort was concentrated in the riverine complex vegetation along Smoke Creek, which was not sampled by a trapline; and around water pools in the creek and in rock holes, where birds and large mammals congregate to drink. During the wet season survey greater effort was expended in the rocky range areas to counteract loss of traplines in these habitats (2.1).

Simple observation provided almost all the data on birds and large mammals, whilst capture methods were used for small mammals and almost all reptiles and frogs. Many members of the latter groups are cryptic and/or nocturnal, and in most cases specimens are necessary to ensure correct identifications.

Headtorching was carried out on sixteen evenings, in all major habitats, and at "Lissadell Gap" and "Pitt Falls" (see Map 1).

During the wet season survey slow traverses of serviceable roads were made by vehicle on nine evenings, using headlights to search for active frogs and snakes.

Bat shooting was carried out on seven evenings at suitable sites during the dry season survey.

The mist net was set for a total of six nights: for two over "Smoke Creek Pool" (see Map 1), during the dry season survey, and for four nights over Smoke Creek between Areas 3 and 4, during the wet season survey.

Trap usage and effort is shown in Table 1. As the results show (see Appendices), pit fences are very efficient in catching large numbers of ground dwelling small vertebrates; but, because the pits are buried in the ground, they are not suitable for rocky substrates. For this reason only combination lines were used in the range habitat Areas. Pit fences were used in all other Areas except Area 5. Because of the relative efficiency of the pit fences (see 5.1.1), only this type of trap was used in the second and third surveys.

Table 1: Numbers of trapnights (1 trapnight = 1 trap set for 1 night) for which the various trap types were used in each Area, on the three parts of the survey: DS = dry season, PS = planigale survey, WS = wet season.

Lines	Combination traplines					Pit fence traplines							Total trapnights (all trap types)
Survey	DS Only					DS		PS		WS			
Trapnights	Nights	Breakback	Elliott	Cage	Totals	Nights	Pits	Nights	Pits	Nights	Pits	Totals	
Creek valley habitats													
Levee/terrace complex													
Area 1	8	56	56	24	136	9	90	-	-	14	140	230	366
Area 3	8	56	56	24	136	9	90	-	-	-	-	90	227
Area 11	-	-	-	-	0	-	-	-	-	7	70	70	70
Total	16	112	112	48	272	18	180	0	0	21	210	390	662
Plains complex													
Area 2	8	56	56	24	136	9	90	-	-	13	130	220	356
Area 4	8	56	56	24	136	9	90	-	-	-	-	90	226
Area 8	-	-	-	-	0	9	90	-	-	-	-	90	90
Area 15	-	-	-	-	0	-	-	12	120	-	-	120	120
Total	16	112	112	48	272	27	270	12	120	13	130	520	792
Black soil plains complex													
Area 9	-	-	-	-	0	-	-	-	-	12	120	120	120
Area 12	-	-	-	-	0	-	-	12	120	-	-	120	120
Area 13	-	-	-	-	0	-	-	15	150	-	-	150	150
Area 14	-	-	-	-	0	-	-	13	130	-	-	130	130
Total	0	0	0	0	0	0	0	40	400	12	120	520	520
Hills complex													
Area 5	8	56	56	24	136	-	-	-	-	-	-	0	136
Area 10	-	-	-	-	0	-	-	-	-	12	120	120	120
Total	8	56	56	24	136	0	0	0	0	12	120	120	256
Valley totals	24	280	280	120	680	45	450	52	520	58	580	1550	2230
Range habitats													
Mountain complex													
Area 6	8	56	56	24	136	-	-	-	-	-	-	0	136
Area 7	8	56	56	24	136	-	-	-	-	-	-	0	136
Total	16	112	112	48	272	0	0	0	0	0	0	0	272
Range total	16	112	112	48	272	0	0	0	0	0	0	0	272
Column totals	40	392	392	168	952	45	450	52	520	58	580	1550	2502

4.0 RESULTS

All specimens collected during the survey are lodged in the collections of the Western Australian Museum. Specimen registration numbers are given at the beginning of the Appendix listing the detailed results for each group.

4.1 MAMMALS

4.1.1 Nomenclature

Scientific names and concepts of marsupial species follow Kirsch and Calaby (1977); for higher categories of marsupial classification they follow Kirsch (1977). Those for rodents follow Watts and Aslin (1981), and for other placentals, and monotremes, Ride (1970).

Common names for species (see Appendix I) are those adopted in 1980 by the Australian Mammal Society as recommended standards (Strahan, 1980).

4.1.2 Species recorded

The survey recorded 20 species of mammals (Table 2). Of these, 15 are native, consisting of two carnivorous marsupials, one rock-wallaby, one kangaroo, two wallabies, one rock-rat, four mice, two insectivorous bats, one fruit bat, and the Dingo; five are introduced species, consisting of four species of stock (three feral) and the feral Cat. A full systematic list of the species, with details of the records, is given in Appendix I. A summary of the distributions of the species between habitats is also given in Table 2; because the only vegetation complex recorded in the ranges by Weston (1980) is the mountain complex, it is assumed that species recorded in the ranges occurred within that complex, even if the observation (Appendix I) does not include habitat details.

4.1.3 Comments

The mouse listed as *Pseudomys* sp. affin. *P. chapmani* is a probably unnamed species, although it has been recorded before in north-west and central North Kimberley ("*Pseudomys* sp." of McKenzie *et al.*, 1975, and McKenzie *et al.*, 1977). The identification has been carefully checked, both by Dr. D.J. Kitchener, Curator of mammals at the W.A. Museum; and

Table 2: Mammals recorded by the survey, and their distribution between habitats. The parts of the survey are distinguished: DS = dry season, PS = planigale survey, WS = wet season. C = capture, S = sighting, R = report. n = No. of individuals collected, or No. observed.

Habitats	Valley														Range	
Weston vegetation complex	Riverine		Levee/terrace		Plains			Black soil plains		Hills		(unspecified)			Mountain	
Survey	DS	WS	DS	WS	DS	PS	WS	PS	WS	DS	WS	DS	PS	WS	DS	WS
Planigale ingrami	-	-	C2	-	-	-	-	C4	C6	-	-	-	-	-	-	-
Sminthopsis macroura	-	-	-	-	C7	C3	C5	C1	-	-	C2	-	-	-	-	-
Petrogale brachyotis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S1	-
Macropus robustus	-	-	-	-	-	-	-	-	-	-	-	S3	?	S22	S3	-
M. agilis	-	-	-	-	-	-	-	-	-	-	-	S5	?	-	-	-
Onychogalea unguifera	-	-	-	-	-	-	-	-	-	-	-	S4	?	-	-	-
Zyzomys argurus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C4	-
Pseudomys nanus	-	-	C1	-	-	-	-	-	-	-	-	-	-	-	C1	-
P. delicatulus	-	-	C14	C6	C4	-	-	-	-	-	-	-	-	-	-	-
P. sp. affin. P. chapmani	-	-	-	-	-	-	-	-	-	-	C4	-	-	-	-	-
Leggadina forresti	-	-	C3	-	C3	-	C2	C1	-	-	-	-	-	-	-	-
Tadarida jobensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C2	-
Taphozous georgianus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C7	-
Pteropus alecto	C1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Canis familiaris	-	-	-	-	-	-	-	-	-	-	-	R2	S11	S7	-	S1
Felis catus	-	-	-	-	-	-	-	-	-	-	-	S2	S9	S2	-	-
Equus caballus	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-
E. asinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S1	-
Bos taurus	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-
Camelus dromedarius	-	-	-	-	-	-	-	-	-	-	-	R	S3	-	-	-

by Dr. A. Baynes who originally recognised the species in North Kimberley, and had previously examined another, similar, unnamed species collected in Arnhem Land by the C.S.I.R.O. Division of Wildlife Research. In Dr. Baynes' opinion, the Kimberley Pseudomys has close affinities to P. chapmani, recently described from the Hamersley Range area by Kitchener (1980).

Most of the native mammals recorded during this survey were already known to occur in the modern fauna of the Ord River area, which has recently been reviewed by Kitchener (1978). This survey recorded three additional species: the undescribed mouse, Pseudomys sp. affin. P. chapmani; an insectivorous bat, the Northern Mastiff-bat (Tadarida jobensis); and a fruit bat, the Black Flying-fox (Pteropus alecto).

Fourteen native species recorded by Kitchener (1978) were not found in this survey. The Short-beaked Echidna (Tachyglossus aculeatus) was recorded only from signs by Kitchener. The Ninbing Antechinus (Antechinus sp.) was recorded by Kitchener (1978) as A. bilarni, but it is a different, so far unnamed, species (see Archer, 1979, p.37). (Sminthopsis froggatti of Kitchener, 1978, is the same species as S. macroura of this report.) The Long-haired Rat (Rattus villosissimus) was recorded by Kitchener from remains in owl pellets of unknown age. The greatest difference between the faunas is in the insectivorous bats. Ten species recorded by Kitchener (1978) were not found in this survey: the Ghost Bat (Macroderma gigas), the Arnhem Land Long-eared Bat (Nyctophilus arnhemensis), the Little Cave Eptesicus (Eptesicus pumilus), Gould's Wattled Bat (Chalinolobus gouldii), the Hoary Bat (Chalinolobus nigrogriseus), the Little Broad-nosed Bat (Nycticeius greyi), the Dusky Horseshoe Bat (Hipposideros ater), the Orange Horseshoe Bat (Rhinonicteris aurantius), the Little Northern Mastiff-bat (Tadarida loriae), and the Yellow-bellied Sheathtail Bat (Taphozous flaviventris). Kitchener (1978) also recorded the Little Red Flying Fox (Pteropus scapulatus). Finally, Kitchener recorded one more introduced mammal species, the House Mouse (Mus musculus). Some causes of the differences between the faunas recorded by Kitchener (1978) and in this survey are discussed in 5.1.2.

All the native mammal species now recorded from the Ord River area, including the three additional species found in this survey, have extensive geographic ranges in northern Australia. Kitchener (1978) only commented that the 26 native mammals he recorded "... are typical of those found elsewhere in the Kimberley and include no arid element." Comparison

with distributional data in Ride (1970), Parker (1973), Archer (1976, 1979), Hall and Richards (1979), and Watts and Aslin (1981), and with the records in McKenzie et al. (1975) and McKenzie et al. (1977), shows that, under current taxonomy, only the Ninbing Antechinus and Pseudomys sp. affin. P. chapmani are restricted to Kimberley, and that all other species occur across the Northern Territory. The ranges of many of the species, particularly bats (including Tadarida jobensis and Pteropus alecto) also reach Queensland.

The habitats from which the ground dwelling native mammals were recorded during this survey (Table 2), are consistent with what is known of their habitat preferences. Several species were recorded only in valley or rocky range habitats. Although the Long-tailed Planigale (Planigale ingrami) was first recorded on sandy clay loam at Area 3 during the dry season survey, it was subsequently found to be common in its more usual habitat of black soil plains (Archer, 1976). This species is further discussed in 5.2. The Stripe-faced Dunnart (Sminthopsis macroura) was found in a wider variety of valley habitats. The rock-wallaby (Petrogale brachyotis) and the rock-rat (Zyzomys argurus) were found only in the rocky ranges, to which, as their names imply, they are adapted (Ride, 1970; Watts and Aslin, 1981). The records of the Euro (Macropus robustus) are consistent with its habit of sheltering in rocky ranges and descending to the plains to feed, and the Sandy Wallaby (M. agilis) and Northern Nailtail Wallaby (Onychogalea unguifera) were found in their typical valley habitats (Ride, 1970). The habitats of the three named mice (Forrest's Mouse, Leggadina forresti; Delicate Mouse, Pseudomys delicatulus; and Western Chestnut Mouse, P. nanus) were also generally consistent with those described for these species by Watts and Aslin (1981). Thus, Forrest's Mouse was recorded from all valley alluvial and black soil habitats, but the Delicate Mouse only from the relatively sandier valley alluvia. The Western Chestnut Mouse was found on the sandy alluvium, which is typical, but it has also been previously recorded in rockier habitats (e.g. Parker, 1973, in which the species is called P. gracilicaudatus). The stony rise habitat in which the Pseudomys sp. was found in the Argyle survey area is similar to those in which it occurs in Drysdale River National Park (McKenzie et al., 1977). It is also very similar to the stony spurs and lower slopes of ridges on which P. chapmani is found in the Hamersley Range (Dunlop and Pound, 1981). The Dingo occurs in a wide range of habitats.

The main difference between records from the dry season and wet season surveys, is that many fewer species were detected in the range habitats (only the Dingo) during the wet. Otherwise, species were generally recorded in fewer of the same habitats than during the dry season, except in the hills complex where mammals were recorded for the first time. This last point may reflect use of pit traps in this habitat only during the wet season survey (Table 1, 3.3; see also 5.1.1).

4.2 BIRDS

4.2.1 Nomenclature

Both scientific and common names for all birds follow Storr (1980a).

4.2.2 Species recorded

A total of 115 species of birds, all native, was recorded during the survey (Table 3). They comprised 62 species of non-passerines representing 26 families, and 53 species of passerines representing 23 families. A full systematic list, with detailed notes on the habitat and number of observations, is given in Appendix II.

The numbers of observations (not individuals, some of which may have been counted more than once) of all species recorded during the two main parts of the survey, and their distribution between riverine versus non-riverine vegetation, are given in Table 3. Only two species, the Emu (Dromaius novaehollandiae) and the Australian Bustard (Otis australis), were identified during the planigale survey (see Appendix II).

4.2.3 Comments

With a mean annual rainfall of about 630 mm (Slatyer, 1970), the Argyle survey area lies toward the drier limit of the Kimberley semiarid zone (500-1000 mm p.a.) of Storr (1980a). The results of the survey need to be considered in that context.

All the species found by this survey have been previously recorded in the Kimberley bird fauna (Storr, 1980a); and all have wide distributions in Australia (Slater, 1970, 1974).

Table 3: Numbers of observations of bird species, and occurrence among or over riverine versus non-riverine vegetation, during the dry season and wet season surveys. Asterisks mark species classified on the basis of Storr (1980a) as nomadic (*) or migratory (**)

X = observed - = not recorded

Survey	Dry season			Wet season		
Species	No. of obs.	Riverine veg.	Non-riverine veg.	No. of obs.	Riverine veg.	Non-riverine veg.
Emu	1	-	X	-	-	-
Pelican	-	-	-	1	X	-
Pacific Heron	4	X	-	3	X	-
White-faced Heron	4	X	X	2	X	X
Rufous Night Heron	1	X	-	-	-	-
Black-necked Stork	11	X	-	1	-	X
Straw-necked Ibis	2	-	X	-	-	-
Plumed Whistling Duck	2	X	-	-	-	-
Black Duck	1	-	X	7	-	X
Black-shouldered Kite	-	-	-	1	-	X
Square-tailed Kite	1	-	X	-	-	-
Black-breasted Kite	1	X	-	-	-	-
Whistling Kite	13	X	-	1	X	-
* Black Kite	52	-	X	8	X	X
Brown Goshawk	3	X	-	1	-	X
Collared Sparrowhawk	4	X	X	2	X	X
Wedge-tailed Eagle	-	-	-	1	-	X
Spotted Harrier	6	X	X	-	-	-
Peregrine Falcon	-	-	-	1	-	X
Australian Hobby	1	X	-	-	-	-
Grey Falcon	1	-	X	-	-	-
Brown Falcon	16	X	X	21	-	X
Australian Kestrel	19	X	X	13	-	X
Brown Quail	1	X	-	1	X	-
** Red-breasted Button-quail	-	-	-	3	-	X
Little Button-quail	2	-	X	2	-	X
* Brolga	2	X	X	15	X	X
* Australian Bustard	-	-	-	13	-	X
Masked Plover	1	X	-	-	-	-
* Black-fronted Plover	-	-	-	7	-	X

Table 3 (cont.)

**	Wood Sandpiper	-	-	-	4	-	X
	Black-winged Stilt	-	-	-	1	X	-
*	Australian Pratincole	-	-	-	1	-	X
	Bar-shouldered Dove	1	X	-	-	-	-
	Peaceful Dove	85	X	X	60	X	X
	Diamond Dove	46	X	X	37	X	X
	Spinifex Pigeon	2	-	X	5	-	X
	Crested Pigeon	30	X	X	34	X	X
	Rainbow Lorikeet	9	X	-	7	X	X
*	Varied Lorikeet	1	X	-	31	-	X
	Red-winged Parrot	20	X	X	37	X	X
	Northern Rosella	3	-	X	7	X	X
	Budgerigar	3	X	X	7	X	X
*	Cockatiel	5	X	X	24	X	X
	Red-tailed Black Cockatoo	11	X	X	3	-	X
	Galah	9	X	-	11	X	X
	Corella	23	X	X	39	X	X
	Sulpher-crested Cockatoo	1	-	X	-	-	-
	Pallid Cuckoo	4	X	X	10	X	X
	Black-eared Cuckoo	-	-	-	1	-	X
	Pheasant Coucal	1	X	-	-	-	-
	Barn Owl	-	-	-	1	-	X
	Barking Owl	1	-	X	1	-	X
	Boobook Owl	9	X	X	9	X	X
	Tawny Frogmouth	5	-	X	4	X	X
	Australian Owlet-nightjar	9	X	X	2	-	X
	Spotted Nightjar	16	X	X	9	-	X
	Blue-winged Kookaburra	15	X	X	24	X	X
*	Red-backed Kingfisher	10	-	X	42	X	X
**	Sacred Kingfisher	2	X	X	11	X	X
**	Rainbow Bee-eater	47	X	X	70	X	X
	Dollarbird	-	-	-	2	X	-
*	Horsefield's Bushlark	4	X	X	54	X	X
**	Tree Martin	18	X	-	-	-	-
	Fairy Martin	2	X	-	1	-	X
	Richard's Pipit	2	-	X	-	-	-
	Ground Cuckoo-shrike	1	-	X	-	-	-
**	Black-faced Cuckoo-shrike	26	X	X	51	X	X
	Little Cuckoo-shrike	2	X	X	5	X	X

Table 3 (cont.)

** White-winged Triller	40	X	X	60	X	X
Jacky Winter	1	-	X	6	-	X
Rufous Whistler	31	X	X	18	X	X
Grey Shrike-thrush	5	X	-	8	X	X
Willie Wagtail	49	X	X	65	X	X
Northern Fantail	2	X	X	-	-	-
Restless Flycatcher	24	X	-	17	X	X
Grey-crowned Babbler	31	X	X	30	X	X
Weebill	1	-	X	10	-	X
* Red-backed Fairy-wren	9	X	X	33	-	X
* Rufous Songlark	-	-	-	76	X	X
Australian Sittella	3	-	X	-	-	-
Black-tailed Tree-creeper	12	-	X	42	-	X
Mistletoebird	3	X	X	12	X	X
Red-browed Pardalote	3	X	-	5	X	X
Striated Pardalote	13	X	X	17	X	X
* Brown Honeyeater	95	X	X	53	X	X
Singing Honeyeater	3	X	X	3	-	X
* Yellow-fronted Honeyeater	5	X	X	19	X	X
Yellow-tinted Honeyeater	11	X	X	4	X	X
White-gaped Honeyeater	1	X	-	-	-	-
White-throated Honeyeater	2	X	-	-	-	-
Black-chinned Honeyeater	1	-	X	-	-	-
Little Friarbird	44	X	-	85	X	X
Silver-crowned Friarbird	1	-	X	-	-	-
* Banded Honeyeater	5	X	-	34	X	X
Bar-breasted Honeyeater	1	X	-	-	-	-
* Rufous-throated Honeyeater	2	X	-	14	X	X
Yellow-throated Miner	17	X	X	29	X	X
Crimson Finch	1	-	X	-	-	-
Zebra Finch	7	-	X	17	X	X
Double-barred Finch	2	X	X	1	X	-
Masked Finch	2	X	X	2	X	X
Long-tailed Finch	18	X	X	14	X	X
Gouldian Finch	-	-	-	1	-	X
* Pictorella Mannikin	1	-	X	24	X	X
Olive-backed Oriole	1	X	-	-	-	-
** Magpie Lark	88	X	X	233	X	X
White-browed Woodswallow	-	-	-	1	-	X

Table 3 (cont.)

	Black-faced Woodswallow	122	X	X	191	X	X
**	Little Woodswallow	48	X	X	30	-	X
	Pied Butcherbird	65	X	X	63	X	X
	Australian Magpie	2	-	X	25	X	X
	Great Bowerbird	6	X	-	8	X	-
	Australian Crow	30	X	X	31	X	X
	Little Crow	2	X	X	-	-	-

The 115 species recorded represent a substantial proportion of the total Kimberley semiarid zone bird fauna. Because the Argyle survey area contains few bodies of water, and none of these is permanent or very extensive, it provides no suitable habitat for many water birds, which is in marked contrast to Lake Argyle and the Lower Ord River valley. The few water birds which have been recorded, are either those which exploit temporary waters such as the ducks, or chance visitors to Smoke Creek, such as the pelican. On the other hand, among the land birds (i.e. those which do not swim or wade) a high proportion of the possible species has been recorded. About 122 species of land birds are expected to occur in the Argyle survey area; of these, 102 have so far been observed. Factors influencing the presence and detection of bird species in the survey area are discussed in 5.1.

The observations of two species in the Argyle survey area are of particular interest. The White-browed Woodswallow (Artamus superciliosus) had previously only been recorded in south-west Kimberley (Storr, 1980a), although it is a generally widespread and nomadic species (Slater, 1974). There had been only six observations before of the Red-breasted Button-quail (Turnix pyrrhothorax) in Kimberley (Storr, 1980a); this species also has wide range in eastern Australia (Slater, 1970).

The status of four species recorded in this survey is assessed by Storr (1980a) as less abundant than "uncommon" in the Kimberley semiarid zone. Two of these are the Red-breasted Button-quail ("uncertain"), and White-browed Woodswallow ("rare visitor"), noted above. The other two are falcons. The Grey Falcon (Falco hypoleucos) is "rare" in the Kimberley except for the south-west of that division where it is "scarce"; the Peregrine Falcon (Falco peregrinus) is "scarce" in all parts of Kimberley except the hilly north-west. Both species are wide ranging (Slater, 1970): the Grey Falcon occurs throughout the arid and semiarid zones of Australia, and the Peregrine Falcon occurs not only throughout Australia, but has a world wide distribution.

The riverine vegetation along the creeks is a very important habitat for birds, particularly as a dry season refuge. Table 4 summarizes the Table 3 data on distribution of bird species between the riverine and non-riverine vegetation. It can be clearly seen that a higher proportion of species was recorded in riverine vegetation in the early dry season than in the wet season (about three quarters as against about two thirds),

Table 4: Summary of numbers of bird species recorded among or over riverine versus non-riverine vegetation during the dry season and wet season surveys. Proportions are given as percent, and cumulative percent.

Vegetation	Dry season			Wet season		
	N	%	Cum.%	N	%	Cum.%
Riverine only	28	28.3	28.3	8	9.0	9.0
Both	46	46.5	74.8	50	56.2	65.2
Non-riverine only	25	25.2	100.0	31	34.8	100.0
Totals	99	100.0		89	100.0	

and that a much higher proportion was restricted to the riverine vegetation in the dry season (over one quarter of the species as against less than one tenth).

Inspection of Table 3 suggests that this change is mainly the result of movement of species from the riverine vegetation into more open country, rather than species preferring riverine habitat being replaced in the local fauna by open country birds in the course of normal seasonal movements. Of the 28 species observed only in riverine habitat in the dry season, four were again observed only in riverine habitat in the wet season, four were observed only in non-riverine habitat, and eight (of which five were passerines) in both. Twelve species observed only in riverine habitat during the dry season survey were not found in the wet season. Nine of these were observed only once during the dry season, suggesting that chance may have played a part in non-observation in the wet season; but a number of these species also may have dispersed into open country, where they were less likely to be detected, and been truly absent from the riverine vegetation. Of the remaining three species, the Plumed Whistling Duck (Dendrocygna eytoni) and the White-throated Honeyeater (Melithreptus albogularis) were observed twice during the dry season survey and the Tree Martin (Hirundo nigricans) 18 times. Notes in Storr (1980a) indicate that all three would be expected in riverine habitats at the time of the dry season survey. The Plumed Whistling Duck concentrates at river pools and similar water bodies during the dry season and disperses during the wet. The Tree Martin is a dry season visitor to Kimberley, most often found along rivers away from the coast. The White-throated Honeyeater is largely confined to riverine forest in the semiarid zone; no observation in the wet season is probably a matter of chance.

Species recorded for the first time during the wet season survey, and observed only in riverine habitat, include the Australian Pelican (Pelecanus conspicillatus) and the Black-winged Stilt (Himantopus himantopus), which are both nomadic water birds, and the Dollarbird (Eurystomus orientalis) whose principal habitat is tall trees round water or watercourses (Storr, 1980a).

Local bird faunas change between seasons as species move in to or out of an area, nomadically in response to changing availability of food, or as part of regular seasonal migrations. As would be expected, the majority of species whose abundances in the Argyle survey area (as represented by the numbers of observations) changed markedly between the dry and wet season surveys, are nomadic or migratory (see Table 3).

4.3 REPTILES

4.3.1 Nomenclature

Australian reptiles are less thoroughly known than the mammals or birds. Their taxonomy is less stable, with considerable numbers of species still being named. As a result, published checklists become rapidly out of date. The basis for scientific names used in this report is the unpublished running checklist used by the Western Australian Museum (Storr, MS.). Most species do not have common names, so none is used, but common names are provided for the families (Appendix III).

4.3.2 Species recorded

The survey recorded a total of 57 species of reptiles, consisting of 46 lizards representing five families (see column "A" in Table 6), and 11 snakes representing four families. Unconfirmed reports of a further three snake species, from families represented in the survey collection, were received from C.R.A.-Exploration staff, the manager of Lissadell Station, and Martinick (1980). A full systematic list of the species, with detailed notes on the observations and habitats, and assessments of abundance, are given in Appendix III.

Table 5 shows the distribution of lizard species (the only adequately sampled reptile group, 4.3.3) between valley and range habitats.

Table 5: Numbers of lizard species recorded from valley versus rocky range habitats in the Argyle survey area.

Habitat	No. of species
Valley only	36
Both	5
Ranges only	5

4.3.3 Comments

Since no account of the reptiles of the Ord River area, or zoogeographic synthesis of Kimberley reptiles, has yet been published, it is necessary to make comparisons with the records of the Western Australian Museum. These show that the Argyle record of the skink Ctenotus schomburgkii is the first in the Kimberley Division. The species is widespread in arid central Australia (Cogger, 1979). The survey records represent extensions of known geographic range for seven other species: southward for the dragons Chlamydosaurus kingii and Diporiphora bennettii, the skink Notoscincus ornatus wotjulum, the monitor lizard Varanus mitchelli, the blind snake Ramphotyphlops unguirostris, and the back-fanged snake Demansia atra; and northward for the skink Ctenotus piankai, as well as C. schomburgkii.

Comparison with distributional data in Cogger (1979) and Storr (1978, 1980b) shows that all the reptiles recorded in the Argyle survey area, except Ctenotus militaris and Lerista borealis, are widely distributed in northern and/or central Australia. C. militaris and L. borealis are restricted to Kimberley but have substantial distributions within that Division.

The total lizard fauna of 46 species recorded from the Argyle survey area represents the vast majority of those present. Only about another six species would be expected in the area. This high level of detection probably in part reflects the use of pit traps (see also 5.1). However, the recorded snake fauna of 11 species, out of a likely total of 20, represents a far lower level of detection.

The Argyle record of Ctenotus schomburgkii forms an addition to the arid element already known to be present in the fauna of the Ord River area (Storr, quoted by Kitchener, 1978). Since only the lizards of the Argyle area are adequately sampled, zoogeographic comparisons can only be made for that group. Table 6 shows such a comparison, made between the Argyle lizard fauna and those found in the three principal published mainland Kimberley vertebrate surveys: in the Drysdale River National Park (Storr and Smith, 1977), Prince Regent River Reserve (Storr and Smith, 1975), and Mitchell Plateau area (Smith and Johnstone, 1981). The Prince Regent River and Drysdale River faunas have been revised in the light of reidentifications or new names in Storr (1978)

Table 6: Comparison of lizard faunas from Mitchell Plateau (M), Prince Regent River Reserve (P), Drysdale River National Park (D), and Argyle survey area (A).

Species	M	P	D	A
GECKOS				
Crenadactylus ocellatus naso	X	-	-	-
Diplodactylus ciliaris	X	-	X	X
D. conspicillatus	-	-	-	X
D. mcmillani	X	-	X	-
D. stenodactylus	X	-	X	X
D. taeniatus	-	-	-	X
Gehyra australis	X	-	X	X
G. nana	X	X	X	X
G. pilbara	-	-	-	X
G. xenopus	X	X	-	-
Heteronotia binoei	X	X	X	X
H. spelea	X	X	X	X
Nephrurus asper	X	X	X	X
Oedura marmorata	X	X	X	-
O. rhombifera	X	X	-	-
Pseudothecadactylus lindneri cavaticus	X	X	-	-
Rhynchoedura ornata	X	-	X	X
LEGLESS LIZARDS				
Delma borea	X	-	-	X
D. nasuta	-	-	-	X
Lialis burtonis	X	X	X	X
Pygopus nigriceps	X	-	-	X
DRAGON LIZARDS				
Amphibolurus inermis	-	-	-	X
A. microlepidotus	X	X	-	-
A. mitchelli	-	-	X	-
Chelosania brunnea	X	X	-	-
Chlamydosaurus kingii	X	X	-	X
Diporiphora albilabris albilabris	X	X	-	-
D. arnhemica	-	-	-	X
D. bennettii	X	X	X	X

Table 6 (cont.)

	M	P	D	A
D. convergens	X	-	-	-
D. magna	X	X	X	X
D. superba	X	X	-	-
Lophognathus gilberti gilberti	X	X	X	X
SKINKS				
Carlia amax	X	X	X	-
C. foliorum	X	X	X	-
C. gracilis	X	-	-	-
C. johnstonei	X	X	X	-
C. triacantha	X	X	X	X
Cryptoblepharus megastictus	X	-	X	X
C. plagiocephalus	X	X	X	X
Ctenotus decaneurus	X	-	X	-
C. inornatus	X	X	X	X
C. mastigura	X	X	-	-
C. militaris	-	-	-	X
C. pantherinus calx	-	-	-	X
C. piankai	-	-	-	X
C. robustus	X	X	X	-
C. saxatalis	-	-	-	X
C. schomburgkii	-	-	-	X
Eremiascincus richardsonii	-	-	-	X
Lerista borealis	-	-	-	X
L. walkeri	X	X	-	-
Menetia greyii	-	-	-	X
M. maini	X	X	-	-
Morethia ruficauda ruficauda	X	X	X	X
Notoscincus ornatus wotjulum	X	X	X	X
Omolepida maxima	-	X	-	-
Proablepharus tenuis	X	X	-	X
Sphenomorphus brongersmai	X	X	-	-
S. isolepis	X	X	X	-
Tiliqua multifasciata	-	-	-	X
T. scincoides	X	X	X	X

Table 6 (cont.)

	M	P	D	A
MONITORS				
Varanus acanthurus	X	X	X	X
V. glauerti	X	X	X	-
V. glebopalma	X	X	X	-
V. gouldii	X	X	X	X
V. mertensi	X	X	X	X
V. mitchelli	-	X	X	X
V. panoptes panoptes	-	-	X	X
V. storri ocreatus	-	-	-	X
V. timorensis scalaris	X	X	X	X
V. tristis	X	-	-	X
SPECIES TOTALS	52	41	36	46

and Storr (1980b). The numbers of species shared between the faunas, and the proportions of the aggregate faunas that these constitute, are summarized in Table 7. The order from left to right in which the sites are listed in Tables 6 and 7 is the order from west to east in which they occur across northern Kimberley. Concomitant with the geographic positions of the sites is a falling gradient in rainfall received from the north-west monsoon of the wet season: highest in the Mitchell Plateau area to lowest in the Argyle area, which is also farther south than the other sites.

Although the use of the very efficient pit traps in only the Argyle survey area may have introduced a slight bias, tending to increase the differences from faunas not sampled by the same method (5.1.1), Table 7 shows that the Argyle survey area lizard fauna shares less than half its species with those from the higher rainfall sites. The faunas from the latter sites all have more than half their lizard species in common. Species found in the Argyle survey area but absent from the other sites (Table 6), belong to genera widespread in arid Australia, such as Ctenotus and, to a lesser extent, Diplodactylus. Groups adapted to high rainfall are either absent from the Argyle survey area (e.g. the genera Pseudothecadactylus and Chelosania) or poorly represented (e.g. the genus Carlia).

Table 6 shows that the Argyle survey area lizard fauna contains substantial semiarid and arid elements. The whole fauna is probably representative of that occurring in the Kimberley semiarid zone.

Lizard species are particularly sensitive to substrate. Table 5 (4.3.2) shows that few species were recorded in both valley and range habitats. It also shows that far more species were recorded from valley habitats than from range habitats. In part this may reflect more thorough sampling in the valley, by pit traps. It may also reflect greater diversity of substrates and shelters in the valley habitats, including those provided by large trees in the fringing woodland along the creeks.

Little seasonal difference was found in the reptile faunas detected in the dry season and wet season surveys. Although reptiles do not migrate between seasons, their activity, and hence their detectability, can change markedly between season. Only six species were detected for the first time during the wet season survey. As would be expected,

Table 7: Numbers of lizard species in common in pairwise comparisons between the four Kimberley faunas (data from Table 6); and the proportions (expressed as percent) which these represent of the aggregate lizard faunas of each pair of localities (N). Abbreviations as in Table 6.

	M	P	D	A
M	-	39	33	28
P	72% (N = 54)	-	27	21
D	60% (N = 55)	54% (N = 50)	-	25
A	40% (N = 70)	32% (N = 66)	40% (N = 62)	-

half of these are snakes, which show a greater increase in activity in the wet season.

4.4 FROGS

4.4.1 Nomenclature

The frogs of Australia are even less well known than the reptiles. Scientific names of species used here follow Storr (MS.); similarly, common names are only given for the families (Appendix IV).

4.4.2 Species recorded

A total of 14 species of frogs representing two families was recorded during this survey. A full systematic list of the species, with detailed notes on the observation and habitats, and assessments of abundance, are given in Appendix IV.

4.4.3 Comments

Because frogs are highly dependent upon water, seasons have an even greater effect upon the activity of this group than other vertebrates. For this reason it was expected that substantially more frogs would be recorded by the wet season survey than had been found in the dry season. Unfortunately, although many more individuals were found (about 570 as against about 160), only two additional species were detected. This was probably because rainfall had practically ceased for the 1980/81 summer when the wet season survey began in late February 1981. As a result, several species in the frog fauna of the Argyle survey area are probably still undetected. Most of these will be ground frogs.

The recorded Argyle frog fauna is probably still too incomplete for zoogeographic analysis to be meaningful. However, it may be noted that all the named species which have been recorded are widespread in northern and/or central Australia (Cogger, 1979). The distributions of the three unnamed species are unknown. At least one population of each was detected in a locality where it will probably remain undisturbed by mine developments. Uperoleia sp. 1 was found in a creek in Pitt Range, and U. sp. 2 and Litoria sp. on black soil plains, which would be avoided as a substrate on which to build mine plant.

Comparison with Western Australian Museum records shows that the Argyle records are southward extensions of known range for the ground frogs Cyclorana australis and Limnodynastes ornatus, and the tree frog Litoria splendida.

5.0 DISCUSSION

5.1 ASSESSMENT OF THE SURVEY

The comprehensiveness of the vertebrate inventory resulting from a faunal survey, and the validity of comparisons made between faunas resulting from such surveys, may be affected by a number of factors. In this section, factors affecting detection of species actually present by survey methods (5.1.1), and biotic factors affecting presence and absence of species (5.1.2), are discussed.

5.1.1 Survey methods

Vertebrate species actually present in the survey area can only be detected if appropriate methods and sufficient effort are applied. Species vary very greatly in abundance and ease of detection. Large species, particularly predators, are often present in very low numbers on a survey area. If they have behaviour which calls attention to their presence, e.g. soaring of eagles or howling by Dingoes, they will be easily detected; but if they are also cryptic and silent, e.g. snakes, their detection depends upon chance encounter, the likelihood of which can only be increased by expenditure of more search effort in suitable places and at suitable times. Small species are often present in large numbers, but may be less noticeable to casual observers than larger species because they are nocturnal or cryptic, or both. In this case appropriate techniques, particularly pit trapping, can be employed to overcome the problem. These are discussed below.

In the Argyle survey area, observational methods were more appropriate than trapping in the fringing woodland along the creeks, because of the attenuated nature of this habitat. The number of bird observations made there during the day (4.2.2; Appendix II), and the number of frogs found by headtorch at night (Appendix IV), suggest that this habitat was adequately sampled.

The upper slope and plateau habitats of the Argyle survey area received less intensive investigation than the valley alluvia. The only part of these rocky range habitats which will be directly affected by the proposed mining development, is the AK1 kimberlite pipe. The rest will be protected by its inaccessibility. The only cave sheltering a colony of bats was found at "Lissadell Gap" (Appendix I), which is

outside the diamond exploration leases. The rocky range habitats were generally less productive. In part this may reflect the fact that pit traps could not be used there because of the hard substrate, and most records depended upon observation which is more difficult to carry out in less accessible country.

The greater effort expended on the valley habitats proved very effective, particularly for small ground dwelling lizards and mammals. The total Argyle lizard fauna exceeds those from two of the three north-west Kimberley surveys (4.3.3), which were carried out over much larger areas carrying more diverse habitats. Also, comparison with Kitchener (1978) shows that many more individuals of small ground mammals (from all habitat types, but especially valley habitats - 4.1.2) were captured fresh (as opposed to remains from caves or stomach contents) during the Argyle survey than during the Ord survey by the W.A. Museum in 1971/72.

The most important factor in the greater success of the Argyle survey in collecting small ground mammals was probably the use of pit traps. More trapping effort was expended in the W.A. Museum survey (3536 trapnights, consisting of 1670 with Elliott, 1406 with breakback, and 460 with cage traps - Kitchener, 1978) than during this survey (2502 trapnights, consisting of 392 with Elliott, 392 with breakback, 168 with cage traps, and 1550 with pits - Table 1). The successes of various capture methods during the two surveys are compared in Table 8; since Kitchener (1978) does not differentiate between Elliott and breakback traps in reporting his results, captures in both are combined under "traps". The comparison clearly shows the superiority of pits in catching all small mammals except those adapted to rock substrates, such as Zyzomys argurus and Antechinus sp.

Compared to the Ord surveys reported by Kitchener (1978), a far lower proportion of catching effort was directed toward bats in the Argyle survey. This was because pools on Smoke Creek were the only suitable catching sites found on the exploration leases, which also lack bat roosts. Mist netting along Smoke Creek produced poor results.

Failure to detect species actually present in a survey area reduces the value of comparisons with faunas from other surveys. On the other hand, species may be really absent from an area as a result of biological factors.

Table 8: Numbers of individuals of each species of small ground mammal captured by various methods during the Ord survey (O) by the W.A. Museum - data from Kitchener (1978), and the Argyle survey (A) - data from Appendix I.

Method	By hand		Spinifex burning		Traps		Pits	
Survey	O	A	O	A	O	A	O	A
Species:								
Antechinus sp.	0	0	0	0	1	0	-	0
Planigale ingrami	4	0	2	0	0	0	-	12
Sminthopsis macroura	1	0	0	0	0	2	-	16
Zyzomys argurus	0	0	0	0	4	4	-	0
Pseudomys nanus	0	0	2	0	0	1	-	1
P. delicatulus	0	0	0	0	0	0	-	24
P. sp. affin. *P. chapmani*	0	0	0	0	0	0	-	4
Leggadina forresti	0	0	0	0	0	0	-	9
Totals (all species) Ord	5		4		5		0	
Argyle		0		0		7		66

5.1.2 Presence and absence of species

Biological factors controlling the presence of a particular species in an area at any one time include those limiting geographic range, mainly climate; the presence of suitable habitat, especially substrate; the recent history of local populations; and nomadic or migratory behaviour in vagile species.

Thus, the Argyle survey area may lie just beyond the range limits of some species found in the northern part of the Ord River Basin. One example is the Ninbing Antechinus, recorded by Kitchener (1978) from near the main Ord dam. Western Australian Museum records show that this small mammal occurs in rocky ranges over much of north and central Kimberley, but the most south-easterly records are Kitchener's and M15933 from Elgee Cliffs in the Durack Range, some 70 km west of the Argyle survey area. Another example is the White-quilled Rock Pigeon (Petrophassa albipennis). The rocky ranges appear to provide suitable habitat, but the species was not found. Storr (1980a) records its geographic range also as extending south to Lake Argyle and the Durack Range.

The Argyle survey area forms quite a small part of the Ord River Basin, and its topography and substrates are limited compared to the range found over the whole of that area. The effects of this are most clearly seen in the small number of water bird species recorded along Smoke Creek, compared to the number occurring on the Ord (Storr, 1980a); and the small number of bat species found, compared to that part of the Ord River valley investigated by Kitchener (1978), where caves suitable as bat roosts were numerous. On the other hand, the large size of the Argyle lizard fauna, comparable to those from the northern Kimberley sites (4.3.3) in spite of smaller size and lower habitat diversity, suggests that this Argyle fauna has been sampled at least as thoroughly as any in Kimberley.

For one mammal species the fauna recorded by Kitchener (1978) at the Ord may not have been comparable to that obtained in the Argyle survey because the species was locally extinct in 1980 and 1981. The Long-haired Rat (Rattus villosissimus) was recorded by Kitchener (1978) only from remains in owl pellets. The species has a very variable

geographic range, which only expands to include such extremes as the Ord River area, from refuges to the south-east, in very favourable years (e.g. Carstairs, 1974). It is probably not a resident of the Ord River area, and the remains reported by Kitchener may date from an invasion which had finished before the W.A. Museum Ord survey began.

Seasonal movements by birds resulting in differences in fauna and dispersion in the Argyle survey area have been noted in 4.2.3. One example of a highly visible bird which showed marked change in abundance between the parts of the survey is the Australian Bustard (Otis australis). It was not observed during the dry season survey, but was common during the planigale and wet season surveys. This is typical of this species, which is highly nomadic and can become very common in favourable seasons (Storr, 1980a).

5.2 ANIMALS OF SPECIAL SIGNIFICANCE

Three species which are listed under the Western Australian Wildlife and Conservation Act as likely to become extinct, are rare, or are otherwise in need of special protection, were recorded in the Argyle survey area. These consist of a small mammal, the Long-tailed Planigale, and two birds, the Peregrine Falcon and Grey Falcon.

Opinions have differed in the past as to whether the Kimberley Long-tailed Planigale, Planigale ingrami subtilissima (Lonnberg, 1913), is a separate species restricted to Kimberley, or a member of a more widespread species. Following the latest revision of the genus (Archer, 1976; who gives a full history of the taxonomic judgements) it is no longer considered distinct from P. ingrami, which is widely distributed across northern Australia. This taxonomy is followed in the latest revision of the Western Australia Department of Fisheries and Wildlife list of protected species (Anon., 1978), in which it appears as P. ingrami.

Archer (1979) did not consider Planigale ingrami to be a rare and endangered species. It was probably included in the Fisheries and Wildlife list because at the time of the last revision in September 1978 (Anon., 1978) it was known from only a few published Kimberley records. In addition to the nine Ord specimens listed by Archer (1976) and Kitchener (1978), before this survey began the W.A. Museum collection included a further five specimens from the Ord river area. These are

M11072, M11073, M13022, M14434, and M14439, the latest of which was collected in 1976. There are also records from west Kimberley: the holotype of P. subtilissima (Lonnberg, 1913) collected by the Mjoberg expedition in 1911 from Noonkanbah Station (Archer, 1976), W.A. Museum M14438 from plains near Windjana Gorge collected in 1976, and M3191 from Wotjulum Mission (Archer, 1976). All 17 specimens above were collected by hand or found in the stomachs of predators.

The two specimens collected during the dry season Argyle survey were the first Planigale ingrami captured in any deliberate trapping mechanism in Kimberley. Both were captured in pit traps, set in the sandy clay loam of Area 3. This is an atypical substrate for this species which usually occurs on cracking clays (Archer, 1976).

Following the discovery by the first survey of one population of this listed species on the Argyle diamond exploration leases, in a situation where it was endangered by the imminent removal of the Upper Smoke Creek deposit (1.1), it was necessary to assess its status in the general area. The planigale survey was therefore undertaken in October 1980. Four study areas were selected outside the exploration leases. Three were on the black soil substrate (Areas 12-14; 2.2.1.3) which the species typically occupies, and the fourth was on alluvial sandy loam (Area 15; 2.2.1.2). Pit fence traplines were set on each, and P. ingrami were obtained in two of the black soil Areas (13: one individual of P. ingrami; 14: three individuals; Appendix I). A further six P. ingrami were obtained in pit traps in a black soil plain at Area 9 during the wet season survey (Appendix I).

These results show Planigale ingrami to be abundant and quite widespread on black soils in the central western Ord River Basin. They also emphasize the importance of pit traps in the detection of such very small ground dwelling vertebrates. Archer (1979) was inclined to attribute a recent dramatic increase in the detection of small dasyurid marsupials, including Planigale spp., to the introduction of pit trapping, rather than to any changes in the real abundances of the species.

Both of the listed bird species recorded in the Argyle survey area are widespread in Australia. The Peregrine Falcon (Falco peregrinus) not only occurs throughout Australia, but has a world wide distribution (Slater, 1970). Although scarce in south-eastern Kimberley (4.2.3) it

is not a very rare species in Australia overall, and is probably included in the Fisheries and Wildlife list to give it special protection, as it is liable to be taken for falconry. The Peregrine Falcon's preferred habitat is cliffs. It was not observed in the Argyle survey area during the dry season, which is its breeding season (Storr 1980a), so the bird recorded during the wet season was probably a wandering individual which will not be affected by the proposed mining developments.

The distribution of the Grey Falcon (Falco hypoleucos) includes most of the arid and semiarid zones of Australia (Slater, 1970). It probably occurs at low densities throughout this range; and is listed both because its abundance is low, and to give it special protection. The species was only observed during the dry season survey, but if it is resident in the area the mining development should have no more adverse effect than rendering part of its previous home range unuseable. It would represent no direct threat to an individual falcon. When restored (7.0), the mined areas should provide as many resources for this species as the existing habitats.

6.0 CONCLUSIONS

6.1 ZOOLOGICAL SIGNIFICANCE OF THE SURVEY AREA

The Argyle survey area contains a diverse vertebrate fauna. All the described species have substantial distributional areas; a few are restricted to Kimberley, but the geographic ranges of most extend into north central or arid Australia. Some extensions of known range were established. Most species present, however, had been recorded in the Kimberley semiarid zone before. No unique faunas or relict populations of very rare species were detected.

The three species listed for protection under the Western Australian Wildlife and Conservation Act found in the Argyle area will not be endangered as species by the proposed mining development. The Long-tailed (Ingram's) Planigale was shown by additional survey work, using pit traps, to be abundant and quite widespread on the black soil plains of the region. It also occurs in other states across northern Australia. The Peregrine Falcon, and Grey Falcon are both widespread species.

The riverine woodland along Smoke Creek, although of limited extent, is a very important habitat for birds. The observed changes in dispersion of birds between the wet and dry seasons, are consistent with the expected use of this woodland by birds as a dry season refuge.

6.2 EFFECTS OF MINING DEVELOPMENTS

The most significant effect upon local wildlife of the full programme of proposed mining developments will be through the destruction of habitats on the alluvia of the Smoke Creek valley. It will have the immediate effect of killing most small ground animals resident upon each area as it is mined. It will also lead to the removal of the important riverine woodland habitat, which will be more difficult to re-establish than the other valley habitats.

The development of a mine on the AK1 pipe will have a direct effect upon only a small area of rocky range habitat, but will indirectly affect a much larger area of alluvial habitats used to accommodate services to the mine. If the full proposed programme is implemented,

the same plant and tailings dams will probably be used for treating material from this mine and the alluvia from the Lower Smoke Creek deposit.

The long term effect of the proposed mining developments will be to destroy some wildlife habitats, in spite of land restoration and revegetation. This will not represent a threat to any of the animals detected, as species. Nor is it expected to alter the regional status of any species, many of which have already been recorded elsewhere in the Ord River Basin.

Rehabilitation of the mined areas will result in habitats which have undergone further changes. For some species, these will provide fewer resources than the present habitats, but for others, more resources.

7.0 RECOMMENDATIONS

In order that the maximum conservation of the existing wildlife, compatible with the proposed mining developments, can be achieved, the following recommendations are made:

1. That if it is planned to expand the mining operations to include Flying Fox Creek, or a townsite is to be established, further faunal surveys and assessments of the additional areas be undertaken.

2. That mined ground is revegetated and that an attempt be made to restore the riverine woodland by replanting the new banks of the creek with the same species of trees, as currently grow there.

3. That mining of alluvia which are to be rehabilitated proceed on a chequer-board pattern of plots, with the greatest possible elapsed time between mining on adjacent plots. This will permit invasion of revegetated mined plots by many species from adjacent unmined areas, before these are mined.

4. That trees and large shrubs removed from a plot prior to mining be placed on adjacent plots (in windrows if necessary), rather than burnt. These trees will carry a fauna of animals such as bark haunting geckos which will continue to use the fallen trees. They will also provide important shelters for other vertebrates beneath and within the branches.

5. That stock be fenced off mined plots which are being rehabilitated, to permit regeneration of the larger plants.

6. That if a townsite is to be developed with large numbers of people resident in the area, there is adequate planning for recreation and environmental awareness. Planning should include liaison with local officers of the Fisheries and Wildlife Department and the National Parks Board.

8.0 REFERENCES

Anon. (1978). Western Australian Wildlife is protected - fauna. Perth: Department of Fisheries and Wildlife.

Archer, M. (1976). Revision of the marsupial genus Planigale Troughton (Dasyuridae). Memoirs of the Queensland Museum 17: 341-365.

Archer, M. (1979). The status of Australian dasyurids, thylacinids and myrmecobiids. Pp. 29-43 in Tyler, M.J. ed. The status of endangered Australasian wildlife. Adelaide: Royal Zoological Society of South Australia.

Beard, J.S. (1979). Kimberley. Explanatory notes to sheet 1, 1:1 000 000 series, Vegetation Survey of Western Australia. Nedlands: University of Western Australia Press.

Carstairs, J.L. (1974). The distribution of Rattus villosissimus during plague and non-plague years. Australian Wildlife Research 1: 95-106.

Cogger, H.G. (1979). Reptiles and amphibians of Australia. 2nd ed. Sydney: Reed.

Dunlop, J.N., and Pound, I.R. (1981). Observations on the Pebble-mound Mouse Pseudomys chapmani Kitchener, 1980. Records of the Western Australian Museum 9: 1-5.

Hall, L.S., and Richards, G.C. (1979). Bats of eastern Australia. Queensland Museum booklet No. 12: i-vi, 1-66.

Harold, G. (1980). Fauna study (April-May, 1980) Argyle diamond project for C.R.A. Exploration - Ashton Joint Venture. Unpublished report.

Harold, G. (1981). Wet season fauna survey (February-March, 1981) Argyle diamond project for C.R.A. Exploration - Ashton Joint Venture. Unpublished report.

Kirsch, J.A.W. (1977). The comparative serology of Marsupialia, and a classification of marsupials. Australian Journal of Zoology, Supplementary Series No. 52: 1-152.

Kirsch, J.A.W., and Calaby, J.H. (1977). The species of living marsupials: an annotated list. Pp. 9-26 in Stonehouse, B., and Gilmore, D.P. eds. The biology of marsupials. London: MacMillan.

Kitchener, D.J. (1978). Mammals of the Ord River area, Kimberley, Western Australia. Records of the Western Australian Museum 6: 189-219.

Kitchener, D.J. (1980). A new species of Pseudomys (Rodentia: Muridae) from Western Australia. Records of the Western Australian Museum 8: 405-414.

McKenzie, N.L., Chapman, A., and Youngson, W.K. (1975). Mammals of the Prince Regent River Reserve, north-west Kimberley, Western Australia. Wildlife Research Bulletin, Western Australia No. 3: 69-74.

McKenzie, N.L., Chapman, A., Youngson, W.K., and Burbidge, A.A. (1977). The mammals of the Drysdale River National Park north Kimberley, Western Australia. Wildlife Research Bulletin, Western Australia No. 6: 79-86.

Martinick, W.G. (1980). Fauna study (October, 1980) Argyle diamond project for C.R.A. Exploration - Ashton Joint Venture. Unpublished report.

Parker, S.A. (1973). An annotated checklist of the native land mammals of the Northern Territory. Records of the South Australian Museum 16 (11): 1-57.

Paterson, S.J. (1970). Geomorphology of the Ord - Victoria area. C.S.I.R.O. Land Research Series No. 28: 83-91.

Ride, W.D.L. (1970). A guide to the native mammals of Australia. Melbourne: Oxford University Press.

Slater, P. ed. (1970). A field guide to Australian birds: non-passerines. Adelaide: Rigby.

Slater, P. (1974). A field guide to Australian birds: passerines. Adelaide: Rigby.

Slatyer, R.O. (1970). Climate of the Ord - Victoria area. C.S.I.R.O. Land Research Series No. 28: 62-74.

Smith, L.A., and Johnstone, R.E. (1981). Amphibians and reptiles of Mitchell Plateau and adjacent coast and lowlands, Kimberley, Western Australia. Pp. 215-227 in Biological survey of Mitchell Plateau and Admiralty Gulf, Kimberley, Western Australia. Perth: Western Australian Museum.

Stewart, G.A. (1970). Introduction to the Ord - Victoria area. C.S.I.R.O. Land Research Series No. 28: 7-10.

Storr, G.M. (1978). Seven new gekkonid lizards from Western Australia. Records of the Western Australian Museum 6: 337-352.

Storr, G.M. (1980a). Birds of the Kimberley Division, Western Australia. Western Australian Museum Special Publication No. 11: 1-117.

Storr, G.M. (1980b). The monitor lizards (genus Varanus Merrem, 1820) of Western Australia. Records of the Western Australian Museum 8: 237-293.

Storr, G.M. (MS.). Checklist of the amphibians and reptiles of Western Australia.

Storr, G.M. and Smith, L.A. (1975). Amphibians and reptiles of the Prince Regent River Reserve, north-western Australia. Wildlife Research Bulletin, Western Australia No. 3: 85-88.

Storr, G.M., and Smith, L.A. (1977). Amphibians and reptiles of the Drysdale River National Park north Kimberley, Western Australia. Wildlife Research Bulletin, Western Australia No. 6: 97-101.

Strahan, R. ed. (1980). Recommended common names of Australian mammals. Bulletin of the Australian Mammal Society 6 (2): 13-23.

Watts, C.H.S., and Aslin, H.J. (1981). The rodents of Australia. Sydney: Angus and Robertson.

Weston, A. (1980). Report: Flora Study Argyle Diamond Project by Dames & Moore. Job No. 11873-001 for C.R.A. Exploration - Ashton Joint Venture.

APPENDIX I

SYSTEMATIC LIST OF MAMMALS RECORDED FROM THE ARGYLE SURVEY AREA

Mammals collected are lodged in the Western Australian Museum: under mammal collection registration numbers M16863-M16903, M16956, M16992-M16998, M18792-M18795, M18831-M18835, and M19273-M19297.

The results of the different parts of the survey are distinguished by the following abbreviations: DS = dry season (survey), PS = planigale survey, WS = wet season.

METATHERIA - MARSUPIALS

POLYPROTODONTA - Carnivorous marsupials

DASYURIDAE

Planigale ingrami (Thomas, 1906)		Long-tailed Planigale
DS:	2 (females) captured in pit traps	Area 3
PS:	1 (male) captured in pit trap	Area 13
	3 (1 male, 2 females) captured in pit traps	Area 14
WS:	6 (5 males, 1 female) captured in pit traps	Area 9
Sminthopsis macroura (Gould, 1845)		Stripe-faced Dunnart
DS:	4 (2 males, 2 females) captured in pit traps	Area 2
	2 (males) captured in Elliott traps	Area 2
	1 (male) captured in pit trap	Area 4
PS:	1 (female) captured in pit trap	Area 14
	3 (females) captured in pit traps	Area 15
WS:	2 (1 male, 1 female) captured in pit traps	Area 10
	5 (2 males, 3 females) captured in pit traps	Area 2

DIPROTODONTA - Herbivorous marsupials

MACROPODIDAE

Petrogale brachyotis Gould, 1841		Short-eared Rock-wallaby
DS:	1 observed on rocky spinifex covered slope near top of range	S of Area 7
Macropus agilis (Gould, 1842)		Sandy Wallaby
DS:	3 observed in mixed open woodland of *Lysiphyllum cunninghamii*, *Terminalia* sp. and *Adansonia gregorii* over bunch-grasses on reddish brown sandy loam	3 km S Area 1
	2 observed in savanna woodland on reddish brown sandy loam	Between Areas 4 and 5

Macropus robustus (Gould, 1841) — Euro

DS:	1 and 2 observed in open woodland of Eucalyptus pruinosa and E. brevifolia over spinifex on rocky clay soil	5 km N-E main camp
	3 observations of one animal on rocky slope with bloodwood spinifex savanna	N-E Area 7
WS:	2 observed in open woodland	1 km S-W Area 10
	2 observed in open woodland	2 km S-W Area 1
	1 observed in open woodland	1 km E Camp Nicholas
	2 observed in open woodland	2 km N-E Area 10
	3 observed in open woodland	2 km S-W Area 10
	2 observed in open woodland	3 km S-W Area 10
	2 observed in open woodland	near new H.M.S. plant
	7 observed in open woodland	near new H.M.S. plant
	1 observed in open woodland	1 km W Camp Nicholas

Onychogalea unguifera (Gould, 1841) — Northern Naitail Wallaby

DS:	4 observations of single animals in mixed open woodland over bunch-grass or spinifex	

EUTHERIA - PLACENTAL MAMMALS

RODENTIA - Rodents

MURIDAE

Zyzomys argurus (Thomas, 1889) — Common Rock-rat

DS:	3 (2 males, 1 female) captured in Elliott traps	Area 6
	1 (female) captured in Elliott trap	Area 7

Pseudomys nanus (Gould, 1858) — Western Chestnut Mouse

DS:	1 (male) captured in pit trap	Area 3
	1 (female) captured in Elliott trap	Area 7

Pseudomys delicatulus (Gould, 1842) — Delicate Mouse

DS:	14 (12 males, 2 females) captured in pit traps	Area 1
	1 (male) captured in pit trap	Area 2
	1 (female) captured in pit trap	Area 4
	2 (males) captured in pit trap	Area 8
WS:	6 (5 males, 1 female) captured in pit traps	Area 1

Pseudomys sp. affin. P. chapmani Kitchener 1980 -

WS:	4 (males) captured in pit traps	Area 10

Leggadina forresti (Thomas, 1906) — Forrest's Mouse

DS:	3 (2 males, 1 female) captured in pit traps	Area 2
	3 (males) captured in pit traps	Area 3
PS:	1 (male) captured in pit trap	Area 13
WS:	2 (males) captured in pit traps	Area 2

CHIROPTERA - Bats

MOLOSSIDAE

Tadarida jobensis (Miller, 1902) — Northern Mastiff-bat

DS: 2 shot while active at night — "Pitt Falls"

EMBALLONURIDAE

Taphozous georgianus Thomas, 1915 — Common Sheathtail-bat

DS: 6 mist netted during day at cave entrance — "Lissadell Gap"
1 shot while active at night — "Pitt Falls"

PTEROPODIDAE

Pteropus alecto Temminck, 1837 — Black Flying-fox

DS: 1 mist netted over "Smoke Creek Pool" — near Area 1
1,000 + individuals observed in "camp" in riverine woodland — Flying Fox Creek

CARNIVORA - Carnivores

CANIDAE

Canis familiaris Linnaeus, 1758 — Dingo

DS: Reported by C.R.A. personnel — near Camp Nicholas, near Area 1

PS: 3 feeding on dead calf — near Smoke Creek Bore
10 observations of 1-5 between Camp Nicholas and Lake Argyle — Smoke Creek valley
8 (3 adults, 5 subadults) reported by C.R.A. staff — -

WS: 1 observed — 6.5 km E Lissadell turn-off
1 calling — near "Pitt Falls"
c.6 calling — near Area 10
1 observed — 5 km E Lissadell turn-off
1 observed — 9.5 km E Lissadell turn-off
1 observed — 2 km N-W Camp Nicholas

FELIDAE

Felis catus Linnaeus, 1758 — Cat

DS: 1 observed while active at night — 4 km S Camp Nicholas
1 observed while active at night — 2 km E Area 4

PS: 9 observations during October 1980 — -

WS: 1 observed at night — 1 km N-E Camp Nicholas
1 observed at night — 7 km N-E Camp Nicholas

PERISSODACTYLA - Horses, etc.

EQUIDAE

Equus caballus Linnaeus, 1758 — Horse

DS: 3 observed from helicopter — W of Area 1
13 observed from helicopter — E of Area 2

Equus asinus Linnaeus, 1758 — Donkey

DS: 1 observed from helicopter — E of Area 7

ARTIODACTYLA - Cloven-hoofed Mammals

BOVIDAE

Bos taurus Linnaeus, 1758 — European Cattle

DS: Large herds observed throughout leases

CAMELIDAE

Camelus dromedarius Linnaeus, 1758 — Arabian Camel

DS: Low numbers reported by Manager of Lissadell Station

PS: 3 observed — lower Smoke Creek valley

APPENDIX II

SYSTEMATIC LIST OF BIRDS RECORDED FROM THE ARGYLE SURVEY AREA

The results of the different parts of the survey are distinguished by the following abbreviations: DS - dry season (survey), PS = planigale survey, WS = wet season.

CASUARIIDAE

Dromaius novaehollandiae (Latham) — Emu

DS: Two birds in sparse eucalypt woodland over grass.

PS: Eight observations of one to four individuals; on two occasions with three chicks at heel.

PELECANIDAE

Pelecanus conspicillatus Temminck — Australian Pelican

WS: Single bird observed on pool in Smoke Creek.

ARDEIDAE

Ardea pacifica Latham — Pacific Heron

DS: Four observations of single birds in creek bed and flying over riverine *Terminalia* woodland.

WS: Three observations of single birds on banks of Smoke Creek.

Ardea novaehollandiae Latham — White-faced Heron

DS: Single birds seen twice on banks of Smoke Creek; two seen at cattle trough in open woodland; one seen on dam near Lissadell Homestead.

WS: Single bird on bank of Smoke Creek and single bird by ephemeral pool on spinifex grassland.

Nycticorax caledonicus (Gmelin) — Rufous Night Heron
N. c. hilli Mathews

DS: Observation of immature bird flushed from riverine *Terminalia* woodland.

CICONIIDAE

Ephippiorhynchus asiaticus (Latham) — Black-necked Stork

DS: Eleven observations of one to three birds in and near Smoke Creek.

WS: Single bird over low open eucalypt woodland over spinifex grassland.

THRESKIORNITHIDAE

Threskiornis spinicollis (Jameson) Straw-necked Ibis

DS: Two birds on freshwater dam near Lissadell Homestead.

ANATIDAE

Dendrocygna eytoni (Eyton) Plumed Whistling Duck

DS: Six birds sleeping on bank of Smoke Creek.

Anas superciliosa Gmelin Black Duck

DS: Two in an ephemeral pool soon after heavy rain on spinifex plain.

WS: Seven observations of single birds on ephemeral water in spinifex grassland.

ACCIPITRIDAE

Elanus caeruleus (Desfontaines) Black-shouldered Kite
E. c. notatus Gould

WS: Single bird hunting in snappy gum over low open eucalypt woodland over spinifex grassland.

Lophoictinia isura (Gould) Square-tailed Kite

DS: Single bird over open eucalypt woodland.

Hamirostra melanosternon (Gould) Black-breasted Kite

DS: Single bird over riverine vegetation.

Haliastur sphenurus (Vieillot) Whistling Kite

DS: Thirteen observations of one to three birds near and over Smoke Creek.

WS: Single bird in riverine Lysiphyllum cunninghamii woodland.

Milvus migrans (Boddaert) Black Kite
M. m. affinis Gould

DS: Fifty-two observations; mainly two to eight birds, ocasionally singly, or in flocks of up to 65 birds. Flocks were mainly concentrated at rubbish tip near Camp Nicholas, along, and up to 1 km from Smoke Creek.

WS: Seven observations of one or two birds: one flock of nine birds. Riverine Lysiphyllum cunninghamii woodland and around H.M.S. plant.

Accipiter fasciatus (Vigors and Horsfield) Brown Goshawk

DS: Two observations of single birds, one observation of two birds over or near Smoke Creek.

WS: Two birds in low open eucalypt woodland over spinifex woodland.

Accipiter cirrocephalus (Vieillot) Collared Sparrowhawk
A. c. cirrocephalus

DS: Four observations of single birds in riverine Lysiphyllum cunninghamii woodland, mixed woodland with grasses, and open eucalypt woodland over spinifex.

WS: Single bird over H.M.S. plant and single bird in riverine Melaleuca belt.

Aquila audax (Latham) Wedge-tailed Eagle

WS: Two birds in low open eucalypt and Melaleuca woodland over spinifex and other grasses.

Circus assimilis Jardine and Selby Spotted Harrier

DS: Six observations of single birds mostly in riverine Terminalia woodland. One sighting in open eucalypt woodland over mixed grasses.

FALCONIDAE

Falco peregrinus Tunstall Peregrine Falcon
F. p. macropus Swainson

WS: Single bird in dead tree in low open eucalypt woodland over spinifex grassland.

Falco longipennis Swainson Australian Hobby
F. l. longipennis

DS: Single bird in riverine Lysiphyllum cunninghamii woodland.

Falco hypoleucos Gould Grey Falcon

DS: Single bird hunting over sparse Acacia shrubland over spinifex.

Falco berigora Vigors and Horsfield Brown Falcon
F. b. berigora

DS: Sixteen observations; mainly single birds, occasionally in groups of up to four. Recorded in open eucalypt woodland over spinifex, sparse eucalypt woodland at base of range, riverine Terminalia woodland, Acacia shrubland over grasses and Melaleuca woodland over grasses.

WS: Twenty-one observations of one to four, mainly single birds. Mostly seen on termitaria in open spinifex grassland.

Falco cenchroides Vigors and Horsfield Australian Kestrel
F. c. cenchroides

DS: Nineteen observations; mainly single birds, with some groups of up to seven. Recorded in most woodland habitat types, mainly riverine Lysiphyllum cunninghamii woodland. Also at base of range and grassy plains near Lissadell Homestead.

WS: Twelve observations of single birds, one observation of two birds; seen in most grassland and open woodland habitats.

PHASIANIDAE

Coturnix ypsilophora Bosc — Brown Quail
C. y. australis (Latham)

DS: Group of four birds in riverine Lysiphyllum cunninghamii woodland.

WS: Single bird in riverine Lysiphyllum cunninghamii woodland.

TURNICIDAE

Turnix pyrrhothorax (Gould) — Red-breasted Button-quail

WS: Three observations of one to three birds; black soil grassland on grey friable stony loam.

Turnix velox (Gould) — Little Button-quail

DS: Two observations of single birds in sparse Adansonia gregorii woodland over grasses.

WS: Two observations of single birds in low open eucalypt woodland over spinifex grassland.

GRUIDAE

Grus rubicundus (Perry) — Brolga

DS: One observation of a single bird in mixed woodland over grasses, and two birds on alluvial flat with riverine Lysiphyllum cunninghamii.

WS: Fifteen observations of one or two birds. Mainly riverine Lysiphyllum cunninghamii woodland or mixed grassland.

OTIDIDAE

Otis australis Gray — Australian Bustard

DS: Reported to occur on grassy plains by C.R.A. staff.

PS: Twelve observations of one to two birds, mainly on larger black soil plains carrying mixed grasslands.

WS: Thirteen observations of one to four, mainly single, birds. Spinifex and other grasslands.

CHARADRIIDAE

Vanellus miles (Boddaert) — Masked Plover
V. m. miles

DS: One bird calling over riverine Lysiphyllum cunninghamii woodland.

Charadrius melanops Vieillot — Black-fronted Plover

WS: Six observations of single, one of two birds around ephemeral pools in woodland and grassland habitats.

SCOLOPACIDAE

Tringa glareola Linnaeus — Wood Sandpiper

WS: Four observations of one or two birds around ephemeral pools in woodland and grassland habitats.

RECURVIROSTRIDAE

Himantopus himantopus (Linnaeus) — Black-winged Stilt
H. h. leucocephalus Gould

WS: Four birds on edge of Smoke Creek.

GLAREOLIDAE

Stiltia isabella (Vieillot) — Australian Pratincole

WS: Four birds over low open eucalypt woodland over spinifex grassland on rocky soil.

COLUMBIDAE

Geopelia humeralis (Temminck) — Bar-shouldered Dove

DS: Single bird in lush riverine vegetation at Flying Fox Creek.

Geopelia striata (Linnaeus) — Peaceful Dove
G. s. placida (Gould)

DS: Eighty-five observations; mainly one to five birds, some groups of up to 14 birds. Throughout all riverine and alluvial habitats. Some birds observed feeding in open eucalypt woodland over grasses up to 10 km from river.

WS: Sixty observations of one to 11, mainly two or three birds. Most woodland and open woodland habitats, particularly riverine Lysiphyllum cunninghamii woodland.

Geopelia cuneata (Latham) — Diamond Dove

DS: Forty-six observations; mainly one to four birds, some groups of up to 12. Recorded from most riverine habitats and extending out into eucalypt woodland, also some birds at base of range.

WS: Thirty-seven observations of one to four birds. Most open woodland habitats, particularly those with a spinifex understorey.

Geophaps plumifera Gould — Spinifex Pigeon

DS: Two observations of single birds. One in open eucalypt woodland over spinifex and one in Lysiphyllum cunninghamii woodland over tall grasses.

WS: Five observations of one or two birds. Low open eucalypt woodland over spinifex grassland.

Ocyphaps lophotes (Temminck) Crested Pigeon

DS: Thirty observations; mainly one to five birds - one group of 17. Most records from riverine Lysiphyllum cunninghamii woodland, also grassy plains or open eucalypt woodland over spinifex.

WS: Thirty-four observations of mainly one or two birds, four groups of four birds. Recorded from most habitats, particularly riverine Lysiphyllum cunninghamii woodland.

PSITTACIDAE

Trichoglossus haematodus (Linnaeus) Rainbow Lorikeet
T. h. rubritorquis Vigors and Horsfield

DS: Nine observations, mainly two to five birds, one group of nine in riverine Lysiphyllum cunninghamii woodland.

WS: Seven observations of one to six birds. Riverine Lysiphyllum cunninghamii woodland and eucalypt woodland over spinifex grassland.

Trichoglossus versicolor Lear Varied Lorikeet

DS: One observation of nine birds over riverine Lysiphyllum cunninghamii woodland.

WS: Thirty-one observations of mainly one to seven birds, some groups up to 32. Recorded from most open woodlands and spinifex grassland.

Aprosmictus erythropterus (Gmelin) Red-winged Parrot

DS: Twenty observations of two to six birds, mainly in riverine Lysiphyllum cunninghamii woodland. Occasionally in mixed woodland over grasses.

WS: Thirty-seven observations of one to five birds. Mainly riverine Lysiphyllum cunninghamii woodland though also from low open eucalypt woodland over spinifex and other grasses.

Platycercus venustus (Kuhl) Northern Rosella

DS: Three observations of two to three birds - two birds at base of range in open Lysiphyllum cunninghamii woodland over grasses, two and three birds in mixed woodland over grasses.

WS: Seven observations of one or two birds. Mainly dense Acacia shrubland, low open eucalypt woodland over spinifex grassland and riverine Lysiphyllum cunninghamii woodland.

Melopsittacus undulatus (Shaw) Budgerigar

DS: A pair, and a flock of 12 birds in riverine Lysiphyllum cunninghamii woodland, and three birds in open eucalypt woodland over spinifex.

WS: Seven observations of one to five birds. Low open eucalypt woodland over spinifex grassland and riverine Lysiphyllum cunninghamii woodland.

Nymphicus hollandicus (Kerr) Cockatiel

DS: Five observations of four to ten birds in riverine Lysiphyllum cunninghamii woodland, Melaleuca woodland and open eucalypt woodland over spinifex.

WS: Twenty-four observations of mainly one to nine birds, some groups up to 20. Favouring riverine Lysiphyllum cunninghamii woodland, also recorded from low open eucalypt woodland over spinifex grassland.

Calyptorhynchus magnificus (Shaw) Red-tailed Black Cockatoo
C. m. macrorhynchus Gould

DS: Eleven observations of two to seven birds, as well as one flock of 47. Mainly in Eucalyptus pruinosa woodland over grasses, and occasionally in riverine Lysiphyllum cunninghamii.

WS: Nineteen birds in Eucalyptus pruinosa woodland over grassland, three birds on rocky spinifex covered hillslope, and six birds in dense Acacia scrub.

Cacatua roseicapilla Vieillot Galah

DS: Nine observations of one to seven birds; mainly in riverine Terminalia with Adansonia gregorii, and occasionally in riverine Lysiphyllum cunninghamii woodland.

WS: Eleven observations of mainly one to three birds, one group of 14. Mainly low open eucalypt woodland over spinifex grassland, also two birds in riverine Lysiphyllum cunninghamii woodland.

Cacatua tenuirostris (Kuhl) Corella
C. t. sanguinea Gould

DS: Twenty-three observations of one to 12 birds. Recorded from most riverine Terminalia woodland and riverine Lysiphyllum cunninghamii woodland. Six birds at Lissadell Homestead.

WS: Thirty-nine observations of mainly one to 13 birds, some groups to 69 birds. Recorded from most woodland and open woodland habitats, favouring riverine Lysiphyllum cunninghamii woodland and Terminalia woodland. Roosts in large numbers in Adansonia gregorii.

Cacatua galerita (Latham) Sulphur-crested Cockatoo
C. g. fitzroyi (Mathews)

DS: Twenty-four birds at Lissadell Homestead in Adansonia gregorii around dam.

CUCULIDAE

Cuculus pallidus (Latham) Pallid Cuckoo

DS: Four observations of single birds, three in mixed woodland, one in riverine Lysiphyllum cunninghamii woodland.

WS: Ten observations of single birds in mainly riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

Chrysococcyx osculans (Gould) — Black-eared Cuckoo

WS: Single bird in low open eucalypt woodland over spinifex grassland.

Centropus phasianinus (Latham) — Pheasant Coucal
C. p. phasianinus

DS: One bird in lush riverside vegetation at Flying Fox Creek.

STRIGIDAE

Tyto alba (Scopoli) — Barn Owl
T. a. delicatula (Gould)

WS: Single bird sheltering under boulder on side of range.

Ninox connivens (Latham) — Barking Owl
N. c. connivens

DS: Single bird in open eucalypt woodland over spinifex.

WS: Single bird in low open eucalypt woodland over spinifex grassland.

Ninox novaeseelandiae (Gmelin) — Boobook Owl
N. n. boobook (Latham)

DS: Nine observations of one or two birds in most riverine woodlands and open grassy plains.

WS: Nine observations of single birds in most riverine woodlands, and open grassy plains.

PODARGIDAE

Podargus strigoides (Latham) — Tawny Frogmouth

DS: Five observations of one or two birds in open eucalypt woodland grasses and Lysiphyllum cunninghamii woodland.

WS: Four observations of single birds. Recorded from low open eucalypt woodland over spinifex grassland, riverine Terminalia forest, and one calling at "Pitt Falls".

AEGOTHELIDAE

Aegotheles cristatus (White) — Australian Owlet-nightjar
A. c. leucogaster Gould

DS: Nine observations of single birds in open eucalypt woodland over grasses and in riverine Lysiphyllum cunninghamii woodland.

WS: Two observations of single birds in low open eucalypt woodland over spinifex grassland.

CAPRIMULGIDAE

Eurostopodus guttatus (Vigors and Horsfield) Spotted Nightjar

DS: Sixteen observations of one to three birds in mixed woodland over grasses, riverine Lysiphyllum cunninghamii woodland, open eucalypt woodland over spinifex, and one bird at "Lissadell Gap".

WS: Eight observations of one, one observation of two birds. Most open woodlands and grassy plains particularly low open eucalypt woodland over spinifex grassland.

ALCEDINIDAE

Dacelo leachii (Vigors and Horsfield) Blue-winged Kookaburra
D. l. leachii

DS: Fifteen observations of one to three birds; mainly in riverine Lysiphyllum cunninghamii woodland, occasionally in open mixed woodland over grasses.

WS: Twenty-four observations of mainly one to three birds, single groups of seven and eight birds. Riverine Lysiphyllum cunninghamii woodland, low open eucalypt woodland over spinifex grassland and open spinifex grassland.

Halcyon pyrrhopygia Gould Red-backed Kingfisher

DS: Ten observations of single birds, mainly in Eucalyptus pruinosa and mixed woodland over grasses, occasionally in Lysiphyllum cunninghamii woodland.

WS: Forty-two observations of one or two birds. Recorded from all woodland and grassland habitats.

Halcyon sancta Vigors and Horsfield Sacred Kingfisher
H. s. sancta

DS: Two observations of single birds; one in Melaleuca woodland and mixed woodland over spinifex, and one in riverine Terminalia woodland.

WS: Eleven observations of one or two birds. Mainly riverine Lysiphyllum cunninghamii and Terminalia woodlands, also low open eucalypt woodland over spinifex grassland.

MEROPIDAE

Merops ornatus Latham Rainbow Bee-eater

DS: Forty-seven observations of one to 11 birds in most riverine and alluvial woodlands.

WS: Seventy observations of mainly one to eight birds, one flock of 142 birds at "Pitt Falls". Recorded from most habitats, particularly riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

CORACIIDAE

Eurystomus orientalis (Linnaeus) Dollarbird
E. o. pacificus (Latham)

WS: Single bird and pair in riverine Lysiphyllum cunninghamii woodland.

ALAUDIDAE

Marafra javanica Horsfield Horsfield's Bushlark

DS: Four observations of one to three birds in open grassland and riverine Lysiphyllum cunninghamii woodland.

WS: Fifty-four observations of one to eight birds, mainly one or two. Recorded from most grassland habitats, particularly black soil grassland and stony spinifex; also riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

HIRUNDINIDAE

Hirundo nigricans Vieillot Tree Martin
H. n. nigricans

DS: Eighteen observations of up to 18 birds over riverine Terminalia woodland and riverine Lysiphyllum cunninghamii woodland.

Hirundo ariel (Gould) Fairy Martin

DS: Two observations; three birds over riverine Lysiphyllum cunninghamii woodland, and six over riverine Terminalia woodland. Several old nests by cave entrance at "Lissadell Gap".

WS: Five birds over low open eucalypt woodland over spinifex grassland.

MOTACILLIDAE

Anthus novaeseelandiae (Gmelin) Richard's Pipit
A. n. australis Vieillot

DS: Two observations; one in open grassland and two in open eucalypt woodland over spinifex.

CAMPEPHAGIDAE

Coracina maxima (Rüppell) Ground Cuckoo-shrike

DS: Single bird in open mixed woodland, including Eucalyptus pruinosa, over spinifex.

Coracina novaehollandiae (Gmelin) Black-faced Cuckoo-shrike
C. n. novaehollandiae

DS: Twenty-six observations of one to five birds; in mixed woodland over grasses, open eucalypt woodland over spinifex, and riverine Lysiphyllum cunninghamii woodland.

WS: Fifty-one observations of one to five, mainly one or two birds. Recorded from riverine Lysiphyllum cunninghamii woodland, low open eucalypt woodland over spinifex grassland, base of Pitt Range, and open spinifex grassland.

Coracina papuensis (Gmelin) — Little Cuckoo-shrike
C. p. hypoleuca (Gould)

DS: Two observations; two birds in open eucalypt woodland over spinifex, one bird in riverine Lysiphyllum cunninghamii woodland.

WS: Five observations of single birds in low open eucalypt woodland over spinifex grassland and riverine Lysiphyllum cunninghamii woodland.

Lalage sueurii (Vieillot) — White-winged Triller
L. s. tricolor (Swainson)

DS: Forty observations of one to 13 birds; in open eucalypt woodland over spinifex, mixed woodland over grasses, and riverine Lysiphyllum cunninghamii woodland.

WS: Sixty observations of one to seven birds. Recorded from most open woodlands and grasslands, particularly riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

PACHYCEPHALIDAE

Microeca leucophaea (Latham) — Jacky Winter
M. l. leucophaea

DS: One bird in open eucalypt woodland.

WS: Six observations of single birds in low open eucalypt woodland over spinifex grassland.

Pachycephala rufiventris (Latham) — Rufous Whistler
P. r. rufiventris

DS: Thirty-one observations of one to five birds; in most woodland habitats.

WS: Seventeen observations of single birds, one of two. Most woodland habitats particularly riverine Lysiphyllum cunninghamii and low open eucalypt woodland over spinifex grassland.

Colluricincla harmonica (Latham) — Grey Shrike-thrush
C. h. harmonica

DS: Five observations of one or two birds in riverine Terminalia near base of range.

WS: Eight observations of one to three birds. Mostly in riverine Terminalia near base of range, also low open eucalypt woodland over spinifex grassland.

MONARCHIDAE

Rhipidura leucophrys (Latham) Willie Wagtail
R. l. leucophrys

DS: Forty-nine observations of one to four birds; in most habitats, but mainly near waterside vegetation.

WS: Sixty-five observations of one to seven, mainly one or two birds. Most open woodland and grassland habitats.

Rhipidura rufiventris (Vieillot) Northern Fantail
R. r. isura (Gould)

DS: Two observations of single birds. One in lush riverside vegetation at Flying Fox Creek, one in mixed woodland over spinifex and other grasses.

Myiagra inquieta (Latham) Restless Flycatcher
M. i. nana (Gould)

DS: Twenty-four observations of one to four birds in riverine woodland.

WS: Thirteen observations of one, and four observations of two birds. Mainly riverine Lysiphyllum cunninghamii woodland, low open eucalypt woodland over spinifex grassland, and riverine Terminalia woodland.

ORTHONYCHIDAE

Pomatostomus temporalis (Vigors and Horsfield) Grey-crowned Babbler
P. t. rubeculus (Gould)

DS: Thirty-one observations of one to seven birds; in riverine Lysiphyllum cunninghamii woodland and in mixed woodland over grasses and spinifex.

WS: Thirty observations of one to 11, mainly two or three birds. Most open woodland habitats, mainly riverine Lysiphyllum cunninghamii and low open eucalypt woodland over spinifex grassland.

ACANTHIZIDAE

Smicrornis brevirostris (Gould) Weebill

DS: One bird calling from low Acacia shrubland.

WS: Ten observations of one to three birds. In canopy of Eucalyptus spp. and Melaleuca sp. in open woodlands over spinifex grasslands.

MALURIDAE

Malurus melanocephalus (Latham) Red-backed Fairy-wren

DS: Nine observations of one to eight birds; in open eucalypt woodland over spinifex and in riverine Terminalia woodland.

WS: Thirty-three observations of one to 11, mainly two or three birds. Observed in spinifex and other grasses in most open woodlands and grasslands.

SYLVIIDAE

Cinclorhamphus mathewsi Iredale — Rufous Songlark

WS: Seventy-six observations of one to three birds (mainly one). Observed in most habitats visited, particularly riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

DAPHOENOSITTIDAE

Daphoenositta chrysoptera (Latham) — Australian Sittella
D. c. leucoptera (Gould)

DS: Three observations of one to four birds in Lysiphyllum cunninghamii woodland over grasses, and mixed woodland over mixed grasses.

CLIMACTERIDAE

Climacteris melanura Gould — Black-tailed Tree-creeper
C. m. melanura

DS: Twelve observations of one to three birds in open eucalypt woodland over spinifex.

WS: Forty-two observations of one to five, mainly one, birds in low open eucalypt woodland over spinifex grassland.

DICAEIDAE

Dicaeum hirundinaceum (Shaw) — Mistletoebird
D. h. hirundinaceum

DS: Three observations of single birds; in riverine Lysiphyllum cunninghamii woodland, and mixed woodland over grasses.

WS: Twelve observations of one or two birds. Riverine Lysiphyllum cunninghamii woodland, Terminalia woodland and low open eucalypt woodland over spinifex grassland.

PARDALOTIDAE

Pardalotus rubricatus Gould — Red-browed Pardalote

DS: Three observations of one or two birds in riverine Lysiphyllum cunninghamii woodland.

WS: Five observations of one or two birds. Riverine Lysiphyllum cunninghamii woodland, low open eucalypt woodland over spinifex grassland and riverine Terminalia woodland.

Pardalotus striatus (Gmelin) — Striated Pardalote
P. s. uropygialis Gould

DS: Thirteen observations of one to four birds; in riverine Lysiphyllum cunninghamii woodland and mixed woodland.

WS: Seventeen observations of one to five, mainly two, birds. Riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

MELIPHAGIDAE

Lichmera indistincta (Vigors and Horsfield) Brown Honeyeater
L. i. indistincta

DS: Ninety-five observations of mostly two to seven birds, occasionally singly, or in groups of up to 16. Recorded in every habitat type. Particularly numerous in riverine associations where it was attracted to flowering Acacia sp. and Grevillea sp.

WS: Fifty-three observations of one to seven, mainly two or three, birds. Most woodland and grassland habitats, particularly riverine associations and dense Acacia shrubland.

Meliphaga virescens (Vieillot) Singing Honeyeater

DS: Three observations of one to three birds in open eucalypt woodland over spinifex, riverine Lysiphyllum cunninghamii woodland and mixed woodland.

WS: Two single birds and a pair in low open eucalypt woodland over spinifex grassland.

Meliphaga plumula (Gould) Yellow-fronted Honeyeater

DS: Five observations of three to eight birds; mainly in dense riverine Terminalia thickets, one group in open Acacia shrubland over spinifex.

WS: Nineteen observations of mainly one to seven birds, one flock of 15 birds. Most open woodlands, particularly riverine Lysiphyllum cunninghamii woodland, riverine Terminalia woodland, and low open eucalypt woodland over spinifex grassland.

Meliphaga flavescens (Gould) Yellow-tinted Honeyeater
M. f. flavescens

DS: Eleven observations; mainly one or two birds, occasional groups of up to eight. Mainly riverine Lysiphyllum cunninghamii and Terminalia woodlands, some in open eucalypt woodland over spinifex.

WS: Two observations of two birds in riverine Lysiphyllum cunninghamii woodland, and a single bird and a pair in mixed eucalypt woodland over spinifex grassland.

Meliphaga unicolor (Gould) White-gaped Honeyeater

DS: Single bird in lush riverside vegetation at Flying Fox Creek.

Melithreptus albogularis Gould White-throated Honeyeater

DS: Two observations of birds in riverine Terminalia woodland.

Melithreptus gularis (Gould) Black-chinned Honeyeater
M. g. laetior Gould

DS: Seven birds in open eucalypt woodland with Terminalia, Acacia and Adansonia gregorii over grasses and spinifex.

Philemon citreogularis (Gould) Little Friarbird
P. c. citreogularis

DS: Forty-four observations of one to ten birds; in riverine vegetation, particularly associated with Adansonia gregorii.

WS: Eighty-five observations of mainly one to three birds; also single groups of four, six and 12 birds. Recorded from most woodland habitats, occasionally in grassland. Mainly seen around Adansonia gregorii in riverine Lysiphyllum cunninghamii woodland.

Philemon argenticeps (Gould) Silver-crowned Friarbird

DS: Single bird in mixed woodland over spinifex.

Cissomela pectoralis (Gould) Banded Honeyeater

DS: Five observations of one or two birds in Melaleuca woodland over mixed grasses. Attracted to flowering Melaleuca.

WS: Thirty-four observations of one to five birds. Most woodlands, favouring those with dense Acacia understorey.

Ramsayornis fasciatus (Gould) Bar-breasted Honeyeater

DS: One adult with one very young bird in riverine Lysiphyllum cunninghamii woodland.

Conopophila rufogularis (Gould) Rufous-throated Honeyeater

DS: Two observations of two and four birds in riverine Terminalia woodland.

WS: Fourteen observations of one to five, mainly two, birds. Riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

Manorina flavigula (Gould) Yellow-throated Miner

DS: Seventeen observations of one to 12 birds. Most records from base of range, some from riverine woodland.

WS: Twenty-nine observations of one to eight, mainly two, birds. Recorded from most woodland and grassland habitats, particularly low open eucalypt woodland over spinifex grassland.

PLOCEIDAE

Neochmia phaeton (Hombron and Jacquinot) Crimson Finch
N. p. phaeton

DS: Single bird in open eucalypt woodland with Terminalia canescens over spinifex.

Poephila guttata (Vieillot) Zebra Finch
P. g. castanotis (Gould)

DS: Seven observations of two to eight birds; in open eucalypt woodland over spinifex and mixed woodland.

WS: Seventeen observations of two to seven, mainly two, birds. Riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex and other grasses.

Poephila bichenovii (Vigors and Horsfield) Double-barred Finch
P. b. annulosa (Gould)

DS: Two observations; one bird in riverine Lysiphyllum cunninghamii woodland, and two in dense Acacia and Melaleuca woodland.

WS: Single bird in riverine Terminalia woodland.

Poephila personata Gould Masked Finch
P. p. personata

DS: Two observations of single birds. One in open eucalypt woodland over spinifex and one in riverine Lysiphyllum cunninghamii woodland over tall grasses.

WS: Two observations of two birds. Riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over Acacia shrubland.

Poephila acuticauda (Gould) Long-tailed Finch

DS: Eighteen observations, mainly one to five birds, occasionally up to ten; in riverine Lysiphyllum cunninghamii woodland, riverine Terminalia woodland and open eucalypt woodland over spinifex.

WS: Fourteen observations of one to five birds, mainly two birds. Riverine Lysiphyllum cunninghamii woodland and low open eucalypt woodland over spinifex grassland.

Erythrura gouldiae (Gould) Gouldian Finch

WS: Male and female of the black-headed form feeding on spinifex heads in low open eucalypt woodland over spinifex grassland.

Lonchura pectoralis (Gould) Pictorella Mannikin

DS: Single bird in open eucalypt woodland with Terminalia, Acacia and Adansonia gregorii over grasses and spinifex.

WS: Twenty-four observations of one to nine, mainly two or three, birds. Most woodland and grassland habitats, particularly low open eucalypt woodland over spinifex grassland and riverine Lysiphyllum cunninghamii woodland.

ORIOLIDAE

Oriolus sagittatus (Latham) Olive-backed Oriole

DS: Single bird in riverine Lysiphyllum cunninghamii woodland.

GRALLINIDAE

Grallina cyanoleuca (Latham) Magpie-lark

DS: Eighty-eight observations mainly one to five birds, occasionally up to eight. Recorded from most habitats, particularly riverine woodlands. Old nest in Eucalyptus sp. by Smoke Creek.

WS: Two hundred and thirty-three observations of mainly one to five birds, some groups up to 26. Recorded from every habitat type, particularly riverine associations.

ARTAMIDAE

Artamus superciliosus (Gould) White-browed Woodswallow

WS: Single bird on termitarium in spinifex grassland.

Artamus cinereus Vieillot Black-faced Woodswallow
A. c. melanops (Gould)

DS: One hundred and twenty-two observations of mainly one to six birds, occasionally up to ten. Recorded throughout all habitat types, particularly open woodland.

WS: One hundred and ninety-one observations of mainly one to five, with groups up to 19 birds. Recorded from all habitats, particularly riverine associations and low open eucalypt woodland over spinifex grassland.

Artamus minor Vieillot Little Woodswallow

DS: Forty-eight observations; mainly one to five birds, occasionally up to 13; over all riverine woodlands, also open eucalypt woodland over spinifex.

WS: Thirty observations of one to eight birds. Most woodlands, particularly those with Acacia and spinifex understorey, and open spinifex grassland.

CRACTICIDAE

Cracticus nigrogularis (Gould) Pied Butcherbird

DS: Sixty-five observations of one to four birds in all types of woodlands, particularly riverine and alluvial.

WS: Sixty-three observations of one to seven, mainly one or two birds. Favouring riverine woodlands, also spinifex grassland, base of Pitt Range, and low open eucalypt woodland over spinifex grassland.

Cracticus tibicen (Latham) Australian Magpie
C. t. tibicen

DS: Two observations of single birds. One in open eucalypt woodland with Adansonia gregorii over spinifex and other grasses, and one in sparse Acacia shrubland over mixed grasses.

WS: Twenty-five observations of one to five, mainly two birds. Mostly spinifex grass plains with little overstorey, also black soil grassland, and riverine Lysiphyllum cunninghamii woodland.

PARADISAEIDAE

Ptilonorhynchus nuchalis Jardine and Selby — Great Bowerbird
P. n. nuchalis

DS: Five observations of single birds and one of two birds in riverine Lysiphyllum cunninghamii woodland and riverine Terminalia woodland.

WS: Eight observations of one to three birds. Riverine Terminalia and Lysiphyllum cunninghamii woodlands.

CORVIDAE

Corvus orru Bonaparte — Australian Crow
C. o. salvadorii Finsch

DS: Thirty observations of one to six birds; mainly two or three. Recorded from most habitats, mainly riverine associations.

WS: Thirty-one observations of one to three birds, also one flock of 11 birds feeding on a Euro (Macropus robustus) carcass. Open woodland habitats and grasslands, particularly riverine associations.

Corvus bennetti North — Little Crow

DS: Two observations of 13 and 18 birds were probably of this species. The 18 birds were over Eucalyptus pruinosa woodland with spinifex, and the 13 over riverine Lysiphyllum cunninghamii woodland.

APPENDIX III

SYSTEMATIC LIST OF REPTILES RECORDED FROM THE ARGYLE SURVEY AREA

Reptiles collected for specimens are lodged in the Western Australian Museum: under herpetological collection registration numbers between R70026 and R70689, R70947-R70963, and between R75001 and R75551.

Following each species' name is a short summary, including an estimate of local abundance, based upon this survey, and short notes on habitat preferences. Below this is tabulated numbers of individuals observed or collected, habitats and localities (cf. Map 1). The results of the different parts of the survey are distinguished by the following abbreviations: DS = dry season (survey), PS = planigale survey, WS = wet season.

LACERTILIA - LIZARDS

GEKKONIDAE — GECKOS

Diplodactylus ciliaris Boulenger, 1885

Scarce. One collected in grassy riverine area, and one on alluvial plain.

DS:	1 headtorched in low *Melaleuca* shrub	"Smoke Creek Pool"
PS:	1 in pit trap on alluvial plain	Area 15

Diplodactylus conspicillatus Lucas and Frost, 1897

Scarce. One collected in grassy woodland on sandy clay loam, and one in open savanna grassland on black soil plain.

DS:	1 in pit trap in open eucalypt woodland over tall grasses	Area 3
PS:	1 in pit trap in black soil plain	Area 12

Diplodactylus stenodactylus Boulenger, 1896

Moderately common. On sandy and loamy soils with spinifex and other grasses.

DS:	1 in pit trap in open eucalypt woodland over grasses	Area 1
	4 in pit traps in open spinifex grassland	Area 2
	5 in pit traps in open spinifex grassland	Area 8
WS:	7 in pit traps in open eucalypt woodland over grasses	Area 1
	1 under log in open eucalypt woodland over grasses	Area 11
	1 in pit trap in open eucalypt woodland over grasses	Area 11

Diplodactylus taeniatus (Lonnberg and Anderson, 1913)

Uncommon. Four collected from spinifex on loamy soils.

DS:	1 headtorched in open spinifex grassland	Area 2
	1 headtorched in open spinifex grassland	4 km N-E of Area 2
WS:	1 in pit trap in open spinifex grassland	Area 2
	1 in spinifex clump in open eucalypt woodland over spinifex	0.5 km N of Area 10

Gehyra australis Gray, 1845

Common. In rocky ranges, riverine areas and open eucalypt woodlands.

DS:	15	headtorched on rock faces	"Lissadell Gap"
	4	headtorched on baobabs	3 km S of Area 4
	3	headtorched on rock faces	"Pitt Falls"
	5	under bark of dead eucalypt	"Smoke Creek Pool"
	1	headtorched on tree	Area 8
	3	headtorched on baobabs	Area 1
	2	headtorched on trees	4 km N-E of Area 2
WS:	7	on rocks at base of rocky range	"Pitt Falls"
	1	on building	H.M.S. plant
	5	on trees in open eucalypt - Melaleuca woodland over grasses	1 km E of Camp Nicholas
	4	on trees in open eucalypt woodland over spinifex	3 km N-W of H.M.S. plant

Gehyra nana Storr, 1978

Probably moderately common. Probably restricted to rocky hills.

DS:	3	headtorched from cracks in isolated boulders	"Pitt Falls"

Gehyra pilbara Mitchell, 1965

Very common. Apparently every large termite mound has its own colony, some housing up to 20 geckos.

DS:	1	headtorched from termite mound	"Pitt Falls"
	30	headtorched from termite mounds	Area 8
	58	headtorched from termite mounds	4 km S of Area 4
WS:	20	active on termite mound at night	1 km S of Area 4
	7	active on termite mound at night	H.M.S. plant
	1	under tent in open eucalypt woodland over spinifex	0.5 km N of Area 10
	1	under rock at base of rocky hill	Lissadell turn-off

Heteronotia binoei (Gray, 1845)

Very common. In riverine areas, spinifex plains, and black soil plains.

DS:	7	in pit traps in open Melaleuca woodland	Area 4
	1	in pit trap in open spinifex grassland	Area 2
	2	in pit traps in open eucalypt woodland over tall grasses	Area 3
	3	in leaf litter in open eucalypt woodland over grasses	Area 1
	2	under logs adjacent to creek pool	"Smoke Creek Pool"
	2	under rocks in open baobab and bauhinia woodland	"Smoke Creek Bore"
	5	in burrows and headtorched in open spinifex grassland on stony soil	4 km N-E of Area 2
	1	in pit trap in open spinifex grassland	Area 8
	4	in soil and spinifex litter	4.5 km N-E of Area 2
	1	under litter	4 km W of Area 2
	1	in ant nest	2 km N-E of Area 2
	1	under log	3 km N-E of Area 2
	1	in litter	Area 3
	1	burnt from spinifex	4.5 km N-E of Area 2

PS: 2 in pit traps in black soil plain — Area 12
5 in pit traps in black soil plain — Area 13
1 in pit trap in black soil plain — Area 14

WS: 6 under spinifex spoil in open eucalypt woodland over spinifex — 0.5 km N of Area 10
1 active at night in open eucalypt woodland over spinifex — 1 km E of Camp Nicholas
1 in pit trap in open eucalypt woodland over spinifex — Area 10
2 in pit traps in open spinifex grassland — Area 2

Heteronotia spelea (Kluge, 1963)

Uncommon. Two collected from rocky hills.

DS: 1 headtorched from crack in rock — "Pitt Falls"

WS: 1 under exfoliated granite at base of hill — Lissadell turn-off

Nephrurus asper Gunther, 1876

Scarce. One collected from rocky hills.

DS: 1 collected in cave — "Lissadell Gap"

Rhynchoedura ornata Gunther, 1867

Moderately common. In lightly wooded country with spinifex, and spinifex plains.

DS: 2 in pit traps in open spinifex grassland — Area 2
1 in pit trap in open spinifex grassland — Area 8
1 in pit trap in sparse eucalypt woodland over tall heath — Area 5

WS: 2 active at night in open eucalypt woodland over spinifex — 1 km S of Area 4

PYGOPODIDAE — LEGLESS LIZARDS

Delma borea Kluge, 1974

Moderately common. Collected from open woodland over grasses and spinifex on sandy loam.

DS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 in soil and spinifex litter — 4.5 km N-E of Area 2

WS: 2 under spinifex spoil in open eucalypt woodland over spinifex — 0.5 km N of Area 10
2 in pit traps in open eucalypt woodland over grasses — Area 1
1 active in open eucalypt woodland over grasses — Area 1
1 active in open eucalypt woodland over spinifex — Area 10

Delma nasuta Kluge, 1974

Moderately common. Collected from open grassy woodland over grasses on sandy loam, spinifex on stony clay, and grassy black soil plain.

DS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 burnt from spinifex — 4.5 km N-E of Area 2

PS: 1 in pit trap in grassland on black soil plain — Area 14

Lialis burtonis Gray, 1835

Moderately common. Collected from open woodland over grasses including spinifex on sandy loam, and in litter in riverine areas.

DS:	1 in pit trap in open eucalypt woodland	Area 1
	1 in leaf litter	"Smoke Creek Pool"
WS:	1 in pit trap in open eucalypt woodland over grasses	Area 1
	1 in pit trap in open eucalypt woodland over spinifex	Area 10

Pygopus nigriceps (Fischer, 1882)

Scarce. Two collected from eucalypt woodland over grasses on sandy clay loam.

DS:	1 in pit trap in open eucalypt woodland over tall grasses	Area 3
WS:	1 in pit trap	Area 1

AGAMIDAE — DRAGONS

Amphibolurus inermis (de Vis, 1888)

Common. In open eucalypt woodland over spinifex and other grasses.

DS:	1 in pit trap in open spinifex	Area 8
	1 in pit trap in open spinifex	Area 2
	1 under rock	2 km S of Area 2
	1 basking on termite mound in open eucalypt woodland over grasses	Area 1
	1 dug from burrow	2 km N-E of Area 2
	2 basking on rocks	1 km S-W of Area 1
PS:	1 collected by hand	junction airport road and haulroad
WS:	1 basking in open eucalypt woodland over spinifex	1 km S of Area 4
	1 active in open eucalypt woodland over grasses	Area 1
	1 active in low open eucalypt woodland over spinifex	Lissadell turn-off
	1 active in open spinifex grassland	Area 2
	1 active in low open eucalypt woodland over spinifex	12 km W of Area 2
	1 active in low open eucalypt woodland over spinifex	11 km W of Area 2
	1 active in low open eucalypt woodland over spinifex	3 km S-E of Lissadell turn-off
	1 active in low open eucalypt woodland over spinifex	3.5 km E of Lissadell turn-off
	1 active in low open eucalypt woodland over spinifex	4.5 km E of Lissadell turn-off

Chlamydosaurus kingii Gray, 1825

Moderately common. Four in open eucalypt woodland over grasses on sandy loam or spinifex on stony clay loam.

DS:	1 in cage trap in open eucalypt woodland over grasses	Area 1
WS:	2 on trees	1 km S of Area 4
	1 on tree	4 km S of Area 4

Diporiphora arnhemica Storr, 1974

Common. Prefers rocky spinifex habitats though also found in open woodland over grasses on sandy loam.

DS:	9 basking on rocks in low open eucalypt woodland over spinifex	Main camp
	1 basking on rocks in low open eucalypt woodland over spinifex	1 km S of Area 3
	1 in pit trap in open eucalypt woodland over grasses	Area 1
	1 observed in open Melaleuca woodland	Area 4
	3 basking on rock	4 km W of Area 2
WS:	1 basking on rocks	0.5 km S-W of Area 10
	2 active among rocks	1 km N of Camp Nicholas

Diporiphora bennettii (Gray, 1845)

Scarce. One from rocky hillslope.

DS:	1 basking on rocks in sparse eucalypt over spinifex	Area 6

Diporiphora magna Storr, 1974

Very common. This, the most common dragon, was found in most habitats where either spinifex or bunch-grass was present. Only absent from rocky hillslopes.

DS:	14 in pit traps and active in open eucalypt woodland over grasses	Area 1
	3 active in open spinifex	Area 2
	3 basking on spinifex crowns in open eucalypt woodland	Area 3
	1 in pit trap in open Melaleuca woodland	Area 4
	1 active in sparse eucalypt woodland over tall heath	Area 5
	11 in pit traps and active in spinifex	Area 8
	1 burnt from spinifex	
	2 headtorched, asleep in low shrubs over grasses	200 m S of Area 8
WS:	3 basking on low dead shrubs	4.5 km E of Lissadell turn-off
	1 basking on low dead shrub	3 km S-E of Lissadell turn-off
	1 basking on low dead shrub	5 km W of Area 2
	9 active amongst grass tussocks	Area 1
	7 in pit traps in open eucalypt woodland over grasses	Area 1
	1 basking on fence post in open spinifex grassland	Area 2
	2 basking on dead shrubs	3 km S of H.M.S. plant

Lophognathus g. gilberti (Gray, 1842)

Very common. In all riverine areas. Most specimens recorded during the dry season were juveniles.

DS:	7 in pit traps and active in open eucalypt woodland over grasses	Area 1
	34 observed in vicinity of creek (some may have been sighted more than once)	"Smoke Creek Pool"
	4 basking on low shrubs	2 km W of Area 1
	1 observed active in low shrubs over spinifex	Area 2
	1 in pit trap in open spinifex with occasional baobabs	Area 8
PS:	1 caught by hand	Camp Nicholas
WS:	3 active in shrubs in open eucalypt woodland over grasses	Area 1
	1 in pit trap	Area 1
	2 active in creekside vegetation	4 km N-E of Area 2
	1 active in creekside vegetation	1 km E of Area 2

SKINCIDAE SKINKS

Carlia triacantha (Mitchell, 1953)

Scarce. Two recorded from open woodland over bunch-grass and spinifex.

DS: 1 in pit trap in open Melaleuca woodland — Area 4

WS: 1 active at camp site in spinifex — 0.5 km N of Area 10

Cryptoblepharus megastictus Storr, 1976

Locally common. On rocky hills.

DS: 1 active on rock face — Top of AK1 pipe

WS: 10 active on granite boulders at base of hill — Lissadell turn-off

Cryptoblepharus plagiocephalus (Cocteau, 1836)

Common. On trees in open grassland on loamy soils and in open eucalypt woodland over spinifex.

DS: 4 active on low trees in open eucalypt woodland over grasses — Area 1
4 active on low bauhinias along creek margin — "Smoke Creek Pool"
1 active on low tree at base of rockface — "Lissadell Gap"
1 in pit trap in open eucalypt woodland over tall grasses — Area 3
1 active on tree in open eucalypt woodland — 2 km W of Area 2
1 active on tree in open eucalypt woodland — 2 km W-N-W of Camp

WS: 2 on trees in open eucalypt woodland over grasses — Area 1
1 on tree in open eucalypt woodland over spinifex — 0.5 km N of H.M.S. plant

Ctenotus inornatus (Gray, 1845)

Common. In grassy and spinifex woodlands, on sandy and loamy soils and grasslands on black soil.

DS: 6 in pit traps and active in open eucalypt woodland over grasses — Area 1
1 under rubbish among open baobabs over bauhinias — "Smoke Creek Bore"

WS: 5 in pit traps in open eucalypt woodland over grasses — Area 1
9 in pit traps in open eucalypt woodland over spinifex — Area 10
1 active in open eucalypt woodland over spinifex — 0.5 km N of Area 10
2 active in open grassland on black soil — Area 9

Ctenotus militaris Storr, 1975

Very common. Collected in all habitats where bunch-grass or spinifex was present, except rocky hills.

DS: 5 in pit traps and active in open eucalypt woodland over grasses — Area 1
6 in pit traps and active in open spinifex — Area 2
8 in pit traps and active in Melaleuca woodland — Area 4
13 in pit traps and active in open spinifex — Area 8

WS: 5 in pit traps in open eucalypt woodland over grasses — Area 1
2 active in open eucalypt woodland over grasses — Area 1
3 active in open eucalypt woodland over spinifex — Area 10
6 in pit traps in open eucalypt woodland over spinifex — Area 10
3 in pit traps in open spinifex grassland — Area 2
1 active in open eucalypt woodland over spinifex — Lissadell turn-off
2 active in open eucalypt woodland over spinifex — 0.5 km N of Area 10

Ctenotus pantherinus calx Storr, 1970

Common. Collected from grassland on black soil, open woodland over spinifex, open spinifex grassland, and rocky hills.

DS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 observed in open Melaleuca woodland — Area 4
2 burnt from spinifex — 4.5 km N-E of Area 2
4 observed active in spinifex — Camp Nicholas

WS: 3 in pit traps in open spinifex grassland — Area 2
1 in pit trap in open eucalypt woodland over spinifex — Area 10
2 in pit trap in grassland on black soil — Area 9

Ctenotus piankai Storr, 1969

Very common. In open eucalypt woodland over grasses including spinifex.

DS: 21 in pit traps and active in open eucalypt woodland over grasses — Area 1
1 in pit trap in open spinifex — Area 2
1 in pit trap in open Melaleuca woodland — Area 4
1 in pit trap in open eucalypt woodland over tall grasses — Area 3
1 active in grass tussocks — 2 km W of Area 1

WS: 9 in pit traps in open eucalypt woodland over grasses — Area 1
3 active in open eucalypt woodland over grasses — Area 1
4 in pit traps in open spinifex grassland — Area 2
10 in pit traps in open eucalypt woodland over spinifex — Area 10
6 active in open eucalypt woodland over spinifex — Area 10
2 in pit traps in open eucalypt woodland over grasses — Area 11

Ctenotus saxatilis Storr, 1970

Uncommon. Collected from rocky spinifex covered hillslope, open eucalypt woodland over bunch-grasses or spinifex, and black soil grassland.

DS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 observed active in sparse eucalypt woodland over spinifex on rocky hill — Area 7

PS: 2 in pit traps in bunch-grasses on black soil — Area 13

WS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 in pit trap in open eucalypt woodland over spinifex — Area 10

Ctenotus schomburgkii (Peters, 1863)

Scarce. In low open eucalypt woodland over tall heath and spinifex on reddish brown sandy loam.

DS: 1 active among spinifex clumps in low open eucalypt woodland — Area 5

Eremiascincus richardsonii (Gray, 1845)

Moderately common. In riverine areas and associated alluvia.

DS:	3	in soil beneath logs and in rotten tree stumps	"Smoke Creek Pool"
	1	under dead cow	"Smoke Creek Pool"
	2	under rocks in open baobabs over bauhinia	"Smoke Creek Pool"
PS:	1	in pit trap in bunch-grasses on alluvium	Area 15

Lerista borealis Storr, 1972

Very common. In loose soil under leaf litter in riverine areas and associated alluvia, and open eucalypt woodland over bunch-grasses or spinifex.

DS:	3	in soil beneath leaf litter below bushes	Area 1
	15	in soil beneath leaf litter below bushes	"Smoke Creek Pool"
	7	dug up by bulldozer in open baobabs and low bauhinia bushes	½ km N of Area 1
	4	in soil beneath leaf litter below eucalypt tree	Area 5
	1	in pit trap	Area 4
	3	in leaf litter below eucalypt tree	Area 4
WS:	1	in pit trap in open eucalypt woodland over grasses	Area 1
	2	in soil beneath leaf litter in open eucalypt woodland over spinifex	Lissadell turn-off

Menetia greyii Gray, 1845

Locally common. Collected from open eucalypt woodland over bunch-grasses and in spinifex, where leaf litter was present, also grassy riverine alluvia and black soil plain grassland.

DS:	5	in leaf litter in low eucalypt woodland with spinifex	Area 5
	1	in litter in open baobabs and bauhinia	"Smoke Creek Bore"
	2	in pit traps in open Melaleuca woodland	Area 4
	1	in pit trap in open spinifex	Area 2
	1	in pit trap in open eucalypt woodland over tall bunch-grasses	Area 3
	1	in litter	3 km S of Area 4
	1	dug up by bulldozer in open baobabs and bauhinia	½ km N of Area 1
PS:	1	in pit trap in grassland or black soil	Area 13
WS:	4	in pit traps in open eucalypt woodland over grasses with leaf litter	Area 1

Morethia r. ruficauda (Lucas and Frost, 1895)

Scarce. One collected in open eucalypt woodland over tall bunch-grasses on sandy clay loam.

DS:	1	in pit trap in open eucalypt woodland over tall bunch-grasses	Area 3

Notoscincus ornatus wotjulum (Glauert, 1959)

Common. In leaf litter on riverine alluvia covered with spinifex and other grasses.

DS:	4	active in litter in vicinity of creek	"Smoke Creek Pool"
	1	in pit trap in open baobabs over grasses	Area 8
	4	in pit traps and active in litter in open eucalypt woodland over grasses	Area 1
WS:	1	in pit trap in open eucalypt woodland over grasses and leaf litter	Area 1

Proablepharus tenuis (Broom, 1896)

Moderately common. In leaf litter, in open woodland over spinifex and other grasses.

DS: 1 active in eucalypt litter amongst spinifex clumps — Area 5
1 in pit trap in open Melaleuca woodland — Area 4

WS: 1 in leaf litter in open eucalypt woodland over grasses — Area 1

Tiliqua multifasciata Sternfeld, 1919

Uncommon. Collected in spinifex.

DS: 1 burnt from open spinifex on stony clay soil 4.5 km N-E of Area 2

WS: 1 in open eucalypt woodland over spinifex — H.M.S. Plant

Tiliqua scincoides (Shaw, 1790)

Uncommon.

WS: 1 in open eucalypt woodland over Acacia shrubland over spinifex on rocky soil — 1 km S-W of Area 10

VARANIDAE — MONITORS

Varanus acanthurus Boulenger, 1885

Scarce.

WS: 1 in open eucalypt woodland over spinifex — 4 km W of Area 2

Varanus gouldii (Gray, 1838)

Uncommon. Recorded from open eucalypt woodland over grasses including spinifex, and grassland on black soil.

DS: 1 in pit trap in open eucalypt woodland — Area 1
1 active in open spinifex — Area 8

WS: 1 in pit trap in open eucalypt woodland over grasses — Area 1
1 active in grassland on black soil plain — Area 9
1 active in open eucalypt woodland over spinifex — 2 km E of Area 2

Varanus mertensi Glauert, 1951

Scarce. Restricted to riverine habitats where water is present.

DS: 1 observed active in riverine vegetation — "Smoke Creek Pool"

Varanus mitchelli Mertens, 1958

Uncommon. Restricted to riverine habitats where water is present.

DS: 1 observed basking in Pandanus palms — Flying Fox Gorge
1 headtorched asleep in rock pool — "Pitt Falls"
1 active in riverine vegetation — 6 km E of Area 1

Varanus p. panoptes Storr, 1980

Rare.

WS: 1 dead on road through open eucalypt woodland over spinifex — 1 km S of Area 4

Varanus storri ocreatus Storr, 1980

Common. Collected from open spinifex grassland and grassland on black soil plain.

DS: 1 active in open spinifex and bunch-grass tussocks — Area 2
1 active in open spinifex and bunch-grass tussocks — 2 km N of Area 2

WS: 10 in pit traps in grassland on black soil plain — Area 9
3 in pit traps in open spinifex grassland — Area 2
1 under log in open spinifex grassland — Area 2

Varanus timorensis scalaris Mertens, 1941

Moderately common. Collected from open woodland over grasses on alluvia.

DS: 2 in pit traps in open Melaleuca woodland — Area 4
1 in pit trap in open eucalypts over tall grasses — Area 3

WS: 2 in pit traps in open eucalypt woodland over grasses — Area 1
1 in pit trap in open eucalypt woodland over grasses — Area 11

Varanus t. tristis (Schlegal, 1839)

Moderately common. Associated with dead trees and termite mounds in open eucalypt woodlands.

DS: 1 headtorched asleep in standing dead tree in open spinifex — 3 km S of Area 4
1 in pit trap in open eucalypt woodland over tall grasses — Area 3

WS: 1 basking on dead standing tree in open eucalypt woodland over spinifex — Area 10
1 basking on dead standing tree in open eucalypt woodland over spinifex — 1 km S of Area 2
1 basking on dead standing tree in open eucalypt woodland over spinifex — 4 km S-W of Area 2
1 basking on termite mound in open eucalypt woodland over spinifex — H.M.S. plant

SERPENTES - SNAKES

TYPHLOPIDAE — BLIND SNAKES

Ramphotyphlops ligatus (Peters, 1879)

Scarce.

WS: 1 in pit trap in open eucalypt woodland over grasses — Area 1

Ramphotyphlops unguirostris (Peters, 1867)

Moderately common. Collected from open eucalypt woodland over grasses including spinifex.

WS: 2 in pit traps in open eucalypt woodland over grasses — Area 1
1 dead on road through open eucalypt woodland over spinifex — 2 km E of Area 2

Typhlina guentheri (Peters, 1865)

Moderately common. One in soil in dead tree in riverine area and two in spinifex on stony clay loam.

DS:	1 in soil in rotten stump	3 km N-E of Area 2
	1 in pit trap in open baobabs/grasses	Area 8
	1 under soil under log in open bauhinia shrubs	"Smoke Creek Pool"

BOIDAE — PYTHONS

Aspidites melanocephalus (Krefft, 1864)

One in open eucalypt woodland over spinifex on rocky soil. Reported to be common by manager of Lissadell Station.

DS:	1 road kill in open eucalypt woodland over spinifex	1 km E of Main Camp
PS:	1 observed	½ km from Flying Fox Gorge
	1 observed	near Camp Nicholas airstrip

Liasis childreni Gray, 1842

Common. In termite mounds, ranges, valley black soil plains, and eucalypt woodlands over spinifex.

DS:	1 headtorched while active on rockface	"Lissadell Gap"
	1 headtorched while active on rockface	"Pitt Falls"
	1 crossing road through open grasses	1 km W of Area 1
	1 bulldozed out of termite mound in open baobabs/grasses	½ km N of Area 1
	2 headtorched at base of termite mounds in open spinifex	3 km S of Area 4
WS:	3 dead on road through open eucalypt woodland over spinifex	H.M.S. plant
	2 active at night in grassland on black soil plain	2 km W of H.M.S. plant
	3 active at night amongst rocks near creek in rocky range	"Pitt Falls"
	1 active at night in open eucalypt woodland over spinifex	1 km S of Area 4
	1 dead on road through open eucalypt woodland over spinifex	½ km E of Lissadell turn-off

Liasis olivaceus Gray, 1842

Scarce. A snake believed to be this species was observed in a river gum.

PS:	1 observed in Eucalyptus camaldulensis tree	Flying Fox Gorge

COLUBRIDAE — BACK-FANGED SNAKES

Boiga fusca (Gray, 1842)

Uncommon.

DS:	1 headtorched active in thicket at base of rockface	"Lissadell Gap"
WS:	1 headtorched in tree adjacent to creek at base of rocky range	"Pitt Falls"

ELAPIDAE FRONT-FANGED SNAKES

Acanthophis antarcticus (Shaw, 1794)

DS: Reported by manager of Lissadell Station. Probably moderately common.

Demansia atra (Macleay, 1885)

Uncommon.

WS: 1 dead on road through open eucalypt woodland over spinifex — 1 km N-W of H.M.S. plant

Denisonia punctata Boulenger, 1896

One collected in spinifex on stony clay loam. Probably common.

DS: 1 headtorched in open spinifex — 4.5 km N-E of Area 2

Furina christieana (Fry, 1915)

DS: Reported by manager of Lissadell Station.

Furina sp. (F. "ornata" Storr, MS. name)

WS: 1 in open eucalypt woodland over spinifex on rocky hillslope — 1 km E of Area 3

Pseudechis australis (Gray, 1842)

DS: Reported as being common by C.R.A. personnel and the manager of Lissadell Station.

Vermicella semifasciata roperi (Kinghorn, 1931)

Moderately common. In open woodland over spinifex and bunch-grasses.

DS: 1 in pit trap in open Melaleuca woodland — Area 4

WS: 2 in pit traps in open eucalypt woodland over spinifex — Area 10

APPENDIX IV

SYSTEMATIC LIST OF FROGS RECORDED FROM THE ARGYLE SURVEY AREA

Frogs collected for specimens are lodged in the Western Australian Museum: under herpetological collection registration numbers between R70026 and R70689, and between R75001 and R75551.

Following each species' name is a short summary, including an estimate of local abundance, based upon this survey, and short notes on habitat preferences. Below this is tabulated numbers of individuals observed or collected, habitats and localities (cf. Map 1). The results of the different parts of the survey are distinguished by the following abbreviations: DS = dry season (survey), WS = wet season.

ANURA - FROGS

LEPTODACTYLIDAE — GROUND FROGS

Cyclorana australis (Gray, 1842)

Very common. In riverine areas, their associated alluvia, black soil plains, and rocky range creek.

DS:	3	headtorched on edge of pool	"Smoke Creek Pool"
	2	in soil in hollow trees on edge of pool	"Smoke Creek Pool"
	1	in pit trap in open spinifex grassland	Area 8
	1	headtorched in creek	"Pitt Falls"
WS:	32	in pit traps in grassland on black soil	Area 9
	7	in pit traps in open spinifex grassland	Area 2
	5	in flooded grassy depression in open bauhinia woodland	Lissadell turn-off
	2	on road at night in riverine area	4 km N-E of Area 2
	14	active at night	near H.M.S. plant
	1	active at night	Camp Nicholas
	2	active at night in open eucalypt woodland over spinifex	0.5 km N-E of Area 10
	27	active at night on edge of dam in grassland on black soil	2 km W of H.M.S. plant
	1	active at night in open eucalypt and ti-tree woodland over grasses	1 km S of Area 4

Cyclorana longipes Tyler and Martin, 1977

Very common. In riverine areas, their associated alluvia, and black soil areas.

DS:	1	in pit traps in open spinifex grassland	Area 8
	1	headtorched on edge of pool	"Smoke Creek Pool"
	1	dug from soil by bulldozer	c. 300 m N of Area 1
WS:	1	active at night in open eucalypt woodland over spinifex	0.5 km N of Area 10
	35	in pit traps in open eucalypt woodland over grasses	Area 1
	3	active at night in open eucalypt and ti-tree woodland over bunch-grasses and spinifex	1 km S of Area 4

45	in pit traps in open spinifex grassland	Area 2
13	in pit traps in open eucalypt woodland over spinifex	Area 10
1	under rock	Lissadell turn-off
3	in pit traps in grassland on black soil plain	Area 9
1	active at night in creek in rocky hills	"Pitt Falls"
2	active at night on edge of dam on black soil plain	2 km W of H.M.S. plant

Limnodynastes ornatus (Gray, 1842)

Very common. In riverine areas, associated grassy alluvia, black soil areas and open eucalypt woodlands.

DS:	25	headtorched around margins of pool	"Smoke Creek Pool"
	3	in pit traps in sparse eucalypt woodland over tall heath	Area 5
	11	in pit traps in open eucalypt woodland over grasses	Area 1
	2	in pit traps in open Melaleuca woodland	Area 4
	1	in pit trap in open spinifex grassland	Area 2
WS:	1	active at night in creek	1 km E of Camp Nicholas
	119	in pit traps in open eucalypt woodland over grasses	Area 1
	3	active at night in open eucalypt and ti-tree woodland over grasses	1 km S of Area 4
	30	in pit traps in open spinifex grassland	Area 2
	15	in pit traps in open eucalypt woodland over spinifex	Area 10
	2	active at night	Camp Nicholas
	1	in pit trap in grassland on black soil	Area 9
	3	at tailings dam	H.M.S. plant
	1	active at night in open eucalypt woodland over spinifex	0.5 km N of Area 10
	23	in pit traps in open eucalypt woodland over grasses	Area 11
	2	active at night on edge of dam on black soil plain	2 km W of H.M.S. plant

Limnodynastes depressus Tyler, Martin and Davies, 1979

Locally common. In creek in rocky ranges.

DS:	1	headtorched active in vicinity of rock pool	"Pitt Falls"
WS:	24	freshly metamorphosed juveniles under rocks at edge of pool	"Pitt Falls"

Notaden melanoscaphus Hosmer, 1962

Uncommon. In spinifex on clay and open woodland with bunch-grasses.

DS:	1	in pit trap in open spinifex grassland	Area 2
	1	in pit trap in open spinifex grassland	Area 8
WS:	4	calling in open Melaleuca woodland over grasses	1 km S of Area 4

Uperoleia sp. No. 1

Uncommon. In woodland beside creek and in creek in rocky ranges.

DS:	1	in pit trap in open Melaleuca woodland	Area 8
WS:	3	collected from creek	"Pitt Falls"

Uperoleia sp. No. 2

Uncommon. Collected in grassland on black soil.

WS:	4	in pit traps in black soil plain	Area 9

HYLIDAE TREE FROGS

Litoria caerulea (White, 1790)

Moderately common. Found in rocky hills in the vicinity of water and on baobabs on sandy riverine alluvia.

DS: 4 active at night on baobabs — Area 1
1 in pit trap in open eucalypt woodland over grasses — Area 1
2 headtorched in vicinity of creek — "Pitt Falls"
1 headtorched 3 m up a tree at the base of a limestone hill — "Lissadell Gap"

WS: 9 active at night on rocks on edge of creek — "Pitt Falls"
1 active at night on rock on edge of creek — 1 km E of Camp Nicholas

Litoria coplandi (Tyler, 1968)

Locally very common. Restricted to creeks in rocky ranges.

DS: c. 70 perching on rocks at night, many on edge of pools, some up to 70 m from water — "Pitt Falls"

WS: c. 80 perching on rocks at night, many on edges of pools — "Pitt Falls"

Litoria rothii (de Vis, 1884)

Uncommon. Riverine margins and ti-tree woodland.

DS: 2 perching in low vegetation along edge of creek at night — "Smoke Creek Pool"

WS: 4 calling in Melaleuca woodland over grasses — 1 km S of Area 4

Litoria rubella (Gray, 1842)

Moderately common. Riverine areas and valley alluvia, vicinity of artificial pools, and from creek in rocky ranges.

DS: 2 active at night in vicinity of baobab trees — Area 1

WS: 3 calling at night — Camp Nicholas
1 active at night on edge of tailings dam — H.M.S. plant
4 active at night on trees along edge of creek — "Pitt Falls"

Litoria splendida Tyler, 1977

Common. In creek in rocky ranges.

DS: 6 headtorched in the vicinity of rock pools — "Pitt Falls"

WS: 10 perching on rocks at night — "Pitt Falls"

Litoria wotjulumensis (Copland, 1957)

Rare.

WS: 1 in creek at night — 1 km E of Camp Nicholas

Litoria sp. affin. L. latopalmata Gunther, 1867

Very common. Found in riverine areas and associated alluvia, and around artificial pools.

DS: 8 in pit traps in open spinifex grassland — Area 8
5 headtorched on edge of water — "Smoke Creek Pool"
1 in pit trap in open Melaleuca woodland — Area 4

WS:	15 calling at night in flooded open Melaleuca woodland over grasses	1 km S of Area 4
	7 active at night at tailings dam	H.M.S. plant
	3 active at night on edge of dam on black soil plain	2 km W of H.M.S. plant