

## MAMMALS OF THE ORD RIVER AREA, KIMBERLEY, WESTERN AUSTRALIA

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### ABSTRACT

This survey of the Ord River area recorded 26 species of native mammal, mostly from localities that are now submerged beneath Lake Argyle. These species are representative of Kimberley mammals and (unlike the bird and reptile fauna of the area) include no arid element.

Material from archaeological and palaeontological sites in the area indicate that at least three species of native mammal not collected on these surveys were in the area at about the time of its European settlement. Further, there were fewer species of native rodents in the survey area than might be expected and a general absence of arboreal species. With the exception of chiropterans, this mammal fauna was considered low in species and numbers. This is attributed to the combined effects of European settlement, particularly the introduction of cats and the degradation of riverine woodlands by livestock, feral donkeys and fire.

Observations are presented on the period of births for some species.

### INTRODUCTION

Lake Argyle is in the east Kimberley about 50 km south of Kununurra. It was formed by a dam, completed in 1971, across the Ord River, and is the major reservoir for an irrigation project designed to establish agriculture in the region. It began to fill during the 1971/72 wet season. The Lake now has an area of 480 square kilometres at normal spillway level (its extent is indicated on Fig. 1) and 1300 square kilometres at the maximum flood storage level. It encompasses parts of the previous grazing leases of Argyle Downs and Lissadell Stations. Low lying grassy plains formed the greater

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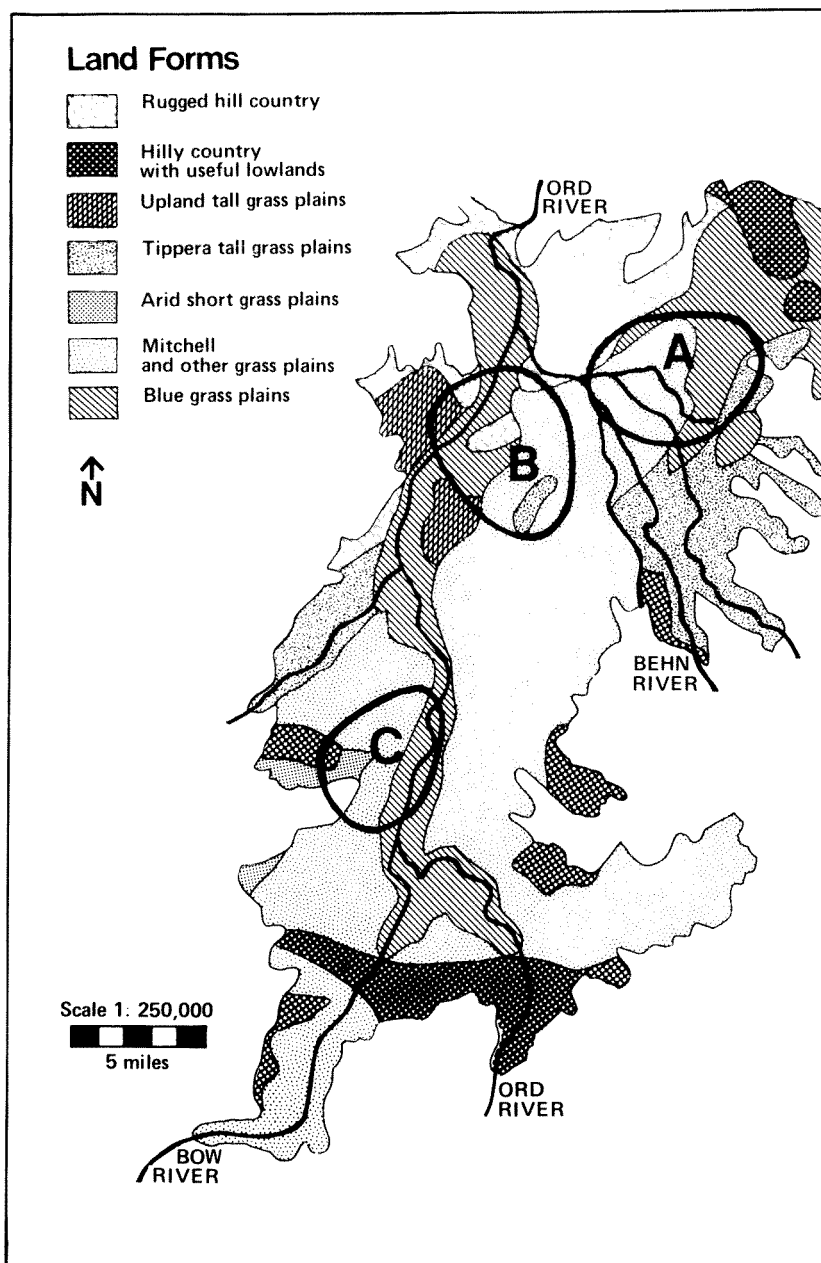


Fig. 1: Showing the land forms (from C.S.I.R.O. Land Research Series No. 28) within that part of the Ord River Basin to be flooded. The three general areas selected for the October 1971 survey (A, B and C) are outlined.

part of the Reservoir area. Hilly country and upland plain to the east and south west, and ridges and foothills of the Carr Boyd Ranges to the north, are included.

In 1885 the Durack family established the first major settlements in the Ord River basin at Argyle, Lissadell, and Rosewood Stations. Stewart (1970) reports that until the 1890s most of the beef produced at these stations was sent to the gold mining area at Halls Creek. With the decline in gold production from that area, their cattle were marketed by exporting them live from Wyndham to the Philippines or by driving them overland to Queensland. By 1920 the cattle population in the region had reached approximately its present numbers.

Although the Ord River Basin had been settled for 85 years prior to the filling of the Dam in 1971, with the exception of birds, there was no record of the fauna of the Reservoir area. For this reason the Western Australian Wildlife Authority commissioned the Western Australian Museum (WAM) to survey the area in October 1971, prior to its being flooded. The objectives of this survey were threefold: to record the mammals, birds, reptiles, frogs, freshwater fish and molluscs present; to indicate which animals may require rescuing when flooding began and how their rescue should proceed; and to predict ecological changes that may occur in the general area and propose recommendations for the management of fauna in the area. Recommendations arising from the October 1971 survey were compiled by me and submitted to the Western Australian Wildlife Authority in November 1971.

In January and February 1972, a party from the Western Australian Museum again visited the area to take vertebrate fauna for their collections, and for those of the National Museum of Victoria, the Australian Museum (Sydney) and the Northern Territory Museum. All these museums contributed towards the cost of collecting. This second visit to the area was at a time when animals were being confined and stranded on the numerous islands formed by the rising waters of Lake Argyle, particularly near the dissected hilly country in the northern region of the Reservoir. A third collection of mammals from the Ord area was made by L.E. Keller, Field Museum of Natural History, Chicago, between 19-24 November 1976 in the vicinity of Lissadell Homestead. Ms Keller has kindly allowed me to examine and report on these specimens.

In conjunction with the October 1971 faunal survey, an archaeological excavation of two Aboriginal sites in the Ord Reservoir Area was carried out by C.A. Dortch in association with D. Merrilees and M. Archer, all of the Western Australian Museum. These two sites, Miriwun and Monsmont, have

been described by Dortch (1972) in an interim report on the excavations. Both sites (Fig. 2) have palaeontological material but Miriwun is particularly rich in mammals. The mammal bones are, however, very fragmented, as is to be expected in a site of this nature. The mammals of the upper surface strata are believed to have been formed in the deposit after Aboriginal contact with Europeans (C.A. Dortch, pers. comm.); they are mixed with occasional pieces of fencing wire, cattle (*Bos taurus*) bones and Aboriginal artifacts made of European bottle glass. The mammals in the surface strata of these sites are listed to enable comparison between mammals occurring in the reservoir area about the time of the first European settlement, and those recorded there in 1971-72 and 1976.

Apart from the collecting by W.H. Butler at Kalumburu (4 December 1965 to 1 February 1966), few mammals have been collected in the Kimberley during the wet season. Mammals collected at the Ord River in October, January and February should, then, complement the sparse information available on mammal breeding in the Kimberley.

Information obtained from the Ord River specimens is presented in conjunction with breeding information obtained from other female Kimberley specimens in WAM collections, and from pertinent published accounts. Most of these WAM specimens have numbers that are prefixed with an 'M'. However, some of those collected by W.H. Butler for the joint 1963/65 American Museum of Natural History and WAM expedition have numbers that are prefixed with a 'B'.

## METHODS

### 1-24 October WAM Survey

For the vertebrate survey three areas within the Ord Reservoir were selected from the Ord-Victoria area map in the C.S.I.R.O. Land Research Series No. 28 (1970). These survey areas include representatives of the major land forms within the Reservoir area. These, and the three general areas (A, B & C) surveyed, are indicated in Fig. 1. The major habitats for mammals within these areas were selected following an aerial reconnaissance on 1-2 October 1971. They are located in Fig. 2 (1-20) and are described in the Environment section (p. 197). Each of these areas was trapped. This involved a total of 1040 Elliott, 776 breakback and 208 cage trap-nights.

The survey was divided into two phases. The first phase, concerned with the general faunal survey, took place between 1-20 October. For this phase 3 teams were formed.

Team 1	R.J. McKay & J. Dell
Team 2	Mr & Mrs W.H. Butler
Team 3	D.J. Kitchener & R. Graves

B.R. Wilson was with the survey between 6-13 October. He joined the teams that allowed him the best coverage of the mollusc fauna. Although each of these teams set mammal traps, individuals had particular specialist interests which covered the faunal groups referred to in the Introduction. Each team spent time in each of the predetermined survey areas A, B and C, according to the following schedule.

	Team 1	Team 2	Team 3
Area A	16-20 October	11-15 October	3-10 October
Area B	3-10 October	16-20 October	11-15 October
Area C	11-15 October	3-10 October	16-20 October

The second phase of the survey took place between 20-24 October. During this period attention was concentrated on the areas that may become important during the actual rescue operation and on any habitat that was not examined in the first phase of the survey. The additional areas surveyed for mammals included Banana Springs, mouth of Hicks Creek, termitaria near Old Lissadell Homestead, Mount Misery and Monsmont.

The mammal traps used were (i) *breakbacks* — a metal rat trap, (ii) *Elliott traps* — collapsible trap with solid aluminium walls with dimensions 0.1 x 0.3 x 0.1 m, (iii) *cage traps* — a collapsible trap made from wire mesh with dimensions 0.6 x 0.5 x 0.6 m. Traps were set at approximately 1600 hrs and baited with 'Universal bait', a mixture of peanut butter, bacon, raisins and oats. They were checked each day between 0500-0700 hrs. In addition to trapping and shooting, mammals were collected by mist-netting over creeks, and spotlighting at night from Landrovers. Each of the 3 teams conducted spotlighting traverses in each of areas A, B and C. Each team's traverses were conducted on the same night (4th, 7th, 11th, 14th and 18th), at the same time (1830-2130 hrs), and by travelling over the same section of road. Where possible, a driving speed of 24 kph was maintained. The routes travelled during these traverses are shown in Fig. 2.

#### 4 January-16 February WAM Survey

The members of this survey team were D.J. Kitchener, L.A. Smith, R.E. Johnstone and W.K. Youngson. Collecting was focused on small islands created by the rising water of Lake Argyle. The main areas examined were at the mouth of Hicks and Matilda Creeks, Mt Misery, Monsmont, Argyle Downs, Argyle Lagoon, Banana Spring, and the Spillway. Small islands

which were to be covered as the lake continued to rise were systematically burnt; mammals and reptiles were caught as they ran from burning *Triodia* sp. In addition planigales were collected from rafters of the almost submerged Argyle Downs Homestead.

A limited amount of trapping was carried out. Between 7-28 January, 10 Elliott, 10 breakback and 4 cage traps were set at each of three sites: in spinifex on rocky slopes, just above the lake water level near the Landing; on slopes behind the Main Dam settlement in open low eucalypt woodland over spinifex; and on sparsely grassed flats 11 km south of Main Dam on the west side of the dam (opposite Monsmont).

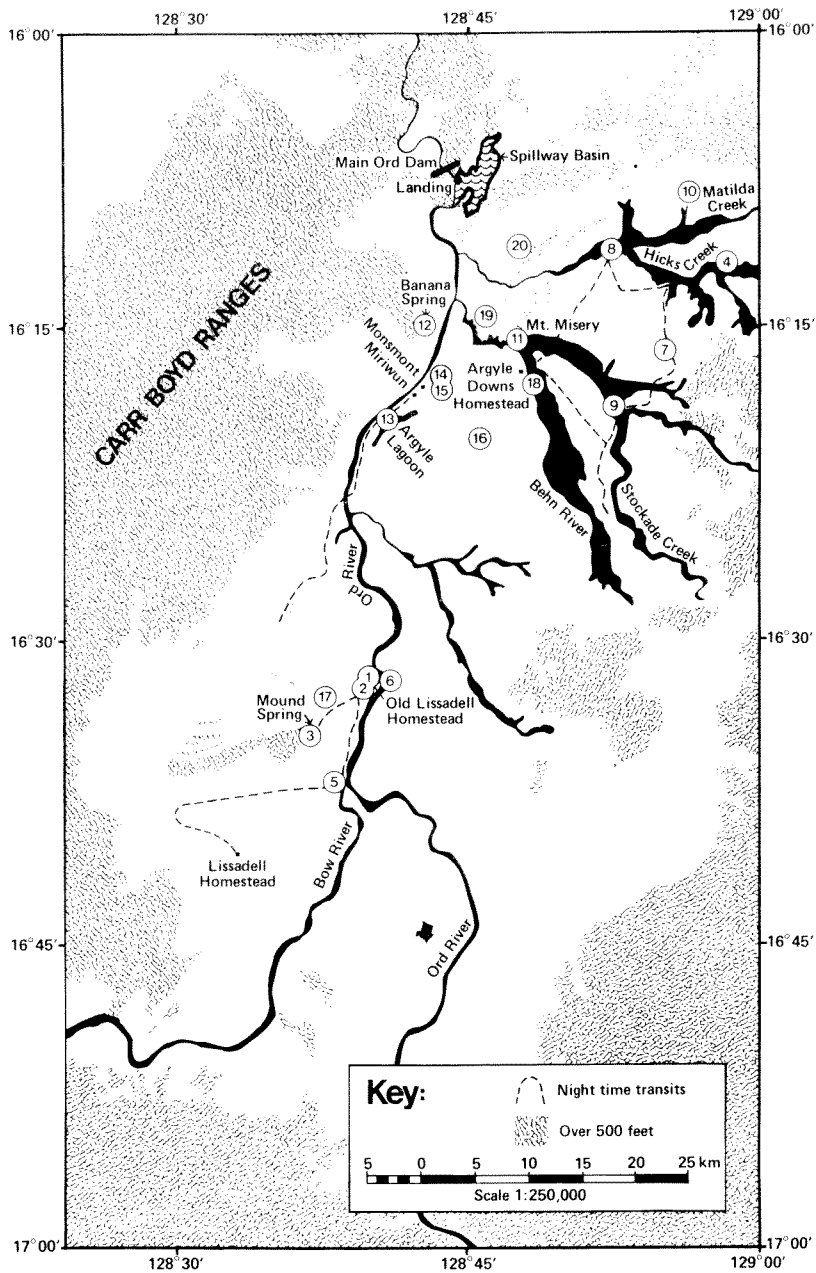
Bats were collected from 8 caves. These caves were referred to as Spillway Cave (8 km N Main Dam), Aboriginal Cave (6.5 km NE of Main Dam), Landing Cave (200 m E of the Landing), Harrys, Tit, Wallaby, Lauries and Fairy Martin Caves (on slopes of Monsmont). Cave floor plans are sketched in Fig. 3.

#### 19-24 November, Field Museum — Chicago, Survey

The members of this survey team were L.E. Keller, K. Morris and R. Munster. Collecting was concentrated around Lissadell Homestead. Mist nets were set over dams at the Station and 6 traplines, each consisting of 8 stations placed 20 m apart, were established over the survey period. These traplines were placed in areas similar to areas 11, 12 and 17 described in the Environment section (p. 197). Two lines were placed on a limestone outcrop vegetated by a deciduous sparse low woodland with arid short grass. Four types of traps were placed at each trapping station: a cage, Sherman (similar to Elliott traps but about two-thirds their size), breakback, and 'special' (intermediate in size between breakback rat and mouse traps). Universal bait was used and traps were inspected between 0500-0700 hrs.

Basic body measurements and weight were recorded from mammals collected during these surveys. Stomachs of larger macropods were preserved. Most specimens were fixed in 10% formalin and then preserved in 75% ethyl alcohol. All specimens were dissected in the laboratory and an examination made of their reproductive organs *in situ*.

Specimens from both WAM surveys were registered into the WAM collections. Those collected in October have the catalogue numbers M11613-652 and in January-February M11457-612. Field Museum specimens have the field numbers 3243-80; these specimens are now lodged in the Field Museum of Natural History, Chicago.



**Fig. 2:** Map of the Ord River Basin showing the major drainage systems, the location of the October trapping areas (1-20), and other sites referred to in text. The broken lines indicate the routes of the spotlighting transects.

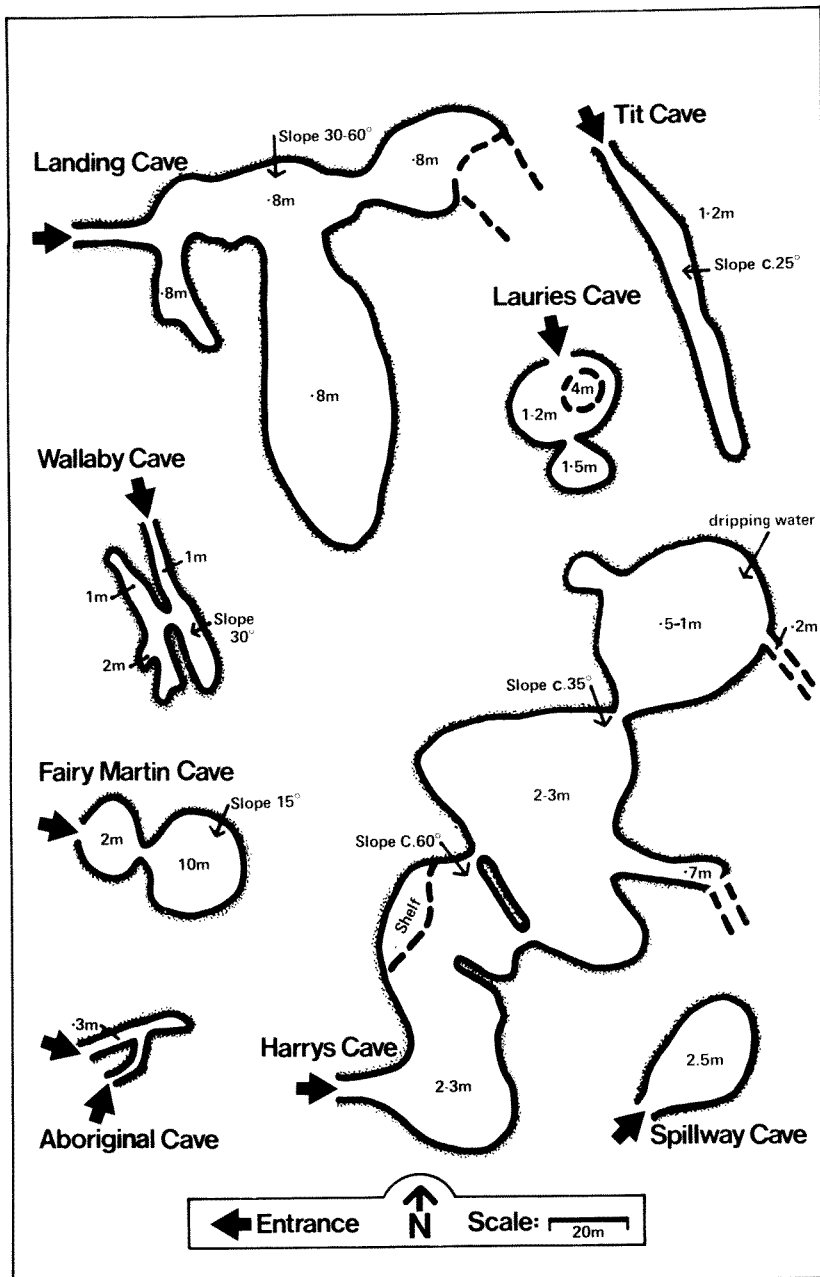


Fig. 3: Sketches of the floor plan of seven bat caves from the Ord River area. The entrance to the caves is arrowed. The height of each cavern and the incline, if present, is indicated on the drawings. See text for localities.



## ENVIRONMENT

Outlines of the geomorphology, physiography, and climate of the Ord River area are covered in the C.S.I.R.O. publication 'Lands of the Ord-Victoria area, Western Australia and Northern Territory', *Land Research Series* no. 28 (1970). Briefly, the Ord River flows through a sequence of lower Cambrian volcanics, middle Cambrian limestones and shales, and Devonian sandstones. The volcanics have mostly been dissected to form mesas and buttes but in the northern areas there are appreciable areas of plains. The vegetation of the Ord area is both structurally and floristically similar to the belt of woodland with grassy understory which stretches from east to west across the continent in similar latitudes. The maximum daily temperature seldom falls below 29°C; it varies by only about 15 degrees throughout the year. The highest temperatures in the lower Ord Valley generally occur in November. Seasons are determined by the presence or absence of rainfall and its associated humidity. There is a marked seasonal distribution of rainfall with the maximum precipitation occurring in the period of December to March. A long dry season covers the remainder of the year. The first rain may fall at any time from October to December. The close of the wet season is generally mid-April to mid-May. Most rainfall is cyclonic and erratic within the wet season and, although the annual average is fairly reliable at 762 mm, there are marked variations in the monthly recordings from year to year.

During October 1971 a number of major habitats were recognised for the mammal survey. These are listed below. The descriptions apply to areas 1-20 which are located in Fig. 2. The descriptions of vegetation structure throughout this report basically follow Specht *et al.* (1974).

### Area 1

Sparse woodland fringing the Ord River. Upper slopes comprised a mixed assemblage of low trees including *Calotropis procera* (Willd) R.Br. ex Ait., *Eucalyptus alba* and *Lysiana subfalcata* (Hook.). There was no shrub layer and grasses were sparse in this zone. Lower down on the embankment the trees were larger with *Eucalyptus camaldulensis* Dehn., reaching a height of over 30 m. There is a second stratum of smaller trees and shrubs including *Melia composita* Willd., *Melaleuca leucodendron*, *Dolichandrone heterophylla* (R.Br.) F. Muell., *Eucalyptus microtheca* F. Muell., *Ficus coronulata* F. Muell., *F. glomerata* Willd., *Hakea arborescens* R.Br. and the climber *Passiflora foetida* L. A third stratum comprises *Ehretia cf. urceolata* W.V. Fitzg., *Santalum lanceolatum* R.Br., *Phyllanthus reticulatus* Poir. and *Acacia*

*farnesiana* Willd. A fourth stratum of moderately dense grasses with *Achyranthes aspera* L. was present (Plate 1). *Pandanus* sp. was common along the water edge together with *Barringtonia acutangula* Gaertn.

#### Areas 2 & 4

Woodland on grassy plains sloping away from low hills. *Eucalyptus grandifolia* R.Br. and *E. tectifica* F. Muell., *Terminalia arostrata* Ewart et Davies and *Dolichandrone heterophylla* (R.Br.) F. Muell., were the dominant trees. The grass *Chrysopogon* sp. was 0.5 m tall, and sparse throughout. Occasional low shrubs were present and included *Hibiscus meraukensis* Hochr., *Sesbania simpliciuscule* Benth., *Grevillea mimosoides* R.Br., *Carissa lanceolata* R.Br. (Plate 2).

#### Area 3

Mound Spring — a series of brackish soaks overgrown with the fern *Acrostichum speciosum* Willd. which had formed a peaty mound. This mound was fenced against cattle and as a result the enclosure contained a specialised vegetation that formed a moderately dense cover dominated by a *Melaleuca* sp. to 7 m and containing *Sesbania formosa* (L.F. Muell.) N.T. Burbidge. There was also *Fimbristylus ferruginea* (L.) Vahl., a dense low grass cover of *Cynodon* sp., and the low shrubs *Ptilotus exaltatus* Nees. and *Enchylaena tomentosa* R.Br. (Plate 3).

#### Areas 5, 6, 8 & 9

The dry watercourse of Hicks and Stockade Creeks, their banks, and the adjacent areas. Trees and shrubs growing on the banks included *Lysiphyllum cunninghamii* (Benth.) De Wit., *Nauclea* sp. and *Eugenia eucalyptoides* F. Muell. (Plate 4). As was typical of other large watercourses in the reservoir area, there was a sparse woodland surrounding the creeks to a distance of about 300 m from the dry creek bed. The woodland at this site was dominated by *Eucalyptus* sp. and *Atalaya hemiglauca* (F. Muell.) Benth. *Eugenia eucalyptoides* and *Bauhinia* sp. were also common. Grasses, which included *Panicum* sp., and *Eulalia* cf. *fulva* Kuntze, formed a low dense ground cover. There was no shrub layer.

#### Areas 7 & 16

Woodland with *Eucalyptus* cf. *dichromophloia* F. Muell., *Santalum lanceolatum*, and *Terminalia arostrata* over grasses to 1 m. There were at least 4 species of grasses including *Aristida* sp. and *Chrysopogon* sp. There was no shrub layer (Plate 5).

Plates 1-11: See Environment section for description.



Plate 1



Plate 2



Plate 3



Plate 4

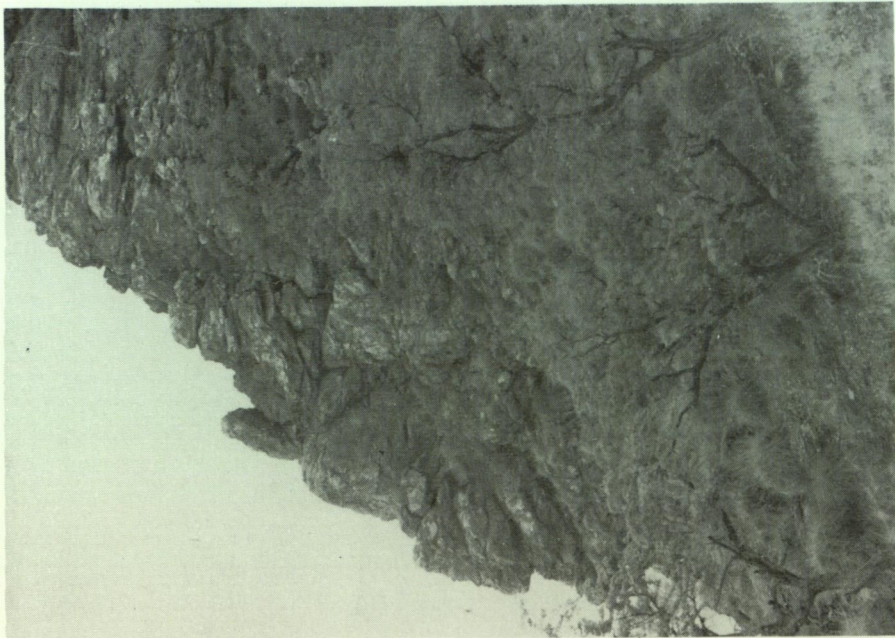


Plate 7



Plate 5

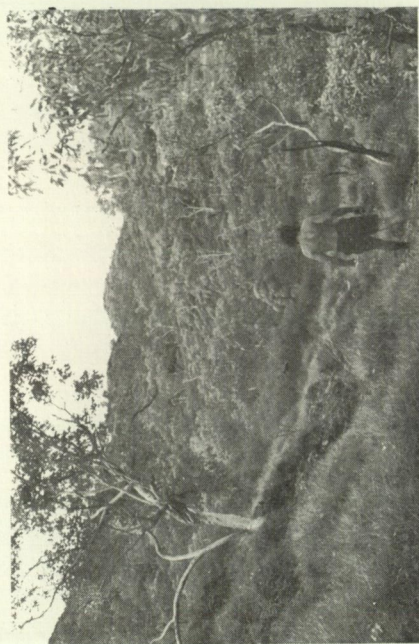


Plate 6

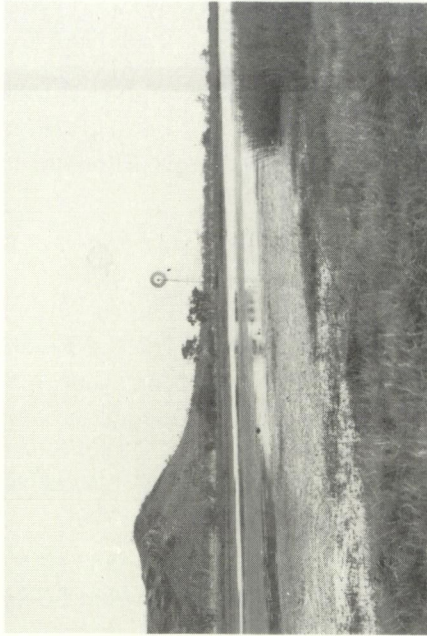


Plate 9



Plate 8



Plate 11



Plate 10

## Areas 10 & 19

Low undulating hills with sparse woodland dominated by *Eucalyptus brevifolia*. On top of the hills, a broad-leaved *Eucalyptus* was dominant. On higher slopes *Eucalyptus* cf. *dichromophloia* F. Muell. was common. Lower slopes had scattered clumps of *Acacia holosericea* Don., and occasional low *Eucalyptus tectifera*. Ground cover was small dense clumps of spinifex, *Triodia* sp. (Plate 6).

## Areas 11 & 14

Rugged hills along the east bank of Ord River and slopes of Mt Misery. *Triodia* sp. and several species of grasses including *Cenchrus* sp. and *Eulalia fulva* occupied crevices amongst boulders on scree slopes, together with occasional low shrubs of *Rhynchosia rhomboidea* F. Muell., *Aerva tomentosa* Forsk, and *Celtis philippensis* Blanco. The lower slopes had *Lysiphyllum cunninghamii* trees beneath which was a dense low grass layer (Plate 7).

## Area 12

Banana Spring — a stream 1 m wide arises from Banana Spring and flows slowly through a dense woodland of *Melaleuca viridiflora* Gaertn. This stream was covered in many places by an unidentified mat plant. There were frequent pandans to 5 m, and a sparse, 2 m tall shrub layer of *Lysiphyllum cunninghamii*. The grasses *Arundinella nepalensis* Trin., 2.5 m, and *Heteropogon contortus* (L.) Beauv., to 1 m, occurred throughout (Plate 8).

## Area 13

Argyle Lagoon — this lagoon was an oval sheet of water about 500 m long and 100 m wide. The edge of the water was surrounded by a 10 m wide belt of sedge *Eleocharis sphacelata* R.Br. that was trampled flat by cattle at its outer edges. A 30 m wide belt of grass *Brachiaria* sp. that had been closely cropped by cattle encircled this sedge. Thickets of *Acacia farnesiana* Willd. were scattered along the grass belt. The *Brachiaria* sp. ended at a line of trees that formed the edge of a sparse woodland encircling the lagoon (Plate 9).

## Area 15

Low hills with large fine-grained granitic boulders. The lower slopes and base were covered with open woodland dominated by *Eucalyptus brevifolia* Schau. and *Eucalyptus* sp. Beneath these eucalypts was a scattered shrub layer of *Acacia wickhamii* Benth. that was denser at the edge of the scree

slope. Large clumps of spinifex and grasses formed an almost continuous ground cover. Occasional clumps of spinifex were the only vegetation further up the slopes (Plate 10).

#### Areas 17 & 20

Grasslands on scree slopes and runoff areas from the rocky outcrops. Characterised by spinifex, *Triodia* sp., with scattered trees and occasional shrubs including *Melaleuca nervosa* (Lindl.) Cheel., *Cassytha* sp., *Dichrostachys spicata* (F. Muell.) Domin., *Gyrocentopus americanus* Jacq., *Ventilago viminalis* Hook., *Lysiphyllum cunninghamii* (Benth.) De Wit, *Carissa lanceolata*, *Eucalyptus pruinosa* Schau., *Hakea arborescens*, *Terminalia arostrata* and *Melaleuca minutifolia* F. Muell. (Plate 11).

### SYSTEMATIC LIST

#### MONOTREMATA

##### Family TACHYGLOSSIDAE

*Tachyglossus aculeatus* (Shaw, 1792) — Echidna

In October, tracks and diggings were recorded by W.H. Butler near the mouth of the Behn River and on the northern slopes of Mt Misery.

#### MARSUPIALIA

##### Family MACROPODIDAE

*Macropus robustus* Gould, 1841 — Euro

In October 1971 these were frequently seen on Mt Misery, the Carr Boyd Ranges, the west side of the Ord River (area A), several at Banana Spring, and a group of 11 near Mound Spring. In November 1976 they were frequently seen on limestone outcroppings near Lissadell Homestead. One adult male and 1 adult female with pouch young were shot near the Spillway area in open eucalypt woodland over spinifex on 23 and 28 January 1972. Compared with other Kimberley material, this pouch young (pes length 76.3 mm) was approximately the same size as one collected at Drysdale River National Park in mid-August 1975 (M14328 — pes length 59.5 mm) and was only slightly smaller than one collected at Inglis Gap in mid-September 1965 (B1341 — pes length 113.1 mm) and Parry Creek in

August 1965 (B1439 — pes length 112.3 mm). The size and date of collection of these pouch young are consistent with the Frith and Calaby (1969) statement that this species has a continuous breeding season.

*Macropus agilis* (Gould, 1842) — Sandy Wallaby

On 24 October, 2 females, both with large pouch young (pes lengths 81.0 and 87.6 mm), were shot in tall grass on the sandy river bank near the mouth of the Behn River. On 6-8 February 2 adult females, neither with pouch young or enlarged teats, were collected in low eucalypt woodland near the Ord Dam Spillway. It appears from pouch young spirit specimens in the WAM collections, that young are born during the wet season (B1958, 4 January, pes length 25.5 mm) and that in some parts of the Kimberley birth of young extends over a considerable period. For example, W.H. Butler collected 4 female *M. agilis* at Injudinah Swamp (west Kimberley) between 12 and 27 August 1963, with pouch young. These pouch young (B227, B237, B244, B248, B267) ranged from very small with ears still fused, to very large and fully furred (pes lengths 107.4, 41.4, 49.0, 4.8 and 17.2 mm respectively). Further pouch young were collected in north Kimberley at Kalumburu in January 1966 (B1958 — pes length 25.5 mm) and in south Kimberley at Mt Anderson in May 1966 (B1958 — pes length 46.0 mm), and Erskine Well (M4224 — pes length 68.5 mm).

Johnson (1964) noted that in the Northern Territory between April and October nearly every adult female *M. agilis*, and some that were subadult, had a pouch young (one instance of twins was recorded). Further, he suggested from the condition of the nipples and occasional instances in which females carrying small pouch young were accompanied by half grown young, that a 'series of offspring may be produced by each female during the dry season'.

Combined, these observations suggest that this species may give birth to young continuously throughout the year.

Johnson (1964) indicates that this wallaby is continuously distributed across the northern part of Australia in low-lying coastal areas. He suggests that it is widely distributed elsewhere in northern Australia but is probably rare or absent in drier and more rugged terrain in the interior. Calaby and Keith (1974) record it as common in the Port Essington District, Northern Territory, in eucalypt forest, especially in moister areas containing abundant perennial grass. Johnson (1964) records mobs of hundreds on plains near large rivers in the Northern Territory. Frith and Calaby (1969) state that in some areas they are regarded as pests and are thought to



seriously interfere with establishment of improved pastures in Northern Territory and Western Australia, and crops in northern Queensland.

*Onychogalea unguifera* (Gould, 1841) — Northern Nail-tailed Wallaby

*O. unguifera* was the only macropod seen on the regular October spotlight transects. An indication of numbers can be obtained from the fact that in a total distance travelled of 775 km on the regular spotlight runs, an average of one per 28 km was sighted. They were seen in most habitats, especially stony parts of grassland bordering the Ord River and on low undulating hills that lead down to the river. On 4 October an adult male was shot while spotlighting in open grassland near the junction of the Bow and Ord Rivers. On 8 February a female with a pouch young (M11611 — pes length 8.4 mm) was shot in grassland 16 km N of Ivanhoe Homestead. A very small pouch young, similar in size to the one collected at Ord River in February 1972, was collected at Cape Bossut (west Kimberley) in August 1973 (B271 — pes length 10.5 mm); much larger but still unfurred young were collected at Kalumburu in December 1965 (B1871, B1893, B1913, B1916 — pes lengths 32.5, 43.3, 31.5, 95.1 mm respectively). Another unfurred young was collected at Turkey Creek in November 1976 (3249 — pes length 36.3 mm). W.H. Butler also sighted a female with a large pouch at the Ord River in early October.

*Petrogale brachyotis* Gould, 1841 — Short-eared Rock Wallaby

During the October 1971 and January/February 1972 surveys these were frequently sighted alone or in pairs in hills and rocky areas. They were not seen on the plains.

On 10 October a female with pouch young was collected 10 km W of Argyle Downs Homestead. Between 13-15 October 2 adult males, subadult female (weight 1.4 kg, pes length 11.1 cm), and a female with a pouch young (pes length 49 mm), were trapped at the same place. Between 14 January and 12 February a further 6 adult males and 6 adult females (5 with pouch young) were collected from several localities: 1 km S of the dam; near Argyle Lagoon; and 10 km W of Argyle Downs Homestead.

The pouch young from the Ord River in October (M11641 — pes length 27.4 mm) was about the same size as those collected there in January and February (M11601, M11603-6, pes length 10.6, 20.5, 26.5, 48.1 and 36.7 mm, respectively). In northwest Kimberley a pouch young was collected at Prince Regent River Reserve (M12399, pes length 33.4 mm) in August 1974 and two fully-furred pouch young at Drysdale River National Park (M14320-1, pes lengths 73.9 and 64.3 mm, respectively).

These observations indicate that similar size young are found in October, February and August, suggesting that in the Kimberley *P. brachyotis* gives birth to young throughout the year.

#### Family DASYURIDAE

*Antechinus bilarni* Johnson, 1954 — Harney's Antechinus

One adult male trapped 9 January on a grassed embankment at the bottom of cliffs 2.5 km SE of Main Dam. These traps were placed about 10-50 m above the rising reservoir water-line.

*Planigale ingrami subtilissima* (Lonnberg, 1913) — Kimberley Planigale

Between 8 and 17 January 1972, 3 males and 4 females were collected: 1 from the gut of a Children's Python (*Liasis childreni* Gray) on a small island 6.5 km south of Main Dam, 3 from rafters in the almost submerged Argyle Downs Homestead, and 2 from beneath spinifex on a small island, 6.5 km S of Main Dam.

The 2 females stranded on islands by rising water were thought to be subadult: neither had a formed pouch and both had 10 tiny teats arranged in a semi-circle. The other 2 females were adults: 1 had a small pouch young with crown to rump length 7 mm; the other had an enlarged pouch and elongated teats and is also thought to have been recently carrying young (Woolley [1974] has described the pouch of these 2 females). Rudeforth (1950) briefly reported on several specimens collected near the Kimberley Research Station, Kununurra. These observations led Woolley (1974) to suggest that this species, unlike the majority of dasyurid marsupials, breeds in the summer months. A further female (M9662) was collected by R. Beeton between 11-17 August 1972 from an irrigation paddock 8.3 km N of Kununurra. This female had four small pouch young with crown to rump ranging from 7.9 to 8.5 mm. Its pouch was about 12 mm deep; the small anterior pockets described by Woolley (1974) were still obvious but the teats were now arranged in two lines (only four were elongated) and none of these elongate teats were contained within the anterior pockets of the pouch. This additional observation of a female in August 1972, with pouch young which were about the same size as the pouch young of a female collected in January, suggests that this species has either an extended period of births or several widely-spaced breeding seasons.

*Sminthopsis froggatti* (Ramsay, 1887) — Larapinta

In October a female was collected by hand in Mitchell Grass at the base of a rocky outcrop near Argyle Lagoon (area 13). This animal was still lactating

and had eight swollen teats and an enlarged pouch. A left and right dentary attributed to this species was collected among owl pellets on the surface of Harrys Cave on 3 February.

## RODENTIA

### Family MURIDAE

#### *Rattus villosissimus* (Waite, 1897) — Long-haired Rat

Five damaged skulls were removed from owl pellets collected *ca* 5 m inside the mouth of Harrys Cave on 3 February. They appeared to have been deposited recently.

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

Three adult males, 2 adult females and a subadult male and female (weights 16.0 and 17.8 gm) were collected in November 1976 near Lissadell Homestead. These were trapped in open woodland over spinifex on sandstone (similar to areas 11 and 14) and in low open woodland on limestone. One female had 3 large foetuses with crown to rump lengths of about 25 mm. The other was not pregnant but had implantation scars on the uterine horns.

#### *Pseudomys forresti* (Thomas, 1906) — Forrest's Mouse

A minimum number of 8 individuals (represented by right dentaries) were located during February 1972 among owl pellets on the surface of Harrys Cave, *ca* 5 m from the mouth of the cave. A male (M14857) was collected at Kununurra by J. Start in August/September 1976.

#### *Pseudomys delicatulus* (Gould, 1842) — Little Native Mouse

A male (M2863) was collected at Kimberley Research Station, Ord River, in 1951 by Mr A.J. Drysdale.

#### *Pseudomys nanus* (Gould, 1858) — Western Chestnut Native Mouse

Two males were collected by burning spinifex clumps on 14 January 1972 on a small island formed by the rising reservoir, 5 km SW of Ord Dam. One female with small 'thread' uteri was collected in November 1976 near Lissadell Homestead in spinifex (similar to areas 17 and 20).

#### *Mus musculus* Linnaeus, 1758 — House Mouse

On 12 October a female was trapped in tall grass beside the Argyle Downs airstrip.

## CHIROPTERA

### Family MEGADERMATIDAE

#### *Macroderma gigas* (Dobson, 1880) — Ghost Bat

On 3 February R.E. Johnstone shot one in the deepest cavern of Harrys Cave. Unfortunately his torch failed and he was unable to locate the fallen animal. He saw at least three others at that time. No further specimens were sought from Harrys Cave because of the extremely hazardous climb required to reach the mouth of the cave.

### Family VESPERTILIONIDAE

#### *Nyctophilus arnhemensis* Johnson, 1959 — Arnhem Land Long-eared Bat

Two females were mist-netted over a dam at Lissadell Homestead in November 1976. Both were lactating and had faint implantation scars on uterine horns indicating they had recently given birth to young.

#### *Eptesicus pumilus caurinus* Thomas, 1914 — Little Bat

On 19 October 1971 2 juveniles were collected from the bottom of an archaeological excavation pit 2 m deep at Monsmont. These had forearm lengths of 23.7 and 25.5 mm. Between 15 January and 12 February 1972 this species was collected from Spillway Cave (18 ♀♀, 14 ♂♂), Aboriginal Cave (1 ♂), Landing Cave (17 ♀♀, 11 ♂♂), Harrys Cave (1 ♀), and Fairy Martin Cave (1 ♀). In November 1976, 1 adult male and 1 adult female were collected from a cave near Lissadell Homestead and 1 adult female was mist-netted over a dam at the Homestead.

Breeding colonies occupied Spillway and Landing Caves; specimens examined from these caves comprised 13 adult females, 14 subadult females, 10 subadult males, and 4 adult males. Three of these adult females were each carrying 2 large fetuses which had crown to rump lengths of 9.1 to 10.9 mm, 6 had given birth and had distended teats and swollen mammary glands, and 4 had both small teats and uteri and little tooth wear — suggesting that they were recent adults and had not yet bred.

At the Ord River this species gives birth to young at least from October to February. This is indicated by the collection of 2 juveniles in October, lactating females and females which appear to have recently weaned young in mid-January and females carrying large young in mid-February. These observations coupled with those of Maddock and McLeod (1976) who recorded births of *E. pumilus caurinus* at Tennant Creek, Northern Territory, in August, September, October, March, and June (they had no data from

November to February) confirms the belief that this species is polyoestrous and gives birth to young throughout the year.

Maddock & McLeod (1976) found no evidence of maternity colonies in their study of *E. pumilus caurinus*. The occurrence in Spillway Cave of pregnant females together with adult females, recently weaned young, and adult males, further suggests that such colonies are not formed in this species. These authors found that in mine shafts females nursing young were usually found well along the shafts where temperature was more constant; other individuals roosted near the main entrance of adits. If such a grouping of individuals occurred in the caves at the Ord River then it would be expected that adult males would be amongst the first to escape from the caves we visited there. This may explain the low proportion of adult males to adult females in our collection from the Ord River area.

#### *Chalinolobus gouldii* (Gray, 1841) — Gould's Wattled Bat

Four females and 1 male were mist-netted over a small pool near Old Lissadell Homestead at 1830 and 1930 hrs on 17 October 1971. Four females and 2 males were mist-netted over a dam at Lissadell Homestead in November 1976.

Three of the October females had recently given birth to young. They had enlarged teats *ca* 4 mm long, swollen mammary glands, and uteri with implantation scars. The uteri appeared to have not yet fully involuted (maximum width 3 to 4.5 mm). The other female was carrying 2 fetuses which had crown to rump lengths of 15.2 and 16.7 mm. Three of the November females had recently given birth to young, using the same criteria as above, although their uteri had involuted further. The other November female was carrying 2 fetuses with crown to rump length of 2.9 mm.

The October female specimens were included by Kitchener (1975) in his study of reproduction of this species. In that study it was suggested that births in the Kimberleys begin in late September or early October, which is earlier than in the southern areas.

#### *Chalinolobus nigrogriseus rogersi* Thomas, 1909 — Frosted Bat

Eight males and 2 females were collected between 7-19 October 1971. These were shot or mist-netted between 1830 and 1900 hrs. Apart from 2 males shot in low eucalypt woodland near trapping area 1, all were collected in watercourses. The 2 females were collected at a height of 2 m over a small pool near Old Lissadell Homestead on 16 and 17 October (*C. gouldii* were also collected there at about the same time). Five of the males were shot flying at a height of 3 to 4 m along a creek bed, with pools,

near Argyle Downs Homestead. The other male was shot over water near the mouth of Hicks Creek. In November 1976, 2 adult females were mist-netted over a dam at Lissadell Homestead.

One of the October females had 2 large fetuses with crown to rump length of 12.1 and 15.7 mm. It had small teats. The other female appeared to have recently weaned young; it had elongated teats *ca* 3.5 mm long, slightly swollen mammary glands, and slightly enlarged uterine horns with implantation scars. Both the November specimens had small uteri, although one had elongate teats and swollen mammary glands. The WAM collections have a further 9 adult female spirit specimens collected between 1965 and 1975 as follows: 8-25 August from Ninbing, east Kimberley (B155 and M7604); Pine Creek, Northern Territory (M10185); Parry Creek, south of Wyndham (M7603); and Drysdale River National Park (M14034-6, M14052 and M14053). Only one of these (M14034) showed any enlargement of uteri, mammary glands or teats — and that was slight.

These observations suggest that *C. nigrogriseus* gives birth to young in the dry season and perhaps completes its period of births prior to the wet season.

#### *Nycticeius greyi* (Gould, 1858) — Little Broad-nosed Bat

Three adult males were shot at dusk on 8 October 1971 in cadjeput woodland near Old Lissadell Homestead. In November 1976 4 adult males and 4 adult females were mist-netted over a dam at Lissadell Homestead. Each of these females had 2 fetuses of which the crown to rump lengths ranged from 6.3 to 13.2 mm. None of these females had enlarged teats.

The WAM has a further 18 female spirit specimens from the Kimberley and nearby Northern Territory collected since 1965. These specimens were collected between 19-22 June (M10211, M10563, M10584), 12-27 August (M12242-3, M12245-8, M14082-4, M15061-2, B1611, B1657), 21 September (B302-3) and 2 November (M8473). None had enlarged teats, mammary glands, or uterine horns. It appears from these observations that *N. greyi* gives birth to young immediately prior to and during the wet season.

#### Family HIPPOSIDERIDAE

#### *Hipposideros ater gilberti* Johnson, 1959 — Dusky Horseshoe Bat

On 22 January 1972, 2 adult females and 2 subadult males were collected from Wallaby Cave. On 15 January and 3 February a total of 3 adult males,

8 adult females, and 9 juveniles were collected from Harrys Cave. Dorsal pelage colour of adults and subadults differed considerably: subadults had fur with Ridgway (1912) colours of 'pallid mouse grey' tipped with 'hair brown', adults were a 'warm buff' tipped with 'cinnamon brown' (recorded from dried spirit specimens).

The 8 adult females examined from the above collections had slightly enlarged teats, *ca* 2.3 mm long, and slightly swollen mammary glands; all had only one uterine horn slightly swollen (in 7 it was the left, and in 1 the right horn) and 3 had a suggested implantation scar on the swollen horn.

The WAM collections have a further 7 adult female *H. ater* spirit specimens, all with small teats. Specimen M6161, collected on 14 April 1964 at Carlton Crossing, Ord River, had thin uteri; M10026, collected in June 1966, 50 km E of Kununurra, had its right horn slightly swollen to a diameter of 2 mm; M6295-9, collected on 19 September 1964 from a mine shaft at Pine Creek, Northern Territory, all had a single foetus; these ranged in crown to rump length from 3.5 to 8.0 mm. Johnson (1964) records that on 30 October 1920 at Douglas River, Northern Territory, Hoy collected a hairless young *H. ater gilberti* attached to the teat. On 30 October 1948 at Oenpelli, Northern Territory, Johnson collected a female *H. ater gilberti* which had a single foetus with crown to rump length of 16.5 mm. These observations suggest that females may be in early pregnancy in June. A single young is usually carried in the left uterine horn through to October when the birth season begins. The presence at the Ord River of juveniles and young adults with forearm length ranging from 26.7 to 36.6 mm suggests that the period of births is extended over several months. By February births appear to have ended and many young of the year are already weaned and flying.

Observations at the Ord River and those of A.M. Douglas at several other northern localities suggest that in summer this bat roosts only in deep caverns or tunnels where humidity is high, possibly because it is more prone to dehydration than some of the other cave bats such as *Eptesicus pumilus* and *Taphozous georgianus*.

#### *Rhinonictes aurantius* (Gray, 1845) — Orange Horseshoe Bat

On 16 April 1964 a male (M6076) was collected by K. Richards after it flew into a car radiator near the Kununurra Research Station. In June 1966 a female (M10023) was collected by A.M. Douglas at Cave Spring, 50 km E of Kununurra.

### Family MOLOSSIDAE

*Tadarida loriae* (Thomas, 1897) — Little Northern Scurrying Bat

Two males were mist-netted over a dam at Lissadell Homestead in November 1976.

### Family EMBALLONURIDAE

*Taphozous georgianus* Thomas, 1915 — Common Sheath-tailed Bat

On 23 October 1971, 3 pregnant females and 1 adult male (and 1, sex not determinable) were shot flying near cliffs at Monsmont. Between 15 January and 3 February 1972 they were collected from Aboriginal Cave (10 ♀♀, 7 ♂♂), Landing Cave (5 ♀♀, 6 ♂♂), Harrys Cave (2 ♀♀, 3 ♂♂), Tit Cave (3 ♀♀, 2 ♂♂), Wallaby Cave (1 ♂), Lauries Cave (4 ♀♀) and Fairy Martin Cave (1 ♂). The larger colonies consisted of adult females, adult males, juveniles and subadults. In November 1976, 3 adult males and 1 pregnant female were collected from a cave near Lissadell Homestead.

The 1971-72 specimens were included in a study of the reproductive cycle of this species by Kitchener (1973). It was concluded in that study and later (Kitchener 1976), that over its range in Western Australia, *T. georgianus* is monoestrous, giving birth to a single young between October and April. There appears to be a brief anoestrus from mid-autumn to mid-winter before females begin reduced activity in reproductive organs prior to onset of oestrus. Males apparently produce sperm throughout the year.

*Taphozous flaviventris* Peters, 1867 — White-bellied Sheath-tailed Bat

No specimens were collected but this distinctively marked bat was seen by W.H. Butler on 7 October 1971 over the Ord River near trapping area 1.

### Family PTEROPODIDAE

*Pteropus scapulatus* Peters, 1862 — Red Flying Fox

At the Ord River in October a large camp of 50,000-100,000 individuals occupied pandans at Banana Springs. Occasional smaller groups were seen in these *Pandanus* along billabongs. This colony had left Banana Springs when it was visited on 15 January. Ratcliffe (1931) recorded that *P. scapulatus* follows the blooming of eucalypts and other trees to feed on nectar and blossom. It is consequently the most nomadic of the Australian *Pteropus*.



Nelson (1965) studied *P. scapulatus* in southeast Queensland and recorded that movement into camps occurred from November-December, when copulation and conception occur. After conception sexes segregate but individuals may remain in the camp for a short period before moving in small numbers to new camps, or into camps of other *Pteropus*. Parturition occurs in late April-early May when the population is dispersed.

At Banana Springs in October territorial fighting and vocalisation were frequent. It is possible, however, that copulation had largely ceased at that time because there appeared to be a partial segregation of sexes (in one small area 48 of 54 individuals counted were males).

Between 22-24 October 8 males and 3 females were shot at Banana Spring. None of these females had noticeably swollen uteri although all had large teats; in 2 females the teats were triangularly-shaped and *ca* 14 mm long. There are 2 other *P. scapulatus* female spirit specimens from the Kimberley in the WAM collections: M4272, collected at Derby on 8 June 1960; and M13951, collected at Stewart River on 11 September 1975. Neither of these adults had swollen teats or enlarged mammary glands or uteri.

On 21 October 1971, J. Dell saw a White-breasted Sea-Eagle (*Haliaeetus leucogaster* Gmelin) take a *Pteropus* from the Banana Spring camp.

## CARNIVORA

### Family CANIDAE

*Canis familiaris* Linnaeus, 1758 — Dingo

In October tracks and sightings were most frequent in areas B and C (Fig. 1). On 21 October a male and female pair was sighted on slopes of Mt Misery. On 17 October a female with 2 three-quarter grown pups was seen in the dry river bed near the mouth of Behn River. In January a female and litter of at least 2 pups, probably not more than 6 weeks old, were seen in a small cave on the east side of Monsmont.

### Family FELIDAE

*Felis catus* Linnaeus, 1758 — Feral Cat

In October numerous tracks and several individuals seen in areas A, B and C. One was shot near trapping area 7.

## PERISSODACTYLA

### Family EQUIDAE

*Equus caballus* Linnaeus, 1758 — Horse

In October, station horses were mostly confined to paddocks. There was a small group of wild horses at Banana Spring.

*Equus asinus* Linnaeus, 1758 — Donkey

In October a herd of 6 were seen at the base of Mt Misery and several were seen at Banana Spring.

## ARTIODACTYLA

### Family BOVIDAE

*Bos taurus* Linnaeus, 1758 — European Cattle

There were large station herds throughout the Ord Basin in October, including the foothills of Carr Boyd Ranges.

## POST-EUROPEAN MAMMAL REMAINS AT MIRIWUN AND MONSMONT

Dortch (1972) records that the first archaeological salvage work in the Ord Reservoir area was carried out in April and May 1971. He notes that the stratigraphical sequences of artifact material collected from several rock shelters during that survey included a surprisingly thick post-European horizon of approximately 30-40 cm. There was, however, only a small amount of faunal remains. In late September Dortch examined several other archaeological sites in the reservoir area. Two of these sites, Miriwun and Monsmont, contained abundant faunal remains. He describes the Miriwun site as a well-sheltered deposit 20 m long by 5-8 m wide. The deposit is only 1.2 m thick. The monsmont trenches covered about 7 m<sup>2</sup> and were about 3 m deep. They were located in the same line of cliffs about 1500 m downstream from Miriwun.

The entire mammal remains from Miriwun and Monsmont excavations were excavated according to the stratigraphy of the deposit. D. Merrilees and C. Dortch have kindly allowed me to examine the mammals from the surface layer which are believed to have accumulated in the deposit after contact with Europeans.

The mammals identified from the surface material (from tooth-bearing bone only) are as follows:

Macropodidae

*Macropus (?robustus)*

*Macropus agilis*

*Petrogale brachyotis*

Peramelidae

*Isoodon auratus* (Ramsay, 1887)

*Macrotis* sp.

Dasyuridae

*Dasyurus hallucatus* Gould, 1842

Muridae

*Rattus* cf. *villosissimus*

*Zyzomys argurus*

*Pseudomys* sp.

Vespertilionidae

*Eptesicus pumilus*

## DISCUSSION

The Ord River basin is a semi-arid low country salient into the Kimberley Plateau and contains some birds and reptiles from the arid interior (G.M. Storr pers. comm.). Consequently it was thought that the mammal fauna of this basin might contain some drier-country mammals such as the murids, *Pseudomys hermannsburgensis* (Waite, 1896), *P. desertor* Troughton, 1932, *Notomys alexis* Thomas, 1922, and the dasyurids *Ningauai ridei* Archer, 1975, *Antechinomys spenceri* Thomas, 1906, *Sminthopsis hirtipes* Thomas, 1898 and *Sminthopsis murina ooldea* Troughton, 1965. This was not the case, however, because the 26 native mammals recorded in this report are typical of those found elsewhere in the Kimberley and include no arid element.

Comparison between collections from the Ord River area and those from other large-scale surveys in the Kimberley, viz., Prince Regent River Reserve (McKenzie *et al.*, 1975), Drysdale River National Park (McKenzie *et al.*, 1977), Bonaparte Archipelago (McKenzie *et al.*, 1977) and Mitchell Plateau (Kitchener *et al.*, in prep.) indicates that the Ord River area is relatively rich in bats, but has relatively fewer rodents than the other areas (see Appendix I). Notable absentees from the list of Ord River mammals are such arboreal species as the Golden-backed Tree-rat (*Mesembriomys macrurus* [Peters, 1876]); Sugar Glider (*Petaurus breviceps* Waterhouse, 1839); Scaly-tailed Possum (*Wyulda squamicaudata* Alexander, 1919) — recorded at Turkey Creek, ca 60 km SE of Lissadell Homestead — and the Northern Brush Possum (*Trichosurus arnhemensis* Collett, 1897). The absence of this group of mammals probably relates to the degradation of the riverine woodlands in

the Ord River basin. These woodlands appear to have suffered considerably from regular burning and from direct and indirect grazing pressures of stock.

The Ord River basin also appears to have habitat suitable for the Little Rock-wallaby (*Peradorcas concinna* [Gould, 1842]), Golden Bandicoot (*Isoodon auratus* [Ramsay, 1887]), and Little Northern Native Cat (*Dasyurus hallucatus*). Their absence from the collections is more difficult to explain. The mammal material from Miriwun and Monsmont archaeological and palaeontological sites shows that the bandicoots *Isoodon auratus* and *Macrotis* sp. and the native cat, *Dasyurus hallucatus*, were in the area at about the time of the first European settlement. (*Peradorcas concinna* is recorded from sub-surface layers at these sites.) Probably the combination of intense overgrazing by stock and donkeys in recent years and the introduction of feral cats has contributed to the loss of mammal species in the area. Interestingly, the bandicoots *Macrotis lagotis* (Reid, 1837), *Perameles bougainville* Quoy & Gaimard, 1824 and *Chaeropus ecaudatus* (Ogilby, 1838) were among the first mammals to disappear from southwest Western Australia with the advent of extensive farming. A fourth bandicoot, *Isoodon obesulus* (Shaw, 1797), is now almost gone from wheat-growing areas of the South West.

Combined, these observations suggest that in Western Australia bandicoots are amongst the first mammals to disappear in the face of European settlement and farming.

Specimens from the Ord Basin throw a little light on breeding by macropodid, chiropteran and dasyurid mammals in the Kimberley. Despite the markedly seasonal climate of the region there is an indication that the macropods *Macropus robustus*, *M. agilis*, *Onychogalea unguifera* and *Petrogale brachyotis* give birth to young during both wet and dry seasons.

On the other hand it appears that most of the bats are seasonal breeders. *Chalinolobus gouldii*, *C. nigrogriseus*, *Nycticeius greyi*, *Hipposideros ater* and *Taphozous georgianus* begin giving birth to young at the end of the dry season. While *T. georgianus* continues to give birth to young to the end of the wet season, in these others births probably cease by the middle of the wet season. *Nyctophilus arnhemensis* (this collection) and *Macroderma gigas* (see Douglas, 1967) give birth at the end of the dry season but lack of specimens precludes any definition of their season of births. *Eptesicus pumilus* appears to give birth to young throughout the year. Only the nomadic Red Flying Fox, *Pteropus scapulatus*, is known to avoid the wet season for births, giving birth at the start of the dry season.

Young of the dasyurids *Sminthopsis froggatti* and *Planigale ingrami subtilissima* are known to leave the pouch towards the end of the dry season. Those of *P. ingrami subtilissima* also leave the pouch during the wet season.

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Appendix I: Listing, by family, the number of species of native mammals recorded during the large-scale surveys of the Kimberley.

Family	Ord River Area	Pr. Regent River Res.	Drysdale R. Nat. Park	Mitchell Plateau	Bonaparte Archipelago
Macropodidae	4	6	3	5	2
Phalangeridae	0	1	0	1	1
Petauridae	0	1	1	1	1
Peramelidae	0	2	0	1	2
Dasyuridae	3	2	1	4	2
Muridae	5	10	7	10	7
Megadermatidae	1	0	0	0	0
Vespertilionidae	5	7	9	6	1
Hipposideridae	2	0	0	2	2
Molossidae	1	0	2	1	0
Emballonuridae	2	1	2	2	1
Pteropodidae	1	3	2	2	1
Canidae	1	1	1	1	1
Tachyglossidae	1	1	1	1	1
<b>Total</b>	<b>26</b>	<b>35</b>	<b>29</b>	<b>37</b>	<b>22</b>