REPORT ON A BIOLOGICAL SURVEY OF KALBARRI NATIONAL PARK JANUARY - FEBRUARY 1969 WITH SEPCIAL REFERENCE TO MAMMALS AND REPTILES.

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Contents

1. INTRODUCTION

In August 1967 the National Parks Board of W.A. asked the W.A. Museum to undertake a survey of the biota of Kalbarri National Park. Emphasis was to be given to mammals and reptiles but other faunal groups considered in planning were birds, freshwater fish and invertebrates such as insects and spiders. It was realised also that integrated botanical data would be required and the services of a botanist were sought from the National Parks Board.

An appreciation of the factors involved showed that the work could best be carried out in two stages:

(1) a Reconnaissance, followed by (2) the Main Survey. The reconnaissance was carried out between May 4th and 21st 1968, and its results have been the subject of a separate report submitted to the National Parks Board in October, 1968. The main result of the reconnaissance was a division of the Park into 9 broad topographical regions (indicated in Map 1, reproduced in this report) and a selection of a representative sample of habitats for intensive study during the main survey. A report on the plants of the Park was also prepared and has been made available separately.

2. THE MAIN SURVEY, JAN. 4TH - FEB.7TH, 1969

(i) Objectives

From the results of the reconnaissance a series of 10 sites was selected for intensive sampling of mammals and reptiles. These were (Numbers refer to areas noted on Map 2) :

1. Sandplain near east end of Wittecarra Gully.
2. Low sandridge area near centre of eastern sand plain.
3. Murchison Gorge near The Loop.
4. Extensive gullies and breakaway areas near Gorge at "Little Z Bend".
5. Bungabandi Creek, western end including area near Mt. Curious.
6. Limestone areas - Meanarra Hill.
7. Claypan, Junga Dam area.
8. Claypan, Janja thicket area.
9. Coastal area, transect from south of Red Bluff to Wittecarra Spring.
10. Coastal area, sand dunes near rabbit-proof fence.

Two other areas (a) either side of the gorge near P.W.D. Gauging Station, (b) sandplain south of Junga Dam were also selected for investigation if time should allow.

Plans were made to allow a minimum of 4 - 5 days in each of the 10 sample areas. Mammals and reptiles were to be collected as a routine from each area; insects and spiders were also to be collected as opportunities arose.

In addition, 5 areas were selected on the Murchison River for sampling freshwater fish. A minimum of 2 days at each site was planned. This sampling was to be carried out separately but at some time during the main survey. Spiders were to be collected as a routine by the fish party.

Because of other commitments the main survey could not start until early January, 1969. However, it was expected that at that time the density of small mammal populations would be high after spring breeding, and that reptiles would also be abundant.

(ii) Personnel

Mammal/Reptile Parties:

(A) [Landrover] J.L. Bannister (Curator of Mammals, W.A. Museum, Survey Leader)

L.A. Smith (Technical Assistant to the Curator of Birds and Reptiles, W.A. Museum.

(B) [Nissan Patrol] A. Baynes (Zoology Department, University of W.A.)

W.K. Youngson (Technical Assistant to the Curator of Mammals, W.A. Museum).

N.T. Allen (Honorary Assistant, W.A. Museum)

(The composition of the 2 parties was varied occasionally particularly towards the end of the period.)

Fish Party:

R.J. McKay (Technical Officer, W.A. Museum).

J. Gilbert (Zoology Department, University of W.A.)

P. Snowball (Honorary Assistant).

The Park Ranger, R. Gliddon, assisted with transport, particularly for the fish party, and his fund of local knowledge was of constant help to all workers.

(iii) Sampling Methods

Mammals were sampled by the usual means of trapping at night, using metal box "live" traps and "break-backs" for smaller animals and cage traps for larger ones (trapping results are given in Table 1); considerable time was also spent in spotlighting both on foot and from vehicles. Bats were collected by shooting at night; mist nets were set also. Detailed comments on mammals are given in Appendix A.

Reptiles were collected by shooting, or by hand, during the day, or by spotlighting at dusk (for geckoes). Reptiles collected are listed in Appendix B.

In addition, observations were made of animal "sign" along sand-tracks and near water. Some sand-tracks were swept regularly, by towing mallee branches behind the Landrover, to give information on animal (particularly kangaroo) abundance and activity.

Freshwater fish were collected with seine, throw and hand nets. Details are given in Mr. McKay's account (Appendix C.)

(iv) Programme

To cover the large amount of work involved in the minimum period the 10 mammal/reptile sampling sites were divided between two parties, A. and B (shown above), working independently but co-ordinated by Bannister. In that way the total time in the field was cut from just more than two months to just over one.

The fish party worked independently but relied on the Park Ranger for transport between station sites.

(v) Narrative

The effect of one of the hottest spells of the summer was felt most as both mammal/reptile parties drove up the north west coastal highway towards the Kalbarri turn-off during the morning of Sunday January 5th. Earlier reports of a severe two day old bush fire near Kalbarri townsite were soon confirmed by an extensive pall of smoke to the north west, visible from many miles away. We were soon made aware of the severity of the fire when 21 miles inside the park boundary on the Ajana-Kalbarri road visibility was cut to a few yards by the smoke of the fire racing before a fresh south-westerly along the southern edge of the road. The fire's effect on the larger mammals was immediately obvious from the number of grey kangaroo (Macropus fuliginosus) casualties found on the road. The skulls from 4 carcases were collected and in addition 5 animals were seen to cross the road. Two were obviously burnt, one stopping to lick its forearms from which the fur had been burnt off.

The fire continued to sweep through the southern half of the Park during the next 24 hours until approximately 60,000 acres, about 1/7th of the total area of the Park was completely burnt out. The extent of the area affected is shown on Map 3. The drastic effects of the fire caused us to revise plans for the first few days. Instead of beginning to work on the selected sample areas straight away we spent the first 3 days estimating the extent of the fire damage. At the same time the opportunity was taken to look at one area, near the "Z Bend" on the Murchison River Gorge, which we found could now be reached along a new track put in only a month or so earlier.

Of the 10 areas selected for intensive sampling two were badly damaged by the fire. No. 7, Junga Dam, was completely burnt out and plans for work there had to be completely revised. No. 6, Meanarra Hill, was badly affected, particularly on its south and west slopes, but enough unburnt country was left for useful work to be done there. Otherwise plans for work required little alteration. In at least one way the fire was even a help as several specimens were obtained that would have been missed, including at least one mammal species that might not have been recorded otherwise.

From January 5th to 12th both parties were based at Kalbarri. Brief recces were carried out on Meanarra Hill, along river flats towards Murchison House homestead, near the "Z" Bend, at Hawk's Head, and at Junga Dam (to survey fire damage), and along the coastal cliffs and Wittecarra Gully. The planned programme of sampling began on the 8th when traplines were set on Meanarra Hill (Area 6) and along the coastal cliff - Wittecarra Gully transect (Area 9).

a. Areas worked from Kalbarri townsite (Nos. 6 and 9), 8.1.69 - 12.1.69. The Meannarra Hill area was worked by party B. (Nissan Patrol) and the coastal cliff - Wittecarra Gully transect by Party A (Landrover).

Trapping details (how many and where set, species caught and percentage trap success, i.e. per 100 trap nights) are given for all areas in Table 1. The most notable trap capture in the Meanarra Hill area was Notomys mitchelli, the hopping mouse. One animal was taken in dense Acacia woodland, with

thick leaf litter near the top of the hill, another on the lower slopes in Banksia/Acacia country. Several specimens were also obtained of the ashy-grey mouse, Pseudomys albocinereus, particularly in Banksia/Acacia country on the lower slopes of the hill. But the most notable mammal record from the Meanarra Hill area was Tarsipes spencerae, the honey possum. The animal was shot by Baynes at about 0900 hrs., 6.1.69, when his party was searching through recently burnt scrub on flat ground to the east of the hill. It was first seen running very fast along burnt ground between the burnt bushes. The record would obviously not have been obtained but for the effect of the fire. A little earlier, Youngson had seen a small mammal running out from under a bush towards a large unburnt tree. At the time he thought it was a Wambenger (Phascogale) but the sighting could not be confirmed. Grey kangaroos (Macropus fuliginosus) were frequently seen in the area and one Euro (Macropus robustus) was seen by Youngson on the eastern ridge of the hill in thick acacia. It was scared out of a depression under a bush at about 0845 hrs., 10.1.69. An undentified small macropod was seen close to the track, south of the hill, in Casuarina scrub on the night of 8.1.69. Its greyish colour and small size, and general build were that of a Tammar (Macropus eugenii) but its identity could not be confirmed. 12 species of reptiles were recorded from the area, the most notable being a skink (Lerista lineo-punctulata) (the only record of this species during the survey) an animal usually associated with coastal dunes.

The Coastal Cliff - Wittecarra Gully transect was sampled at three places; near the coastal cliffs, in sandplain (Grevillea scrub) half a mile from the gully, and in the gully itself near Wittecarra Spring. Near the coastal cliffs there was abundant evidence of a thriving population of the ashy grey mouse, P. albocinereus, particularly in Grevillea/ low heath just to the east of the coastal track. The same species was abundant in similar country half a mile west of the gully. No native land mammals were found near Wittecarra Spring, though the house mouse (Mus musculus) and black rat (Rattus rattus) were trapped in thick sedge along the creekbed. Signs of wild pig were abundant along the creekbed and several were heard crashing through undergrowth at night. Bats were seen flying in open areas between gum trees in the gully (Eucalyptus camaldulensis) particularly over a small pool to the west of the spring. No specimens were taken but one that was dazzled in a spotlight and fluttered down on to the water, but could not be caught, had the typical brown mantle of Chalinolobus gouldi, Gould's wattled bat, and it is fairly certain that most of the bats seen near the gully belonged to that species.

Rather few reptiles were recorded. The Children's Python, Liasis childreni was found near the coastal cliffs; similarly that was the only area where the legless lizard Delma fraseri was obtained.

During these first days of intensive work both parties began to settle into a daily routine that was to last, with minor variations, for the rest of our stay. A quick breakfast after waking around dawn was followed by inspection of traplines after which specimens would be prepared until lunchtime, about noon. When there were few or no specimens to prepare, reptiles might be collected instead. Noon temperatures were usually around the century during our stay and a siesta was the general rule until about 3 p.m. when rebaiting of traps would begin.

Rebaiting usually took 2 or 3 hours, with reptiles being collected at the same time, and as dusk approached around 7.30 p.m., at least one member of each party would collect geckoes near camp while the others stayed on watch for bats flying against the sunset. An evening meal just after dark was followed by a period of spotlighting, either in the vehicle or on foot, and on most nights preparation of specimens, cleaning gear and writing up notes prevented anyone getting to bed much before midnight.

On 12.1.69 both parties left the Kalbarri townsite for the eastern area of the Park, to the east of the Murchison River, travelling via Ajana and the north west coastal highway. Vehicle trouble delayed us near Mary Springs but by midday on 13.1. we had reached the gorge on its eastern side and selected a campsite some 7 miles from the gorge near a claypan only 2 miles to the west of some prominent sand ridges on the sand plain.

b. Eastern areas (2 and 4), 13.1.69 - 18.1.69

Area 2 as originally selected was near the sand ridges in the middle of the eastern sand plain. But we were impressed with some thick country on the eastern edge of the Park, which we travelled through on the way in along a track and firebreak not seen during the May reconnaissance. This region became area 2 (E) while the original area 2 was redesignated area 2 (w). Area 2 (w) was Party A's responsibility, while Area 4, the gorge and its associated gullies on its eastern side near a sharp bend in the river known as the "Little Z" bend, was worked by Party B. Both parties combined to work area 2 (E).

The sand ridges in area 2 (W) reach, at their highest, 50 - 60 ft. above the surrounding plain and run roughly S.E. - N.W. for up to ½ a mile. Their upper slopes are clothed with fairly dense sand heath scrub dominated by Woody Pear (Xylomelum) and Banksia prionotes, while the highest slopes are topped by dense scrub dominated by two kinds of Banksia - B. sceptrum and B. prionotes (see Botany Report available separately). Between the ridges are areas of sand heath with occasional clumps of mallee. Trapping for mammals on and near the ridges (including areas of mallee), was singularly unsuccessful. In just under 300 "Trap - nights" Party A obtained only one specimen of Pseudomys albocinereus. Murid prints were virtually absent from the exposed sandy areas searched, but fox sign was abundant. From the air several areas of diggings had been seen on the tops of the ridges; when these were investigated on the ground they seemed generally to be caused by foxes digging out lizards or rabbits. Towards the western end of one low ridge some old burrows were found mainly under Jacksonia bushes. At first it was thought these might have been made by Bettongs (Bettongia lesueur) or even Dalgytes (Macrotis lagotis) but it seems more likely that they were abandoned rabbit burrows, though no recent rabbit sign was found in this area of the sand plan. Near the camp site, close to a claypan surrounded by Melaleuca and mallee, the only small mammal recorded was a house mouse (Mus musculus). Emu and pig prints were common around the claypan, which still had water in it, and Emus were seen frequently. The greatest number reported at one time was 11; several smaller parties were seen, some with subadult (about ½ grown) birds in the group.

Grey kangaroos (M. fuliginosus) were seen occasionally. The track between the campsite and the sandridges was swept clear of footprints to give records of animal activity for comparison with other areas.

8 species of reptile were recorded from the area. The spotted dragon, Amphibolurus maculatus was particularly abundant on the sandy tracks, as elsewhere in the Park.

Party B had little more trapping success in Area 4 near the gorge; Pseudomys albocinereus was recorded from a sand ridge in Banksia/woody pear country and Mus musculus from a re-entrant gully (Acacia/Grevillea dominant) leading to the gorge itself. In general, however the gorge area was unsuitable for intensive mammal trapping. Goats were seen frequently in the gorge, and pigs were encountered several times, one being found climbing up out of the re-entrant on 16.1.69.

Baynes reported a Euro from the gorge on 14.1.69, and a grey kangaroo from the bottom of the gorge, the next day. Bats were seen flying round the river gums (E. camaldulensis) in the gorge bottom at dusk. Specimens obtained proved to be the little brown bat (Eptesicus pumilus). Reptiles collected from the gorge proved extremely interesting. The "Ta-ta" lizard, Physignathus longirostris was common on the sandstone rocks and the gecko, Phyllurus milii was recorded. Two skinks, Ablepharus butleri and Sphenomorphus richardsoni were collected only from this locality.

Early in the afternoon of January 16th we set off to work the eastern boundary of the Park (area 2(E)). Party B concentrated on an area near the junction of sandplain and a thick belt of mixed woodland (mainly a mixture of Acacia, Casuarina and mallee with some thick stands of pine (Callitris)). Several bats (identified from specimens collected as Chalinolobus gouldi) were recorded flying low near a firebreak by the campsite, sometimes wheeling over mallee, in the dusk. But two nights trapping produced no land mammals apart from Mus musculus though one pregnant female ashy-grey mouse (P. albocinereus) was shot by Youngson close to camp when it ran on to the firebreak from sandplain heath.

The reptile fauna, however, contained elements quite different from much of the rest of the Park, such as the fast running Agamid lizard Amphibolurus scutulatus, the goanna Varanus eremius and the skink Ctenotus severus. The goanna is here on the very western edge of its range.

Party A concentrated on an area of York gum woodland near the intersection of Eurardy Station's southern boundary and the north west coastal highway, but trapping and spotlighting produced no native mammals. This was surprising since there was a good deal of dead timber and litter with hollows suitable for possums (Trichosurus), and we expected to find carnivorous marsupials (Dasyuridae) such as Sminthopsis murina. Rabbit sign was common near the Eurardy boundary, though only one animal was actually seen, and a herd of goats was observed browsing on low bushes in the York Gum woodland on 18.1.69. Among the reptiles collected were the skinks Ctenotus schomburgkii and Ablepharus lineocellatus.

Both parties returned to Kalbarri townsite on the afternoon of January 18th. On the way back the skull was collected from a Euro, dead on the north west coastal highway 2 - 3 miles south of Mary Springs mine.

c. Junga Dam and P.W.D. Gauging Station/Hardabut Pool (Areas 7,7a) 19.1.69 - 24.1.69

After a reappraisal of results achieved in the first fortnight's work it was decided to split the two parties for the following five days. Party B (Baynes and Youngson) was to investigate briefly the fire ravaged Junga Dam area and then move on to the river near the P.W.D. gauging station, about 2 miles downstream from Hardabut Pool, while Party A reinforced by Allen, moved into the northern sector of the Park, between Mt. Curious and Bungabandi Creek.

At Junga Dam, Baynes and Youngson found large numbers of fox footprints on the track leading from the Ajana-Kalbarri road into the dam, though some may have been made by dogs from a party of native stockmen who passed through the area that night (19.1.69). 3 foxes were seen later that evening. A large sow and 3 half grown pigs were found near the dam that night. Rabbits were common in the area and one black rabbit was seen. Several kangaroos were observed drinking at the dam. One at least was reported as rather "rusty" in colour, while the next morning 3 of a similar colour were seen about 1½ miles to the south of the dam in a belt of unburnt mallee. Mouse tracks were common on yellow sand and two animals were shot near the camp by Youngson. The most interesting mammal record of the area, however, was a specimen of Sminthopsis crassicaudata the fat-tailed marsupial mouse, the only Dasyurid recorded from the Park during our visit. The animal was seen by Baynes on sandy gravel in an area of burnt acacia near an unburnt patch at 2200 hrs. on 20.1.69. The ubiquitous Pseudomys albocinereus was also recorded here, among Melaleuca.

Near the P.W.D. station rabbit tracks were common and several small groups of goats were seen in the gorge. The ground on either side of the gorge was littered with pig and goat droppings and the muddy edges of pools were dotted with their footprints. The largest herd of goats recorded near here was one of 20 about half way along the track between the Ajana-Kalbarri road and Hardabut Pool. Several sets of fresh mouse-sized prints were found on white sand in thick Acacia bush uphill of the P.W.D. hut (overlooking the gorge) early in the morning of January 23rd. Further mouse-sized prints were seen in the same area the following morning, but only one animal, a house mouse (Mus musculus) was caught. 1 euro was seen hopping among rocks between casuarina about 2 - 3 miles east of the P.W.D. station at 11.30 a.m. on 23.1.69; another, smaller euro was seen in the bottom of the gorge later the same day. Bats were seen at dusk; one Chalinolobus gouldi was shot near the top of the gorge and another near Hardabut Pool, flying around river gums. A second species probably Eptesicus primulus, was also seen.

On the way back to Kalbarri townsite from the P.W.D. area, Baynes and Youngson stopped at Hawk's Head Lookout, overlooking the gorge a few miles downstream from the P.W.D. gauging station, to try and confirm sightings of rock wallabies (Petrogale penicillata) reported by the Park Ranger. A careful watch had been kept in the gorge elsewhere for these animals, but with no success so far. This time they were lucky: Baynes saw two rock wallabies on top of a tumble of boulders below the lookout about halfway down the side of the gorge. They were only seen briefly, at approximately 1700 hrs, when the sun was off the rocks on that side of the gorge. Though Baynes and Youngson waited for three quarters of an hour the animals did not reappear and no photograph was possible. There was, however, no doubt of the identification.

This was the only area where the tortoise Chelodina steindachneri was collected though individuals were seen both by the fish party and Youngson and Smith, at Lockwood Springs. As in all the gorge areas visited the "Ta-ta" lizard (Physignathus) was very common among rocks and leaf litter.

d. Mt. Curious/Bungabandi Creek (Area 5) 20.1.69 - 25.1.69

Meanwhile Party A, guided by the Park Ranger, R. Gliddon, left Kalbarri townsite on Monday morning, 20.1.69 for the long haul over the sand plain, following the Old Telegraph Line, to the now dry riverbed at Bettie Crossing before striking into the country near Mt. Curious. This area had not been reconnoitred on the ground the previous May but Gliddon had recently found a track leading around the south-east of Mt. Curious that was thought might join up with another track, seen only from the air, running east-west along the line of Bungabandi Creek.

A campsite was chosen on high ground to the north-east of Mt. Curious in sandheath dominated by Banksia sceptrum and woody pear. It was in striking distance of rocky areas near Mt. Curious itself (1 mile to the S.W.), mallee covered slopes leading down to the dry Bungabandi Creek (2 miles to the N.E.), the creek itself (where there was mixed vegetation with Melaleuca depressa, Grevillea pinaster and Acacia cf microbotrya prominent) and high sandy ridges to the north of the creek (with dense scrub of Banksia sceptrus, woody pear, and occasional mallee, mostly Eucalyptus eudesmioides) (botanical determinations made by P.G. Wilson on specimens collected by Bannister since the Botany report was compiled).

Mammal traps set in all these locations were again rather unsuccessful, the only catches being 2 Mus musculus in the creekbed and 1 Pseudomys albocinereus on the lower slopes of the high sand ridge to the north of the creek. There were even rather few grey kangaroo sightings. Goat, fox and rabbit prints were abundant in the creekbed. Mouse-sized prints were found on a low sandy ridge to the south of the creek but traps and spotlighting in that area met with no success. On the high sand ridge to the north of the creek were found trails of small prints thought to be of the hopping mouse, Notomys, but no animals were seen or trapped. Fox prints were frequent throughout the area. Emu scats and pig droppings were also found. Near our campsite were several recent diggings, probably made by foxes digging out lizards. Goats were seen and heard near camp on several occasions.

Work in this area was disrupted by vehicle trouble which caused Bannister to walk out for assistance during the night of 22.1.69 leaving Smith and Allen to look after the trap lines on foot - no mean task in that rough country and the century temperatures. During his walk Bannister was fortunate to pick up a dead specimen of the Bandy-bandy Vermicella bertholdi littoralis on the track, and was able to obtain counts of animal tracks made since the last vehicle had passed that way 24 hours earlier.

Having corrected the vehicle fault (with the help of the Park Ranger and his assistant) Smith and Allen returned to Kalbarri on 24.1. while Bannister had one last try, spotlighting on foot, to identify the animal responsible for the?Notomys footprints seen on the high sand ridge north of Bungabandi Creek. As they were returning across the river just east of Bettie Crossing Smith and Allen saw one of the largest mobs of goats observed during our stay in the Park - approximately 34 climbing up from the river on its southern side.

Bannister also saw 2 large kangaroos crossing rapidly in front of the vehicle just south of Bettie Crossing on his way back the next day. Both were very russet coloured, one with a bluish tinge to its fur, and it is possible they were red kangaroos (Megaleia rufa), a species reported to us to occur some way north of the Park, at Weerinoogudda Soak, east of Gee Gie outcamp.

Despite the fact that this was the most northerly area sampled the reptiles were not particularly different from those in other sand plain areas. While in the area, contact was made with the fish party who were by then netting a large stretch of permanent water (Wilgiamia Pool) to the east of Bettie Crossing. Goat scats were abundant near the river and there were extensive pig diggings on higher ground among sandstone rocks. Rabbit scats were abundant though only one animal was seen.

e. Janja Thicket and The Loop (Areas 8 and 3) 25.1.69 - 30.1.69

Janja thicket is an extensive area of York gum woodland surrounded by thickets of Melaleuca uncinata situated a few miles south west of The Loop and easily approached from its west or south (the latter approach being along the new track recently made to the Z Bend). The plant associations are as described in p.4 ("Clay-Pan") of the Botany Report. This area was the responsibility of Party B. Though there were many signs of small mammals (especially in the form of footprints or trails on reddish sand) very few were caught. In the areas that were obviously wet in winter there was abundant sign of feral pig in the form of old rootings and wallows. Hollow logs and litter in an old camp area in a woodland clearing were searched extensively for animal life but none was found. Judging from the abundance of footprints foxes were common in the area and several were seen. Several grey kangaroos were observed, and also one Euro. There was no doubt of the Euro's identity; it was observed for 2 - 3 minutes among Melaleuca near the campsite, coming out of an area of hibiscus (Alyogyne). This was the only occasion when a Euro was seen not close to rocky areas outside the gorge. Baynes commented on the area as follows "Much kangaroo sign - runs and scats, and much pig rooting; rabbit sign common in Alyogyne in the south-west corner but not anywhere else. Fox tracks numerous on sand especially in the south-west corner. Birds and insects were very numerous. The area probably once held Tammar (M. eugenii) but pigs and foxes and man [sandal wood cutters and pig shooters?] must have helped remove them". Bats were seen on several occasions, particularly at dusk, but none were obtained and no identifications could be made.

In Janja thicket the most notable reptile recorded was the Agamid lizard Amphibolurus scutulatus, only found otherwise near the eastern boundary of the Park (2[E]). The five-ringed snake Demansia modesta was found only in this area.

The Loop area of the gorge (Area 3) was worked by Party A. From our camp near the tourist lookout at the neck of The Loop we were in striking distance of both arms of The Loop and took the opportunity to explore east and west along the gorge as well as right around The Loop itself. Even in January there were still extensive areas of water in long pools, one of which extended almost the entire length of the southern arm. Such pools were a haven to waterfowl. Goats were common; they could be seen climbing high upon the sides of the gorge or grazing close to the water.

Pigs were seen occasionally, usually near water. Euros could be disturbed from the sides of the gorge during the day; several flat and apparently heavily grazed areas near water were scattered thickly with large kangaroo droppings (presumably euro; no grey kangaroos were seen here in the bottom of the gorge). Sandy areas near small drying pools were frequently criss-crossed with many mammal tracks (mainly kangaroo). At first this was thought to indicate recent activity of many animals coming in to drink, but examination of areas swept on two successive nights showed that, while we were in the area at least, the apparent activity was more likely to have been caused by only one or two animals visiting the water each night. An indication of the amount of easily observed animal life in the gorge is given by the records of sightings during a walk round the Loop, along the gorge bottom, by Bannister and Smith between 0645 and 1140 hrs. on 27.1.69. Sighting were :

Goats:	52+	(in groups of 3,10,1,2,3,33+; including a few half grown animals).
Pigs:	2	(1 plus ½ grown young)
Rabbits:	2	(both single; many tracks and piles of droppings seen).
Euros:	5	(3,1,1)
Black swans:	65+	(together on one long pool).

Other waterfowl were recorded as "numerous".

A careful watch was kept for rock wallabies near suitable rock piles in the gorge but none were identified certainly. Bannister thought he saw one disappear over a large rock in a tumble of boulders in the early evening half way along the southern arm of the Loop, but the sighting could not be confirmed. The species of reptiles collected were little different from those found elsewhere in the gorge; much time was spent searching unsuccessfully for more specimens of a blind snake (Typhlops sp.) discovered earlier by a Hale School expedition.

f. Zuytdorp area and Lockwood Spring 31.1. - 2.2.69

During the two days 31.1. and 1.2.69 Bannister, Baynes and Smith, led by Gliddon, made a brief visit to the area of the Zuytdorp wreck, some 40 miles north of Kalbarri townsite. This was in response to a request from the Lands Department for information on the area, particularly for a comparison of habitat types with those present in Kalbarri National Park. The results of that visit have been reported separately. Meanwhile Youngson and Allen spent a very profitable 3 days at Lockwood Spring, a little known and unspoilt locality near Ross Graham Lookout on the gorge. The locality was especially productive for reptiles, particularly because the two happened to be there during a violent thunderstorm (the only heavy rain that fell during our visit) so that reptile collecting was at an optimum in the wet conditions. The preponderance of skinks in collections from the gorge areas was emphasised when Youngson and Allen obtained the only records of the two skinks Lerista elegans and Lerista planiventrale. The record of L. elegans represents an extension of range, not previously being known on the mainland from further north than Eneabba. Useful information on bats was also obtained, particularly on Chalinolobus gouldi, Gould's wattled bat. 3 grey kangaroos were seen near the bottom of the gorge.

g. Coastal sand dunes and limestone areas near the rabbit-proof fence (Areas 10 and 1), 2.2.69 - 6.2.69

For the last five days of our stay in the Park, Party A surveyed an area near the rabbit-proof fence, close to Balline Station boundary (Area 1) while Party B worked in coastal dune country close to Bluff Point (Area 10).

The topography of Area 10 was quite different from that anywhere else in the Park, and this was evident in the large numbers of reptiles collected, particularly of various species of geckoes and Agamid lizards. The distinction was particularly obvious because of the much smaller number of specimens obtained in the adjacent area (1), where even with an extra person collecting the number of individual reptiles was barely more than a quarter of those from Area 10. At the same time, of the 10 species recorded in the coastal dune area, 6 were not found in area 1, while only 2 of the 8 species found in that area were not recorded from the coastal dunes.

Among mammals recorded in the coastal dune country were the hopping mouse (Notomys mitchelli), the ubiquitous ashy-grey mouse (Pseudomys albocinereus) and the little brown bat, Eptesicus pumilus, particularly abundant at dusk, flying low against the prevailing southerly wind between the dunes over open ground. Though the area seemed suitable for the bush rat (Rattus fuscipes) no records of this species were obtained although Baynes could not be sure that a burrow found south of the rabbit-proof fence had not been made by Rattus sp.

By contrast, area 1 was a mixture of various types of habitat, from sandplain heath to thick acacia woodland (found particularly on high limestone hills). Despite this variety the mammal fauna was disappointing; rabbits were very abundant on the high ground (1 black rabbit was recorded) and several foxes were seen in the area. The hopping mouse Notomys mitchelli was trapped on one occasion in thick heath; another individual, very probably of this species, crossed the track in the light of the vehicle headlights one evening; Pseudomys albocinereus and Mus musculus were trapped also. Grey kangaroos were fairly common on the more open heathland areas. 2 reptiles, the skink Ctenotus lesueuri and the gecko Diplodactylus guttatus, were particularly common, the latter in open sandy country near the rabbit-proof fence.

C O N C L U S I O N S

In terms of native mammals the results were disappointing. Before the survey began there seemed just a chance that some of the more spectacular native mammals once present in drier areas of the south west of W.A. (and now virtually absent because of clearing and the introduction of the fox, cat and rabbit) might still be found in a large and remote area such as Kalbarri National Park. But we found no definite sign of species such as hare wallabies, bettongs or dalgytes. This is not to say they do not occur there still but as a result of our work there the possibility now seems most unlikely. The presence of foxes throughout the Park reinforces that conclusion.

Only two representatives of the now rare "Drier area" mammal fauna were found: the ashy-grey mouse (Pseudomys albocinereus) and the hopping mouse (Notomys mitchelli). It was heartening to discover thriving populations of Pseudomys in at least two localities. Like Notomys this animal still survives in some parts of the south west of W.A. but the Kalbarri area will have considerable significance in the conservation of both these species.

The area is obviously extremely important in terms of reptiles. One of the 45 species recorded (a blind snake) is unique to the Park; at least 8 others represent species with a very restricted range, and 19 others are representatives of southern or south western species now being affected by the opening up of land. Quite apart from its significance in the conservation of the reptile fauna the Park's importance as an example of many different habitats is well demonstrated by the reptiles, which (as Dr. Storr's report, Appendix B, shows) can be divided into at least 7 different categories according to their distribution.

Both the freshwater fish (Appendix C) and the aquatic snails (Appendix F), in contrast to the terrestrial fauna, mostly consist of representatives of northern forms, presumably reflecting the inland nature of the drainage system. At least one fish is endemic to the Murchison River system.

Kalbarri National Park is one of the very few large reserves available for the conservation of representatives of the fauna and flora of the drier areas of south western Australia and though its mammals may have been seriously affected by introduction of pest species the reptiles have not; their habitats should therefore be carefully conserved. Some areas within the Park may already be affected more by human use than others, and relatively unspoilt localities, such as Lockwood Spring, should not, in our opinion, be opened up for use by tourists. At the same time the results of the survey show that at least two areas, the coastal cliffs and Meanarra Hill, contain faunal elements different from or as prolific as anywhere in the Park and should be included in the reserve as soon as possible.

A C K N O W L E D G M E N T S

Our work in and around the Park would not have been possible without the considerable help, advice and hospitality of the Park Ranger and his wife, Mr. & Mrs. Gliddon. During the reconnaissance much useful information was given by Mr. E. Pederick of Red Bluff Caravan Park and Mr. R. Glass, Honorary Fauna Warden. We are also grateful to Mr. & Mrs. D. Bellairs of Red Bluff Caravan Park for advice and specimens of reptiles.

APPENDIX A

MAMMALS RECORDED FROM KALBARRI NATIONAL PARK, JAN.-FEB. 1969

by J.L. Bannister, Curator of Mammals,
W.A. Museum.

17 mammal species were recorded (only 9 of which are native) from the Park or its immediate neighbourhood during our visit, as follows:

Native

Marsupials: Dasyuridae

Sminthopsis crassicaudata (Fat-tailed marsupial mouse)

Tarsipedidae

Tarsipes spencerae (Honey possum)

Macropodidae

Macropus fuliginosus (Western grey kangaroo)

Macropus robustus (Euro)

Petrogale penicillata (Brush-tailed rock wallaby).

Placentals : Rodents:

Muridae

Pseudomys albocinereus (Ashy grey mouse)

Notomys mitchelli (hopping mouse)

Bats:

Vespertilionidae

Eptesicus pumilus (Little brown bat)

Chalinolobus gouldi (Gould's Wattled bat)

Introduced

Oryctolagus cuniculus (Rabbit)

Rattus rattus (Black rat)

Mus musculus (House mouse)

Vulpes vulpes (Fox)

Felis catus (Cat)

Sus scrofa (Pig)

Capra hircus (Goat)

Ovis aries (Sheep)

In addition the Monotreme, Tachyglossus aculeatus (Echidna) was observed by a member of the public in the Park in May, 1968.

Notes on the species

Sminthopsis crassicaudata (Fat-tailed Marsupial mouse)

Surprisingly this was the only Dasyuirid recorded. Though these animals do not readily enter traps we would have expected to see them at night, while spotlighting, or to find them in piles of old timber and litter. Areas such as Janja thicket, the York Gum woodland near the eastern boundary of the Park (2E) and Junga Dam (where this animal was found), with their abundant dead timber and ground litter should have been ideal habitat for at least the smaller members of the family. Another species, Sminthopsis murina, the "common marsupial mouse" of more wooded areas of the south west was recorded from north of Murchison House Station by W.H. Butler in 1964 and it should occur in the Park.

Tarsipes spencerae (Honey possum)

The one record of this species represents an extension of range of over 150 miles, the previous most northerly record coming from west of Coorow. Being a nectar-feeder, Tarsipes probably requires a source of nectar throughout the year and the sand plain flora of the Park would be expected to provide an ideal habitat for this species.

Macropus fuliginosus (Western grey kangaroo)

Grey kangaroos were encountered throughout the Park; a few were even found at the bottom of the Murchison River Gorge (at Lockwood Springs and "Little Z" Bend, though not at The Loop). A few crude indices of abundance obtained from observation of kangaroo tracks crossing swept sandtracks overnight suggest that they were more common in the south west corner (Area 1) than elsewhere in the Park during our visit, as shown in the following Table :

Area or locality	Miles of sand track swept	No. of Nights of observation	No. of separate kangaroo tracks observed	Kangaroo tracks per swept mile per night.
1.	5.6,3.3,3.1 2.8	4	44,19,23,27	7.2
Just south of Bettie Crossing	about 4	1	25	about 6
West of Janja Thicket, south of The Loop	5.0,5.0,2.1	3	10,10,4	2.0
2(E)	0.8	1	13	1.6

The observations just south of Bettie Crossing were of kangaroo tracks crossing tyre marks of a vehicle known to have passed 24 hours earlier; daylight activity is therefore included and the index (about 6) is probably too high by comparison with the rest. Observations at area 2(E) were of kangaroos obviously crossing from the Park into Eurardy station pasture so there may have been some concentration of activity in that small length of swept track, though this is not obvious from the index obtained.

It is interesting to note that the largest numbers of animals sighted during the Reconnaissance in May, 1968 were in the south-west corner of the Park, so there may not be a great deal of movement from one part of the Park to another through the year. It is also interesting to note that numbers of individual animals seen were nowhere near as high as those seen north of Gee Gie on the way to the Zuytdorp area on 31.1.69, in coastal heath land, where in 17 miles traversed in approximately 5 hours 143 animals were counted.

Macropus robustus (Euro)

This species was fairly common in the gorge and individuals were seen in several other places in the Park, e.g. near Paradise Flat, south of Murchison House Station, in Janja thicket, and (during the May Reconnaissance) south of Red Bluff on the coastal cliffs.

Petrogale penicillata (Brush-tailed rock wallaby)

As already described in the body of the report 2 animals were seen on rocks half way down the gorge side at Hawk's Head late one afternoon. Though no other sightings were confirmed it is likely that the species is present, though probably in only small numbers, in other parts of the Gorge. A party of canoeists reported "small kangaroos" west of The Loop in May 1968 and these may have been rock wallabies. It is important that other colonies should be pin-pointed since this species is notoriously shy of human interference and may well disappear from the Hawk's Head Lookout area if molested.

Pseudomys albocinereus (Ashy-grey mouse)

Individuals of this attractive animal were identified from all sand -plain areas (including heath near the coastal cliffs) examined during the survey. It is obviously widespread throughout the Park wherever sand plain vegetation occurs. Population densities, indicated by the trapping results (Table 1) show that the animals were most abundant in the Meanarra Hill - Wittecarra Gully and coastal cliff areas.

This species occurs in the south west of W.A., the previous most northerly mainland record being from Jurien Bay. The species' eastern-most limit seems to be at Israelite Bay, east of Esperance, and it possibly occurs throughout sand plain areas in the south west, though until recently only few records of its distribution were available. The species is part of the fauna that was once found throughout the drier areas of the south west (e.g. in the Wheat belt), before clearing and the introduction of the fox, the rabbit and the cat. It still occurs along with some other representatives of that fauna, on Bernier and Dorre Islands in Shark Bay.

Notomys mitchelli (Hopping mouse)

Notomys has been recorded from the Kalbarri area once before (there is a specimen in the W.A. Museum collected by R.B. Humphries at "Kalbarri" in 1965) and we were glad to be able to confirm that it is still present in at least two areas (Meanarra Hill and the south west corner of the Park) The animal does not frequently enter traps so the trapping results cannot be used to give any true indication of its abundance. This is another of those species that occurs in drier areas of the south west of W.A. and is still reported occasionally from the outer wheat belt.

Eptesicus pumilus (Little brown bat)

Chalinolobus gouldi (Gould's Wattled bat)

Both these bats occur throughout Australia. Eptesicus lives in caves, swallow's nests, tree hollows and buildings; Chalinolobus is generally found in tree hollows. Both fly from just before dusk until well after dark. Eptesicus was recorded from the Loop by a Hale School Expedition in 1967.

During our survey it was recorded from the gorge (where it presumably lives in caves) and over sand-dunes near Bluff Point. Chalinolobus was also recorded from the gorge as well as near heavily wooded areas in the east of the park. It is very probable that other species of bats occur in the Park.

Oryctolagus cuniculus (Rabbit)

Recent rabbit sign and/or animals were found near the coastal cliffs, in the south west corner of the Park (Area 1), near Junga Dam, in Janja Thicket, near the eastern boundary of the Park (Area 2 E), near Bungabandi Creek and in various places in the gorge. Rather few animals were seen, most being recorded in Area 1. Black rabbits (possibly a sign of heavy infestation) were seen in Area 1 and at Junga Dam. No recent rabbit sign was found in the middle of the eastern sand plain (Area 2 E) where abandoned diggings (possibly rabbit) were found on a low sand ridge, as described in the Narrative.

Rattus rattus (Black rat)

Mus musculus (House mouse)

Both species were recorded from thick sedge near the seaward end of Wittecarra Gully. The house mouse was also found on Meanarra Hill, in Acacia country in areas 1 and 10 (south west corner of the Park), and near Bungabandi Creek to the north east of Mt. Curious. This species was also recorded for the gorge. The house mouse has spread far beyond the immediate environs of human habitation in Australia and it is not surprising that it was found in isolated areas of the Park.

Vulpes vulpes (Fox)

Fox tracks were common on firebreaks and sand tracks throughout the Park even though only a few individuals were seen. The animal seems to be ubiquitous within the Park.

Felis catus (Domestic cat)

Only one animal was seen (8 - 9 miles from Kalbarri on the Ajana-Kalbarri road) and a skull was picked up among sand dunes in Area 10. It is to be hoped that these records represent its true incidence in the Park, in view of the feral cat's destructive effect on native fauna.

Sus scrofa (Pig)

Pigs were recorded at Wittecarra Gully (seaward end, Area 9), Junga Dam, in the gorge, and at a claypan near the centre of the eastern sandplain (Area 2 W) i.e. virtually anywhere near fresh water. Particularly intensive sets of diggings were recorded on the top of the gorge north of Bettie Crossing and in one locality near the bottom of the gorge north of the "neck" of the Loop. There is no doubt that they do extensive damage in localised areas and that their numbers should be controlled. The maximum number seen at any one time was 5 and several families (with half grown young) were encountered.

Capra hircus (Goat)

Goats were common in the gorge. They were rarely seen away from the river but one small herd was found browsing on low shrubs in York Gum woodland (Area 2 E). If the numbers seen around the Loop are taken as typical of the gorge as a whole (52 animals in 5 miles) the 40 miles of gorge could be expected to have harboured approximately 400 animals during our visit. This is twice as many as recorded from the gorge area by D.E. Gooding in September, 1967, but the difference is probably because his observations were

based largely on aerial sightings. The total of 400 in the gorge at one time is not large by comparison with some of the sightings reported by the owners of Murchison House Station (for example a total of 400 was reported at one time from one area in the limestone hills north of the Homestead during our visit). At the same time the goats' effects on at least the woody vegetation are not easily seen. Wilson, investigating the plants in May, 1968 found signs of grazing on Melaleuca at the bottom of the gorge near Ross Graham Lookout and at Hardabut Pool, and Party A during our visit reported considerable damage, presumably caused by goats, to a stand of Callitris near the Loop; lower branches were damaged and growth stripped off to a height of about 4 feet. The goats (together with curos) may also be responsible for much of the grazing of annuals (forbs and grasses) on low flats near pools in the gorge.

Ovis aries (Sheep)

2 stray animals were found at the Z Bend, the only occasion on which sheep were found in the Park. They were, however, commonly seen near the boundary with Murchison House Station north of the river at Bettie Crossing, and McKay, in his report on spiders, notes the damage they can do to soil structure. So far, fortunately, their effect on the Park itself seems to be negligible, though there are other centres of possible infiltration into the Park from Balline Station in the south west and Eurardy Station in the north east.

APPENDIX B

LIST OF THE REPTILES RECORDED DURING THE SURVEY OF KALBARRI NATIONAL PARK, JAN. - FEB. 1969

with notes on their significance by Dr. G.M. Storr, Curator of Reptiles, W.A. Museum.

	No. of Species
CHELIDAE	
Chelodina steindachneri	1
GEKKONIDAE	
Gehyra variegata	
Heteronota bynoei	
Phyllurus milii	
Diplodactylus alboguttatus	
Diplodactylus spinigerus	
Diplodactylus vittatus	
Nephrunus levis occidentalis	7
PTGOPODIDAE	
Lialis burtoni	
Delma fraseri	
Pygopus lepidopodus	3
AGAMIDAE	
Moloch horridus	
Amphibolurus adelaidensis	
Amphibolurus barbatus	
Amphibolurus inermis	
Amphibolurus maculatus	
Amphibolurus reticulatus	
Amphibolarus scutulatus	
Physignathus longirostris	8
SCINCIDAE	
Tiliqua rugosa	
Tiliqua occipitalis	
Ablepharus boutoni	
Ablepharus butleri	
Lerista elegans	
Ablepharus greyi	
Ablepharus lineocellatus	
Lerista nichollsi	
Lerista lineopunctulata	
Lerista macropisthopus	
Lerista muelleri	
Lerista planiventrale	
Sphenomorphus richardsoni	
Ctenotus lesueuri	
Ctenotus schomburgkii	
Ctenotus severus	16
VARANIDAE	
Varanus eremius	
Varanus gouldi	
Varanus tristis	3
BOIDAE	
Liasis childreni	1
ELAPIDAE	
Demansia nuchalis	
Demansia psammophis	
Demansia modesta	
Denisonia monachus	
Vermicella bertholdi littoralis	5
TYPHLOPIDAE	
Typhlops eborifrons (M.S. name)	1
	45 species

The 45 species of reptiles definitely known from the Park may be placed in 8 categories according to their total distribution:

(1) Throughout the greater part of Australia (i.e. all but the wettest and coldest regions) - 15 species, e.g. Gehyra variegata.

(2) Widespread in the southern half of Australia - 17 species, e.g. the Bobtail (Tiliqua rugosa).

(3) Northwestern reptiles close to the southern limits of their range - 2 species, viz. Cholodina steindachneri and Physignathus longirostris.

(4) Mid-west coastal reptiles close to their southern limits - 4 species (or subspecies), viz. Nephrurus levis occidentalis, Lerista nichollsi, L. planiventralis and Vermicella bertholdi littoralis.

(5) West Coast reptiles - 4, viz. Diplodactylus spinigerus, Amphibolurus m. maculatus, Lerista elegans and L. lineopunctulata

(6) Southwestern reptiles - Diplodactylus alboguttatus and Ctenotus severus.

(7) Only known from the park - an undescribed species of Typhlops.

Apart from the Typhlops, the species with the most restricted ranges are those of categories (4) and (5). In both of these categories the reptiles are confined to coastal dunes and near-coastal sandplains. Though the reptiles of categories (2) and (6) have a much greater area of distribution, their presence in the Park is of conservational significance; for several of them are becoming scarce in country devoted to agriculture and grazing.

APPENDIX C

THE FISHES OF THE MURCHISON RIVER, KALBARRI NATIONAL PARK

by R.J. McKay, W.A. Museum

Introduction

In conjunction with the terrestrial survey of the Kalbarri National Park, a survey of the fish fauna of the lower Murchison River was made using a selection of nets including seine nets and a throw net. Particular attention was paid to the freshwater fishes of the area, although one survey station was made in the estuary. Approximately 2 days were allowed in each of 5 areas sampled along the river from near its mouth to the Murchison River Crossing close to the Park's eastern boundary.

Aim

To compile a list of the fishes occurring in the Murchison River.

Equipment and Methods

Two seine nets, 100 yds and 50 yds in length, mesh size 3/4", and depths of 200 and 100 meshes were used at all localities. A nylon throw net, 12 feet diameter and 5/8" mesh was used to capture specimens in pools with uneven bottoms, and to selectively capture individual fishes. A small hand net was employed on some occasions. Seining was carried out by running the net across narrow sections of some pools and hauling on to the shore, or by running the net around an area in the middle of the pool and enclosing the lead line. The smaller seine net was most successful in areas of heavy aquatic vegetation where it was necessary to remove the plants with the fish sheltering within the vegetation.

A combination of techniques was frequently employed on the same operation whereby the large seine net was used to enclose a portion of the pool allowing the capture of fish by driving, seine-netting or throw-netting within the enclosed area.

Station 1. Paradise Flats.

22 January 1969: Two hauls made near a sand bar (100 yd net), 6.30 - 7.30 p.m. The area was estuarine with a heavy silty-mud bottom, and no aquatic vegetation. The most abundant species taken was the Perth Herring or Bony Bream Fluvialosa vlaminghi; both adults and juveniles were common. Other fishes captured, in order of abundance, were Sea Mullet Mugil cephalus (34 mm to 137 mm in length), Green-backed Mullet Liza dussumieri (20 - 24 mm), Tarwhine or Silver Bream Rhabdosargus sarba, Black Bream Mylio butcheri, Goby Glossogobius suppositus, Sand Whiting Sillago schomburgkii, Tailor Pomatomus saltator and the River Garfish Hemirhampus regularis.

23 January 1969 : Two hauls made with the large seine net, 3/4 mile up river. One haul made from rocks on the southern bank, the other made from a shallow sand bank on the northern bank. Tarwhine were taken near the rocks, and large numbers of Perth Herring were netted on the sand bank. 5.30 a.m. to 12 noon.

1.30 p.m. to 5.30 p.m. Made two hauls with the large net (100 yds x 200 meshes) and one haul with the small net without obtaining additional species.

Station 2. East of Bettie Crossing, Wilgia Mia Pool.

24 January 1969 : 1.00 p.m. to 6.00 p.m. Used the throw net in shallow water to capture Green backed Mullet L. dussumieri, many Yellowtail Trumpeters Amphitherapon caudavittatus and Gobies Glossogobius suppositus, both small fry and adults. Abundant growth of aquatic vegetation Najas and Ruppia sp. is characteristic of all the freshwater pools along the Murchison River to the Murchison River Crossing (i.e. where it is crossed by the North West Coastal Highway); Gobies, Yellowtail Trumpeter, and the Spangled Perch Therapon unicolor were found to be sheltering within these dense beds of aquatic plants.

25 January 1969

6.30 a.m. to 12 noon. The large net (100 yds) was used in the pool, but the uneven rocky bottom made netting extremely difficult and large numbers of Mullet Mugil cephalus were lost. Large shoals of 10 to 12 inch mullet were observed stirring up quantities of silt whilst feeding in the shallow areas of the pool.

The most abundant fish appeared to be the Yellowtail Trumpeter; these were netted on every occasion. Also plentiful was the endemic Hardyhead Craterocephalus cuneiceps, both adults and small fryswimming in schools at the surface. No Golden Gudgeon or Carp Gudgeon were taken. Black Bream were not captured but were reported to occur in the pool.

Station 3. The Loop. An extensive permanent pool on the southern arm of the Loop.

26 January 1969

10 a.m. to 1 p.m. Observed mullet feeding in the shallow waters at the pool edge, large schools of up to 80 fish were seen moving into the shallows, but these schools quickly moved to more open water when disturbed. Large areas of aquatic vegetation are present throughout the pool, and provide excellent shelter for small fish.

2 p.m. to 7 p.m. The large net was used to confine mullet to one end of the pool but apart from a few taken by hand as they hit the net, all jumped over the three separate lines of net. A large meshing net of 2 inch mesh would capture large numbers of these fish. Yellowtail Trumpeters and Hardyheads C. cuneiceps were common.

A series of hauls were made through the vegetation in the shallow areas of the pool, resulting in the capture of six Carp Gudgeon Carassiops compressus and one Golden Gudgeon Eleotris aurea. A few Gobies G. suppositus were also taken. Water temperature at the surface at 4.45 p.m. was 31.5°C. One Golden Gudgeon Eleotris aurea was seen by spotlight in shallow water at night.

27 January 1969

0900 to 1 p.m. Netted the aquatic vegetation for Gudgeon, capturing a number of C. compressus. The male Carp Gudgeons were in breeding condition while females had maturing ovaries. No Golden Gudgeon taken although seven hauls were made. Gobies were taken in most hauls. The Spangled Perch T. unicolor was captured by throw-net. The following water temperatures were taken.

10 a.m. at surface 26.5°C.

12 noon at surface 30.5°C.

12 noon at 2 feet depth 29.0°C.

Air temperature at 1.40 p.m. was 106°F. (41.1°C.)

2.30 p.m. Netted Carp Gudgeon and Mullet M. cephalus towards the western end of the pool where Hardyheads were common.

Station 4. Lockwood Springs. Deep permanent pool.

28th January, 1969

3 p.m. to 8 p.m. Large areas of aquatic vegetation, deep and shallow waters with rock, mud, and sand bottoms make this pool a very suitable environment for all the freshwater fishes collected from the Murchison River. The following fishes were observed :

A. caudavittatus	Yellowtail Trumpeter
T. unicolor	Spangled Perch
C. cuneiceps	Hardyhead
C. compressus	Carp Gudgeon
G. suppositus	Goby

Mullet were present in the pool but not collected. Large Yellowtail Trumpeter and Spangled Perch were observed at dusk, some examples at least 9 inches in length. Hardyheads were very abundant and were observed swimming in tight schools composed of hundreds of mature fish, all in a state of great activity as they were thrashing around at the surface. Some mature fish were captured by throw net and found to be full of ripe spawn. The behaviour of the fish suggests spawning activity, as recently hatched fry were observed near the pool banks.

Two freshwater tortoises were spotted in shallow water at night.

Station 5. P.W.D. Gauging Station. Permanent Pool.

28th January 1969

3.00 p.m. to 6.00 p.m. The small seine net was used to capture Yellowtail Trumpeter, Spangled Perch, Gobies and Hardyheads. No Carp Gudgeon or Golden Gudgeon were taken at this pool. The aquatic weed growth had been very prolific and due to the shallow depth (less than 5 feet) much of the vegetation had been exposed to high temperatures and was decomposing. The bottom of the pool was deep black mud.

Station 6. Murchison River Crossing. Area up river from Dam.

31 January 1969

6 a.m. to 11 a.m. Due to the large amount of broken bottles, tins and other rubbish discarded by campers and passing motorists, the larger nets were not used at this locality. Spangled Perch were numerous and many specimens were captured with the throw-net. Hardyhead and Gobies G. suppositus were also taken. Most notable was the apparent absence of the Yellowtail Trumpeter A. caudavittatus; none were observed although the related Spangled Perch were very common.

Conclusions

The Murchison River System supports a very interesting freshwater fish fauna which is predominantly northern in species composition. Two fishes are of particular scientific value; the endemic Hardyhead Craterocephalus cuneiceps, restricted to the Murchison system, and the Golden Gudgeon Eleotris aurea, previously believed to be confined to the Murchison River, although recent work has shown it to occur in the Gascoyne River system also.

The Murchison River is the most southern river to be inhabited by the Carp Gudgeon Carassiops compressus, and the most northern river in which the Black Bream Mylio butcheri is known to occur.

Where the river is restricted to isolated pools, large numbers of Mullet are trapped, and thus become quite vulnerable to net fishermen. Any netting of the pools will destroy some of the vegetation, and thus reduce the shelter so necessary to all young freshwater fishes, and will adversely affect the adult population of the Golden Gudgeon and the Carp Gudgeon.

Many of the pools within the Kalbarri National Park are now accessible to tourists, and some pools, particularly Bettie Crossing, have had portions of the foreshore vegetation uprooted by wild pigs which use the shallows of the pools to wallow in. Lockwood Springs contains a variety of habitats least affected by introduced animals and therefore should be given maximum protection to conserve the aquatic fauna of the region.

APPENDIX D

INSECTS AND OTHER TERRESTRIAL ARTHROPODS

by L.E. Koch, Curator of Entomology, W.A. Museum.

No attempt was made to collect insects and other terrestrial "arthropods" systematically but those specimens that members of the survey party came across were taken. The material contains many species previously recorded from the southern part of the south west province of W.A. but many of the other groups (particularly spiders - see R.J. McKay's report) are probably new. The collection shows obvious signs of the particular collecting methods used, e.g. very few Lepidoptera are present because systematic light trapping was not employed.

The following is a list of species. Dr. E.B. Britton, Division of Entomology C.S.I.R.O. Canberra, kindly identified the carabid species of Neocarenum and the Chrysomelid species of Carpophagus; the spiders are the subject of a separate report by Mr. R.J. McKay; all the other species were identified by Mr. Koch assisted by Miss Elizabeth Jefferys of the W.A. Museum.

KALBARRI SURVEY 1969 ARTHROPODS

	Locality (Area No. etc)	Number of Specimens Collected	Date
ORTHOPTERA			
Blattidae (Cockroaches)			
Polyzosteria mitchelli (Angas)	6	1	Jan-Feb. 1969
	2 (East)	2	17. 1. 1969
Anamesia polyzona (walk.)	Hawk's Head Lookout	3	6. 1. 1969
	10	1	3-5.2. 1969
Megazosteria patula (walk.)	6	3	Jan-Feb. 1969
	2	1	13. 1. 1969
	Junga Dam (area 7)	1	6. 1. 1969
Desmozosteria obscura Mackerras	4	1	12-17.1. 1969
	2 (East)	1	16-18.1. 1969
	6	2	Jan-Feb. 1969
	9	4	6. 1. 1969
	2	2	13. 1. 1969
Platyzosteria (Platyzosteria) invisa (Walk.)	9	1	6. 1. 1969
	6	1	Jan-Feb. 1969
nymph	6	1	21. 1. 1969
Mantidae (Preying Mantids)	Junga Dam (7)	1	6. 1. 1969
	6	2	Jan-Feb. 1969
	4	1	12-17.1. 1969
Tettigonidae (Long-Horned Grasshoppers)	Z-Bend	2	7. 1. 1969
Acridiidae (Short-Horned Grasshoppers)			
Goniaea sp.	2 (East)	1	Jan-Feb. 1969
	6	2	Jan-Feb. 1969
Gryllidae (Crickets)	8	2	27. 1. 1969
	6	1	Jan-Feb. 1969

HEMIPTERA			
Cicadidae (Cicadas)			
Kobonga umbrimargo (Walk.)	8	3	27.1.1969.
Macrotristra hillieri Distant	8	2	27.1.1969
	7	1	21.1.1969
	2 (East)	4	17.2.1969
Arenopsaltria fullo (Walk.)	1	1	3-5.2.1969
Reduvidae (Assassin Bugs)			
Ectomocorus truculentus Stal.	8	1	27.1.1969
Cydnidae (Burrower Bugs)			
Adrisa sp.	10	1	5.2.1969
NEUROPTERA			
Myrmeleontidae (Lace Wings)	2 (East)	2	17.2.1969
	14 mi. ESE of Kalbarri	1	21.1.1969
Stilbopterygidae (Shiny Wings)			
Stilbopteryx napoleo Lefebre	16 mi. NE of Kalbarri	2	27.1.1969
LEPIDOPTERA			
Cossidae (Wood Moths)	Taylor's Caravan Park, Kalbarri townsite	1	25.1.1969
Lasiocampidae (Eggar Moths)			
Entometa sp.	Taylor's Caravan Park	1	8.1.1969
Diptera			
Nycteribiidae (Bat Flies)			
Nycteribia (=Basilia, probably fulcozi (Musgrave))	2	5	21.1.1969

SIPHONAPTERA			
Pubicidae (Fleas)			
Xenopsylla sp.	5	1	10.1.1969
COLEOPTERA			
Carabidae (Ground Beetles)			
Gigadema bostocki Cast.	7	1	21.1.1969
	1	1	2.2.1969
Philoscaphus costalis Macl.	Lockwood Springs	1	2.2.1969
	6	1	Jan-Feb. 1969
Neocarenum simplex sl.	2 (East)	1	17.1.1969
	7	1	21.1.1969
	5	1	21.1.1969
Buprestidae (Jewel Beetles)			
Themognatha brucki Thos.	4	1	12-17.1.1969
	8	1	27.1.1969
Themognatha chalcodera Thos.	2 (East)	2	17.1.1969
	5	1	24.1.1969
Themognatha martini Saund.	Lockwood Springs	1	2.2.1969
	Kalbarri Townsite	1	30.1.1969
Themognatha bonvouloiri Saund.	7	1	21.1.1969
	7 (a)(P.W.D. Station)	2	23.1.1969
	6	1	Jan-Feb. 1969
	1	1	2.2.1969
Mirimna atrata Hope	Kalbarri Townsite	3	6.1.1969
	2 (East)	1	17.1.1969
Julodimorpha bakewelli White	4	1	12-17.1.1969
	Hawk's Head Lookout	1	6.1.1969
	Kalbarri Townsite	1	Jan-Feb. 1969

Curculionidae (Weevils)			
Macramycterus insignis (Ferg.)	5	3	21.1.1969
Macramycterus schonherri Hope	6	1	Jan-Feb.1969
Catasarcus carbo Pascoe	1	1	2.2.1969
Catasarcus impressipennis (Boisd.)	7(a) (P.W.D. Station)	1	23.1.1969
Leptopius colossus (Pascoe)	10	1	5.2.1969
Amycterinae	Lockwood Springs	1	2.2.1969
Scarabaeidae (Cockchafers, Dung Beetles)			
Melolonthinae			
Liparetrus sp.	10	1	5.2.1969
Pachytricha sp.	2 (East)	1	17.1.1969
	4	2	12-17.1.1969
	8	1	27.1.1969
	Junga Dam	1	6.1. 1969
	Taylor's Caravan Park, Kalbarri Townsite	1	8.1.1969
Cetoniinae			
Cetonia sp.	Kalbarri Townsite	1	Jan-Feb.1969
Dynastinae			
Semanopterus sp.	Taylor's Caravan Park	1	8.1.1969
Cerambycidae (Longicorn Beetles)			
Pachydissus sp.	8	4	27.1.1969
	7	1	21.1.1969
	10	2	2.2.1969
	Taylor's Caravan Park	1	8.1.1969
Prioninae			
Eurynassa australis Boisd.	1	2	2.2.1969
	10	2	5.2.1969

Elateridae (Click Beetles			
Agrypnus sp.	7(a) (P.W.D. Station	1	27.1.1969
	8	1	22.1.1969
Trogidae (Trox Beetles)			
Trox sp.	10	1	5.2.1969
Tenebrionidae (Tenebrionid Beetles)	10	2	5.2.1969
Chrysomelidae (Leaf Beetles)			
Paropsis sp.	2 (East)	1	17.1.1969
Carpophagus excavatus Baly	5	4	2.1.1969
Buprestidae (Jewel Beetles)			
Themognatha chevrolati Gehin	8	5	27.1.1969
	2(East)	1	17.1.1969
	2	1	17.1.1969
HYMENOPTERA			
Formicidae (Ants)			
Iridomyrmex detectus Sm.	7(a) (P.W.D. Station)	8	23.1.1969
Camponotus sp.	8	7	21.1.1969
	8	3	27.1.1969
Mutillidae (Solitary Ants)	Hawk's Head Lookout	1	6.1.1969
	2	1	13.1.1969
	7(a)(P.W.D. Station)	1	23.1.1969
Eumenidae (Mason Wasps)			
Epiodynerus tasmaniensis (Sauss.)	5	2	21.1.1969
Pomilidae (Spider Hunters)			
Salius sp.	9	1	10.1.1969
Andrenidae (Mining Bees)	8	4	21.1.1969
Sembicidae (Sand Wasps)			
Bembix raptor Sm.	7(a) (P.W.D Station)	3	23.1.1969
	10	10	3-5.2.1969

Sphecidae (Mud Daubers)			
Sceliphron laetum Sm.	2 (East)	1	16-18.1.1969
Sphex modestus Sm.	10	1	3-5.2.1969
Thynnidae (Flower Wasps)	Lockwood Springs	1	2.2.1969
Apidae (Hive Bees)	Lockwood Springs	1	2.2.1969
Apis mellifera L.	Lockwood Springs	1	2.2.1969
ARACHNIDA			
Scorpionidae (Scorpions)			
Urodacus yaschenkoi (Birula)	Meanarra Hill, 4 mi. E of Kalbarri (Area 6)	1	11.1.1969
	18 mi. N of Ajana	1	16-18.1.1969
	"	1	18.1.1969
Urodacus armatus Pocock	19 mi. E of Kalbarri	1	12-17.1.1969
	18 mi. N of Ajana	1	18.1.1969
Acarina			
Mesostigmata			
Dermanyssidae (Parasitic Mite)	5	4	12.1.1969
	8	2	29.1.1969
	16 mi. N.E. Kalbarri	4	30.1.1969
Acarina			
Ixodidae (Ticks)			
Amblyomma triguttatum Koch	9	5	10.1.1969
	5	1	2.1.1969

MYRIAPODA (Centipedes)			
Chilopoda			
Scutigeridae			
Scutigera sp.	7	1	21.1.1969
Scolopendridae			
Scolopendra morsitans L.	2 mi. along river track north of Kalbarri Townsite	1	7.1.1969
	Kalbarri Townsite	1	30.1.1969
	5	1	21.1.1969
	7(a) (P.W.D. Station)	1	23.1.1969
	8	1	27.1.1969
	1	1	Jan-Feb. 1969
	Wittecarra Gully (9)	3	9.1.1969
	10	3	3-5.1.1969
Ethmostigmus sp.	5		
	Wittecarra Gully (9)	7	9.1.1969

APPENDIX E

THE SPIDER FAUNA OF KALBARRI NATIONAL PARK

Introduction

As an adjunct of the fish survey, a number of spiders were collected at night employing head torches. Small collections were made also by members of the mammal survey team. The majority of the collections thus made have been identified, and are listed below.

A. Mygalomorph spiders (Trapdoor spiders)

Dekana diversicolor. A large black spider that was only collected on three occasions, in areas 10,2 (East) and 5, but is probably widespread in the Park. This record is the most northern one made to date.

Other mygalomorph spiders appeared to be rare; Cethegus, a small trapdoor spider was found under bushes in the park, but some suitable habitat outside the National Park had been destroyed by sheep settling down on the shady sides of bushes during the afternoon, thus disturbing the favoured sites for many trapdoor spiders.

B. Araneomorph spiders (Typical spiders)

Sparassidae (Huntsman spiders)

Heteropoda sp. collected in Area 4.

Delena cancerides - common, taken at Kalbarri townsite.

Clubionidae

Miturga sp. These large ground dwelling spiders were found on the littered banks of The Loop pool.

Argiopidae

Araneus sp. One species found on large webs constructed between trees. Area 8.

Nephila sp. These spiders were observed on their webs during the day; one collected. Area 1.

Zodariidae

Storena sp. Common on sandstone rocks throughout the Park.

Lycosidae (Wolf spiders)

These spiders were very common in the surveyed area, and as a systematic revision of this group is in progress, large collections were made. It is interesting to note that a number of undescribed species were found in the National Park; two species appear to be confined to the soils of the Murchison River areaas neither species was found in large collections made north of the National Park and south at Northampton. One species (C. below) has a very restricted distribution on the alluvial sands of the Murchison River bed.

Lycosa A. Paradise Flats, Bettie Crossing and The Loop areas. Found on open sand flats. Found also at Northampton. An undescribed species.

Lycosa godeffroyi. Common in the National Park. A large spider with a black ventral surface to the abdomen. Widespread in Western Australia, South Australia, Victoria and New South Wales.

Lycosa woodwardi. Bettie Crossing. The most northern locality for this Western Australian species.

Lycosa B. Paradise Flats, Bettie Crossing and the Loop. Found also at Northampton. An undescribed species.

Lycosa C. The Loop, P.W.D. Station. On alluvial river sands. An undescribed species possibly restricted to the Murchison River area.

Lycosa D. The Loop. Six specimens of this undescribed species were taken along the pool bank.

Lycosa E. The Loop and P.W.D. Station. This undescribed species was collected on fine grey clay-sands and appears to be restricted to the Murchison River Area.

Lycosa F. 11 miles south of Kalbarri, two specimens taken. An undescribed species.

Lycosa G. Nineteen specimens taken inside the National Park. An undescribed species.

Lycosa H. One specimen found on sandstone rubble - grey sand habitat near P.W.D. Station. An undescribed species.

At least ten species of Lycosid spiders are to be found within the National Park; eight of these are as yet undescribed, and further collecting will no doubt yield additional species, making the National Park a very important reserve for these unique Western Australian spiders.

APPENDIX F

Non-marine molluscs collected on the Kalbarri Survey

January - February 1969. Determinations by G.W. Kendrick. W.A. MUSEUM

6.1.69 Meannarra Hill — Bothriembryon cf. whitleyi Iredale

7.1.69 Murchison River - Z Bend Gorge - flood debris
Corbiculina sp.
Plotiopsis sp.
Stenomelania sp. - this single specimen is the first obtained from the Murchison River system.

11.1.69 Meanarra Hill — Bothriembryon cf. whitleyi Iredale - live specimen

14.1.69 Murchison River - bottom of Little Z Gorge
Corbiculina sp.
Plotiopsis sp.
hydrobiid, possibly Potamopyrgus sp.

31.1.69 Zuytdorp area, Melaleuca-Mallee, 924.5
Bothriembryon cf. minor Pilsbry

31.1.69 Murchison River, Lockwood Pool, 6" - 3' deep
Corbiculina sp.
Plotiopsis sp.

Most of the aquatic snails are northern forms. Bothriembryon is found predominantly in south western Australia.

TABLE 1a : MAMMAL TRAPPING RESULTS, PARTY A, KALBARRI NATIONAL PARK JAN - FEB, 1969

Area Number	Habitat	Dates	Trap Type	Number Set	Nights Set	Trap Nights	Catch by Genera: Pseudomys	Notomys	Mus	Rattus	Reptiles	Catch per 100 Trap Nights: All mammals	Pseudomys
9 ("W")	Cliff top: heath	8/1-12/1	Elliott *	4	3	12							
			Beak-back	1	3	3							
			Cage	1	3	1							
	Cliff top: Grevillea/heath	8/1-12/1	E.	10	4	40	3					7.5	7.5
			B.b	5	4	20	3					15.0	15.0
			C.	2	4	8							
	Cliff gorge: Mallee/ Melaleuca	8/1-12/1	E.	6	3	18							
			B.b	4	3	12							
			C.	1	3	3							
9 ("E")	Sand Plain: Grevillea/heath	8/1-12/1	E.	30	4	119**					1		
			B.b	14	4	56	8				1	14.3	14.3
			C.	0	0	0							
	Wittecarra Gully, Sedge	8/1-12/1	E.	15	3	45		2				4.4	
			B.b	7	3	20**		1		1		10.0	
			C.	2	3	6							
	" ; Melaleuca / Sedge	8/1-12/1	E.	15	3	45		2				4.4	
			B.b	6	3	18		3				16.7	
			C.	2	3	6							
	" : Grevillea /Sedge	8/1-12/1	E.	12	3	36		1				2.8	
			B.b	3	3	9		2				22.2	
			C.	4	3	12							
2 ("W")	Sand Ridge: Banksia/heath	13/1-16/1	E.	35	3	89**					1		
			B.b	18	3	46**							
			C.	3	2	6							
	Malley/heath near Sand Ridge	13/1-16/1	E.	10	3	30	1					2.4	2.4
			B.b	5	3	15							
			C.	1	2	2							
	Banksia/ Calothamnus	13/1-16/1	E.	20	3	60							
			B.b	10	3	30							
			C.	4	2	8							
	Mallee/heath near camp	13/1-16/1	E.	10	3	30							
			B.b	5	3	15		1				6.7	
			C.	3	1	6							

* Metal box traps, including "Sherman" model.

** One or more, not set one night.

TABLE 1a (Continued)

Area Number	Habitat	Dates	Trap Type	Number Set	Nights Set	Trap Nights	Catch by Genera Pseudomys	Notomys	Mus	Rattus	Reptiles	Catch per 100 trap Nights All mammals	Pseudomys
2 ("E")	York Gum Woodland	16/1-17/1	E.	0	0	0							
			B.b	39	1	39							
			C.	11	2	22							
5	Banksia/ heath, low sandridge	20/1-24/1	E.	10	4	40							
			B/b	5	4	20							
			C.	2	2	6							
	Creek bed towards high sandridge.	20/1-24/1	E.	40	4	150**			2			1.3	
			B.b	15	5	50**	1					2.0	2.0
			C.	5	3	15							
	Mallee	20/1-24/1	E.	10	4	40							
			B.b	5	4	20							
			C.	0	0	0							
	Banksia/ Xylomelum heath	20/1-24/1	E.	10	4	40							
			B.b	5	4	20							
			C.	0	0	0							
	Rocky areas near Mt. Curious	20/1-24/1	E.	10	2	20							
			B.b	5	2	10							
			C.	0	0	0							
	Banksia near Mt. Curious	20/1-24/1	E.	10	2	20							
			B.b	5	2	10							
			C.	2	2	4							
1	Sandplain heath	3/2-6/2	E.	15	3	45							
			B.b	8	3	24							
			C.	3	3	9							
	Banksia/ Dryandra	3/2-6/2	E.	30	3	90	1					1.1	
			B.b	16	3	48		1			3	2.1	
			C.	6	2	18							
	Acacia	3/2-6/2	E.	30	3	88**					1		
			B.b	16	3	48	2		1			7.0	4.2
			C.	5	3	15							

TABLE 1 b: MAMMAL TRAPPING RESULTS, PARTY B, KALBARRI NATIONAL PARK JAN. - FEB. 1969

Area Number	Habitat	Dates	Trap Type	Number Set	Nights Set	Trap-Nights	Catch by Genera: Pseudomys	Notomys	Mus	Rattus	Peptiles	Catch per 100 trap-nights: All Mammals	Pseudomys
6	Hilltop:	9.1-12.1	E	79	2	158							
	Acacia/Mallee		B.b	21	4	84		1				1.2	
			C	4	4	16							
	Lower slope:	9.1 - 12.1	E	39	2	78							
	Melaleuca/		B.b	0									
	Casuarina		C	4	4	16							
	Lower slope:	10.1-12/1	E	20	3	60	1	1				3.4	1.7
	Banksia/		B.b	19	3	57	11					19.3	19.3
	Acacia		C	4	3	12							
	Roadside:	10.1-12.1	E	30	3	90	5		1			6.7	5.6
	Grevillea/		B.b	0									
	sandplain		C	0									
4	Sandridge to	14.1-16.1	E	40	3	120							
	top of gorge		B.b	19	3	58	1					1.7	1.7
	Banksia/		C	0									
	Xylomelum												
	Re-entrant	15.1-16.1	E	23	2	46			1			2.2	
	Gully: Acacia/		B.b	20	2	40							
	Grevillea		C	0									
	Top of Gully	15.1-16.1	E	10	2	20							
	Xylomelum/		B.b	9	2	18							
	Acacia		C	0									
2 ("E")	Mallee/Acacia	17.1. -18.1	E	10	2	20							
	Casuarina		B.b	10	2	20							
	(red sand)		C	10	2	20							
	Mallee/	17.1-18.1	E	10	2	20							
	Sand plain		B.b	10	2	20							
			C	0									
	Callitris/	17.1 - 18.1	E	30	2	60							
	sand plain		B.b	12	2	24			1			4.2	
	(some Mallee		C	0									
7	Melaleuca/	21.1.	E	0									
	Acacia		B.b	40	1	40	2					5.0	5.0
			C	5	1	5							

TABLE 1b (Continued)

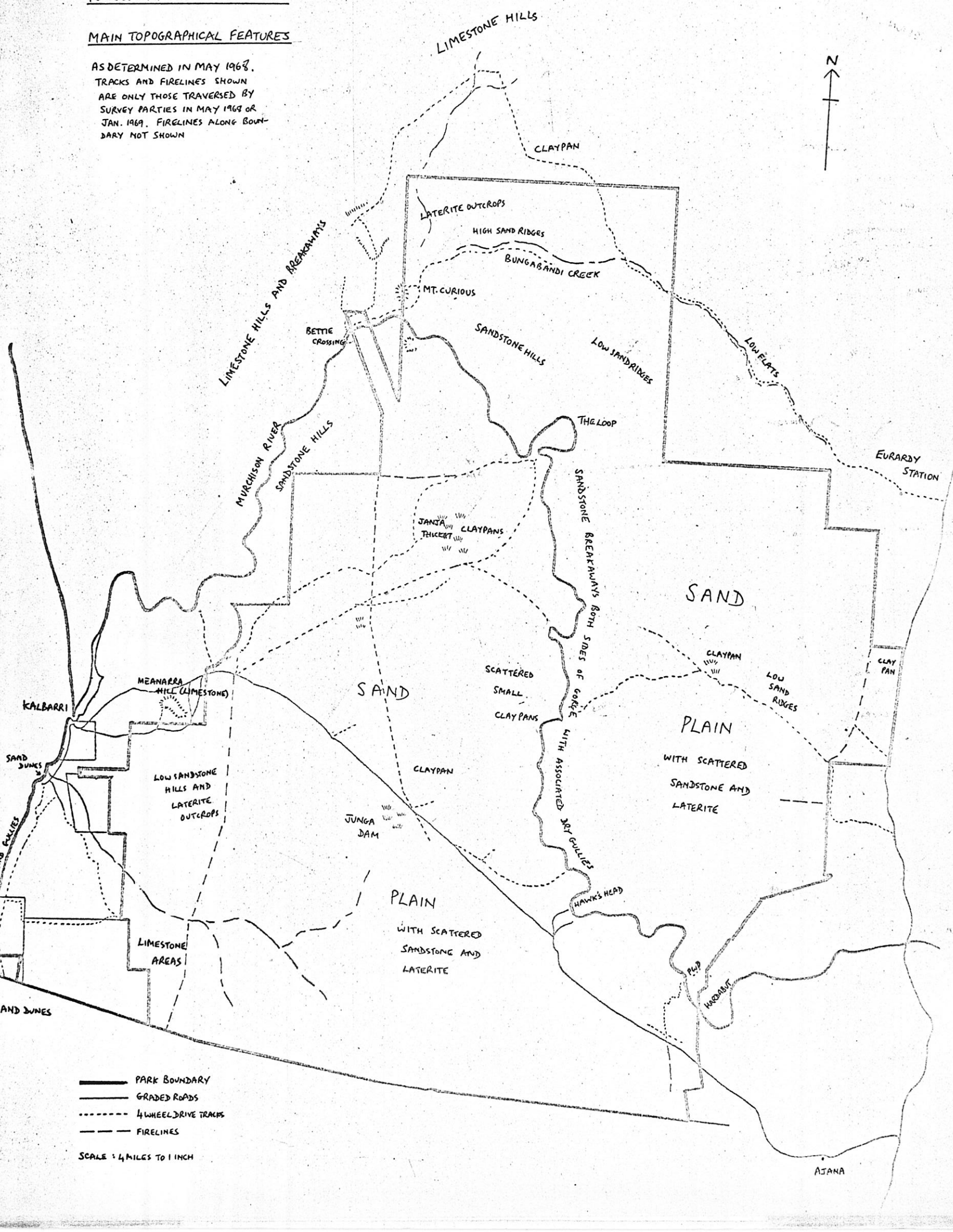
Area Number	Habitat	Dates	Trap Type	Number Set	Nights Set	Trap-Nights	Catch by Genera: Pseudomys	Notomys	Mus	Rattus	Reptiles	Catch per 100 trap-nights: All mammals	Pseudomys
7(a)	Acacia/ Mallee	23.1-24.1.	E	80	2	160			1			0.6	
			B.b	40	2	80							
			C	12	1	12							
8	Sandplain: Mallee/ Melaleuca Junction	27.1-30.1.	E	27	3	81	1					1.2	1.2
			B.b	13	3	39	3					7.7	7.7
			C	9	3	27							
	Melaleuca/ York Gum	27.1-30.1.	E	53	3	159							
			B.b	17	3	51							
			C	9	3	25**							
10	Dunes: Acacia/ Melaleuca	3.1.-6.1	E	60	4	220**	1		1			1.0	0.5
			B.b	40	4	121**	1	1	2			3.3	0.8
			C	0									
	Red sand (R.P.F.) Acacia	4.1.-6.1.	E	30	3	90							
			B.b	13	3	39		1				2.6	
			C	0									

MAP 1

KALBARRI NATIONAL PARK

MAIN TOPOGRAPHICAL FEATURES

AS DETERMINED IN MAY 1968. TRACKS AND FIRELINES SHOWN ARE ONLY THOSE TRAVERSED BY SURVEY PARTIES IN MAY 1968 OR JAN. 1969. FIRELINES ALONG BOUNDARY NOT SHOWN

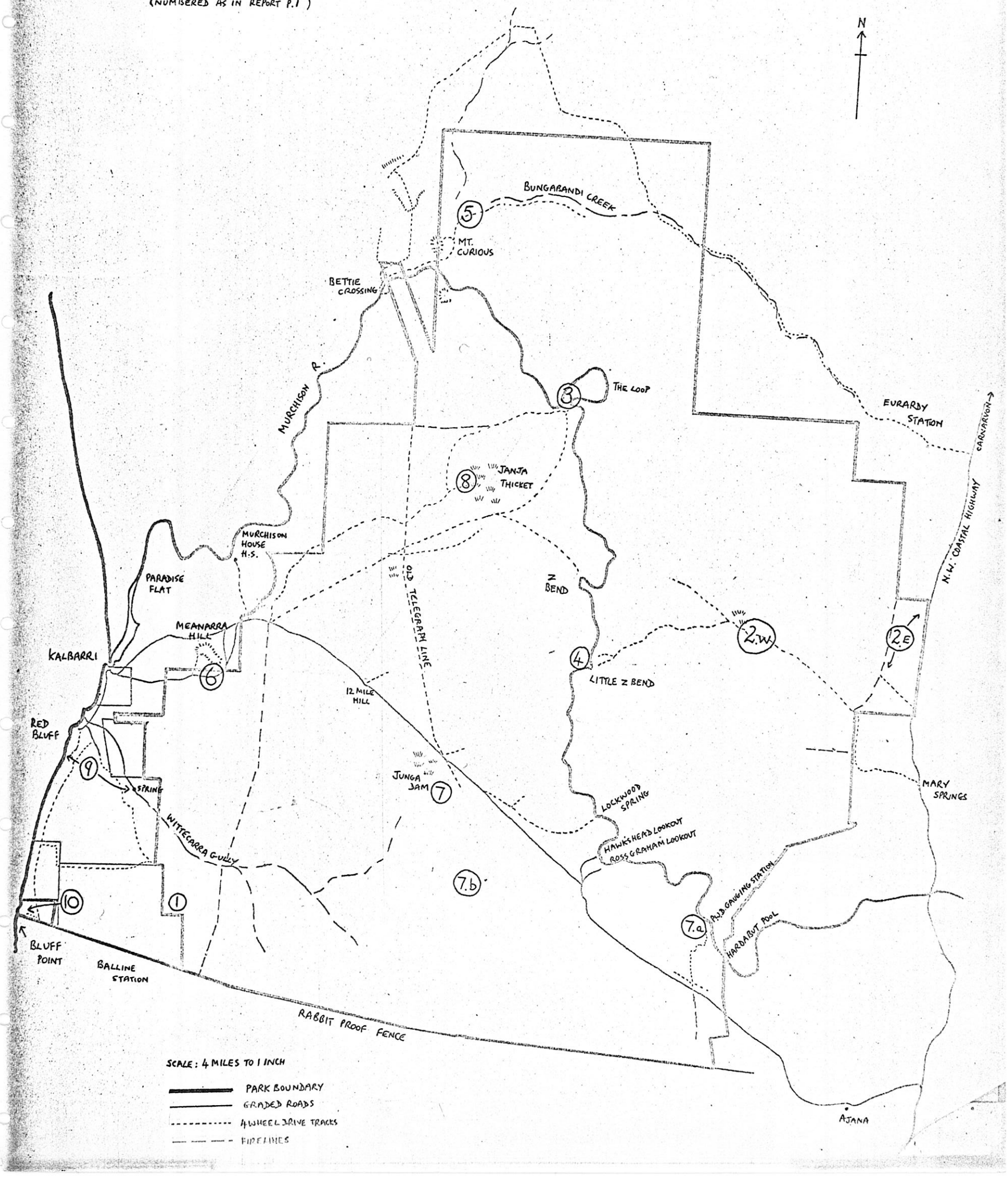


MAP 2

KALBARRI NATIONAL PARK

AREAS SELECTED FOR INTENSIVE SURVEY

(NUMBERED AS IN REPORT P.1)



KALBARRI NATIONAL PARK MAP 3

AREA AFFECTED BY FIRE,
JANUARY 1969
FROM MAP PREPARED BY PARK
RANGER, R. GLIDDON.