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A Biological Survey of
**THE DRYSDALE RIVER
NATIONAL PARK**

North Kimberley,
Western Australia

in
August, 1975

EDITED BY
E. D. Kabay
and
A. A. Burbidge
1977



WESTERN AUSTRALIAN
WILDLIFE RESEARCH CENTRE
DEPARTMENT OF FISHERIES AND WILDLIFE
PERTH, WESTERN AUSTRALIA

This biological survey was conducted by staff of:

THE WESTERN AUSTRALIAN WILDLIFE RESEARCH CENTRE

THE WESTERN AUSTRALIAN MUSEUM

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**THE WESTERN AUSTRALIAN DEPARTMENT OF FISHERIES AND
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P.O. BOX 51, WANNEROO W.A. 6065**

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PREVIOUS PUBLICATIONS:

- No. 1. Fauna Conservation in Western Australia, 1956. (Out of print)
- No. 2. Bernier and Dorre Islands, 1962. (Out of print).
- No. 3. Prince Regent River Reserve—A Biological Survey, 1974.
- No. 4. The Management of the Emu, 1975.
- No. 5. Wildlife of some Reserves in the Great Victoria and Gibson Deserts, 1976.

A BIOLOGICAL SURVEY OF THE DRYSDALE RIVER NATIONAL PARK, NORTH KIMBERLEY, WESTERN AUSTRALIA, IN AUGUST 1975

E. D. Kabay and A. A. Burbidge, Editors (W.A. Wildlife Research Centre, P.O. Box 51, Wanneroo, W.A. 6065). Contains papers by I. F. B. Common and M. S. Upton (C.S.I.R.O. Division of Entomology, P.O. Box 1700, Canberra City, A.C.T. 2601); F. G. Smith (National Parks Authority of W.A., Hackett Drive, Crawley, W.A. 6009); A. S. George and K. F. Kenneally (W.A. Herbarium, George Street, South Perth, W.A. 6151); A. Chapman, J. Dell, J. B. Hutchins, R. E. Johnstone, H. E. Merrifield, S. M. Slack-Smith, L. A. Smith, G. M. Storr and B. R. Wilson (W.A. Museum, Francis Street, Perth, W.A. 6000); and A. A. Burbidge, P. J. Fuller, E. D. Kabay, N. L. McKenzie and W. K. Youngson (W.A. Wildlife Research Centre, P.O. Box 51, Wanneroo, W.A. 6065).

During August 1975, a biological survey of the Drysdale River National Park was carried out by staff of the Western Australian Wildlife Research Centre, the Western Australian Museum, the Western Australian Herbarium and the C.S.I.R.O. Division of Entomology.

The Park includes a cross section of the main geological formations of the north Kimberley, although laterites are poorly represented.

Biologically it is intermediate between the sub-humid north-west Kimberley and the semi-arid east Kimberley. The vegetation is predominantly low open-forest, low woodland and low open-woodland but there are small areas of low closed-forest and just outside the Park an area of tall closed-forest.

The list of plants contains 594 taxa, including 25 ferns and 537 flowering plants. Thirty-four taxa, including 8 genera, are new records for Western Australia. The discovery of *Rapanea* is of particular interest.

The mammal collection of 28 native species includes three bats, *Nyctophilus arnhemensis*, *N. bifax* and *N. walkeri*, not before recorded in Western Australia. The bird and reptile faunas are intermediate between those of the north-west and east Kimberley, although many species are shared by all three areas. There is a rich tree-frog fauna of 10 species. Twenty-six species of freshwater fish were recorded, the richest known in the Kimberley. The molluscs include a number of arboreal and freshwater, as well as terrestrial, species. The insect collection contains some 2 415 species but the lack of collections from much of the Kimberley makes interpretation difficult.

Recommendations are made to enlarge the Park slightly, firstly by including parts of a stock route which at present divides it in two and secondly by including the unique area of tall closed-forest.

PART I

HISTORY OF THE DRYSDALE RIVER NATIONAL PARK

by A. A. BURBIDGE¹

EXPLORATION

The Drysdale and Carson Rivers were named by C. A. Burrowes, Surveyor for the Victoria Squatting Company, in 1886. The Carson River was named after David Carson, a Director of the Victoria Squatting Company which leased land in the vicinity of the Carson River. The Drysdale was named after a J. A. Drysdale of Melbourne and presumably he too was involved with the Squatting Company. Burrowes explored the country west of Cambridge Gulf to Mt Bradshaw (Tomlin and Cleave 1966) and he may have been the first European to visit the area now included in the Drysdale River National Park.

The next Europeans to visit the area were members of the Brockman Exploring Expedition of 1901 (Brockman 1902). Brockman traversed the Park southwards along the Drysdale River during October and November 1901 and his campsites FB89 to FB95 were in the Park. His camp 93 coincided with Crossland's (his second-in-command) Camp 41. From here Brockman travelled south-easterly along Tadarida Creek to Tadarida Scarp and thence southwards to Banko Creek and out of the Park.

Crossland, who led a second party, entered the Park on two occasions, and his camps C37 to C44 were in the Park. He was accompanied during this part of the exploration by Dr. F. M. House who acted as naturalist to the Expedition. Crossland's party travelled northwards from the point on the Drysdale where

Crossland Creek enters, along the east side of the Ashton Range to Latitude 15°S. After going westward to the Carson Escarpment he turned eastward to the Drysdale River and then southward, following the river. Crossland's Camp C38 was very close to our site A4. In 1903 the surveyor A. H. Salmond traversed parts of the Park on two occasions during a trip which started and finished at Napier Broome Bay. He entered the Park near the point where Palmoondoora Creek leaves it. He then journeyed south-eastwards to the Carson River and southward along it to the Foster Range, continuing southward over the Creek near Old Doongan homestead (Old Doongan Creek) and across Crossland Creek before turning eastward, crossing the Drysdale and turning north at Dampier Creek. His northward track passes through the Park between the Drysdale and the Carson Escarpment.

The next visitors to the Park were members of an expedition led by C. P. Conigrave in 1911-12. Conigrave was a member of the Royal Australian Ornithologists Union and an account of his expedition can be found in the journal *Emu* (Anon. 1912). Conigrave passed through the Park on his return to Wyndham from the "Napier Broome Mission Station" (the old Pago Mission to the northeast of the present mission at Kalumburu). They entered the Park near Dysphania Gorge but on the opposite side of the Drysdale and then travelled eastward and south-eastward towards Wyndham.

The Kimberley Expedition of 1921 passed southward along the Carson River en route from the "Drysdale Mission" (again the old Pago Mission) to Derby (Easton

¹ Western Australian Wildlife Research Centre, Department of Fisheries and Wildlife, P.O. Box 51, Wanneroo, W.A. 6065.

1922). A member of this expedition was the well known botanist C. A. Gardner who later published a work on the flora collected during the trip (Gardner 1923).

The last documented visit was that of the North Kimberley Survey and Mapping Expedition, 1954 (Morgan 1955). This expedition conducted detailed surveys and prepared a general land classification of the central north Kimberley. They also constructed the first vehicular track from Gibb River Station to Kalumburu. During this expedition Morgan discovered the falls which now bear his name.

ESTABLISHMENT OF THE PARK

The Drysdale River National Park was gazetted by notice published in the *Government Gazette* of 27 September 1974. The reserve (No. 32853) was for the purpose of "National Park" and was classified "Class B". The National Parks Board of Western Australia (now the National Parks Authority) was appointed Board of Control under the Parks and Reserves Act, 1895. The Park is of 424 342.652 ha.

The first proposals for a reserve in the area came from Mr J. S. Morgan (now the Surveyor General of W.A.) in 1955. The Park with its present boundary was recommended by the Western Australian Sub-committee of the Australian Academy of Science Committee on National Parks (Anon. 1962). The sub-committee recommended that the area be made a National Park and selected it as containing land typical of the northern savannah formations of tropical Australia. Although both the National Parks Board and the Department of Fisheries and Wildlife requested that the area be set aside as a reserve, nothing further eventuated until 1969 when the Government appointed a Reserves Advisory Council. After some members of the Council inspected the reserve, partly by air, and partly on the ground in the vicinity of the Carson River at Cherin-goomeerie Pool, it recommended to the Minister for Lands that the area be reserved for "National Park, Conservation of Flora and Fauna and Protection of Aboriginal Sites". The reasons for this and the conditions of vesting in the National Parks Board were the same as those in the recommendation covering the Prince Regent River Nature Reserve (Burbidge 1975, p. 9). However, this recommendation of the Reserves Advisory Council was not accepted by Cabinet, mainly because of the objections of the Mines Department that the area was prospective for uranium and diamonds. In 1972 the newly created Environmental Protection Authority set up a Conservation Through Reserves Committee to recommend a State-wide system of conservation reserves. The Drysdale River area was one

of the first considered by the Committee and in April 1973 the Authority endorsed its recommendation that the area be made a Class A reserve for National Park. Negotiations with the Mines Department finally resulted in the Class B status being adopted.

BACKGROUND TO THIS EXPEDITION

Since 1971 the Department of Fisheries and Wildlife has organised a series of biological surveys in the north-west Kimberley (see Burbidge 1975). Following the successful outcome of the survey of the Prince Regent River Nature Reserve (Miles and Burbidge 1975) the participating organisations decided to continue their work with a survey of the Drysdale River National Park in the north Kimberley.

Accordingly requests were made for funds to the Western Australian Government (through the Department of Fisheries and Wildlife and the National Parks Board of Western Australia) and the Australian Biological Resources Study Interim Council. The latter body was unable to find the full amount requested and forwarded the application to the Department of Environment (now the Department of Environment, Housing and Community Development) which was able to make up the balance.

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PART II

NARRATIVE OF THE SURVEY OF THE DRYSDALE RIVER NATIONAL PARK

by E. D. KABAY¹

THE SURVEY

The biological survey of the Drysdale River National Park began when E. D. Kabay, T. Evans and H. G. Hall left the W.A. Wildlife Research Centre at Wanneroo with supplies and equipment. Driving a long-wheel base Landrover and a five tonne truck with trailer, they arrived at Old Doongan, the Base Camp, for the expedition on Sunday, 27 July.

Following study of aerial photographs, an initial air reconnaissance over the park was made by A. A. Burbidge in September 1974, to ascertain the type of terrain in the area and the possible location of the survey sites and base camp. Old Doongan homestead was found to be close to the park and to be superficially in reasonable shape. Subsequent enquiries to the managers of the station, Australian Agricultural Consulting and Management Co. Pty. Ltd., seeking permission to use the old homestead and seeking information on the state of the road to the station and its airstrip, received favourable replies. A. A. Burbidge made a second air reconnaissance over the park and visited Old Doongan in June 1975. The condition of the homestead was determined and arrangements were made with the manager of the station, Mr. Tony Doyle, for the airstrip to be regraded and for fresh meat to be supplied to the team during the survey.

In some ways the current survey was to be easier than the preceding Prince Regent River Reserve (Miles and Burbidge 1975). Firstly, the Prince Regent trip provided the necessary experience of running a major expedition using a helicopter as a means of transport. Secondly, unlike the Prince Regent survey, where Beverley Springs Station, the base camp, was 85 km from the border of the reserve, Old Doongan was only 5 km from the Park. However, because of the impassibility of the north/south running Carson Escarpment and the Ashton Ranges, a helicopter was still required.

Old Doongan, the second of three homesteads built on Doongan Station, had not been occupied since 1969. With the aid of A. A. Burbidge, who had been picked up at Derby on the way through, the five days following July 27, were spent removing evidence of cattle habitation and repairing the flywire screening, electrical wiring and plumbing and connecting up the water from the creek to the homestead. By the time the chartered MacRobertson-Miller Airlines Twin Otter aircraft from Derby landed bringing the main survey party, Old Doongan was ship-shape.

On the morning of the day the rest of the team flew in, A. A. Burbidge, E. D. Kabay and T. Evans conducted a brief survey of the sites in the helicopter. Sites A4 and A3 were shifted slightly nearer to water and a better helicopter landing place. Site B3 was shifted 15 km north of its original site onto Johnson Creek, a more rugged and interesting place. During the first supplementary survey by A. A. Burbidge and A. S. George to

Cape Londonderry, the helicopter landed at Solea Falls (Plate 3). Several rock wallabies were seen and one was collected. Because of the interesting nature of the immediate surrounding area, the B4 site was shifted to this location from 40 km south. All other sites were found to be suitable and no alterations were made to their location. The selection of the survey sites, their numbering and duration of occupancy were similar to the previous expedition (Miles 1975). The only major changes in the general format of the survey were to allow a botanist to visit each site for up to 3 days, and to locate Team 1 on water. As well, supplementary one-day surveys for each of the specialist groups were to be conducted in between resupply and shift days.

The sites were designated A1 to A4, B1 to B4 and C1 to C5. Application was made to the Nomenclature Advisory Committee of the Department of Lands and Surveys to name various features associated with these and other sites. Attempts were made through the efforts of Dr. Ian M. Crawford, Head of Division of Human Studies in the W.A. Museum, to obtain authentic local aboriginal names for the various physical features in the Park. However, these efforts were unsuccessful and biological names suggested by members of the survey team were put to the Nomenclature Committee. The names adopted have been listed in Table 1.

The survey party consisted of the following personnel who were responsible for their own particular speciality: A. S. George and K. F. Kenneally—plants; N. L. McKenzie, A. Chapman, A. A. Burbidge, W. K. Youngson and E. D. Kabay—vertebrates, especially mammals; J. Dell, R. E. Johnstone and P. J. Fuller—vertebrates, especially birds; L. A. Smith—vertebrates, especially reptiles and frogs, J. B. Hutchins—fishes, B. R. Wilson and S. M. Slack-Smith—molluscs; I. F. B. Common and M. J. Upton—insects; F. G. Smith—vegetation mapping; J. Henry—Technical Officer at Base Camp and H. G. Hall—truck driver, cook and general rouseabout. E. D. Kabay and A. A. Burbidge shared Base Camp co-ordination with field duties.

People in the various teams were:

Team 1—E. D. Kabay/A. A. Burbidge, I. F. B. Common, M. J. Upton, J. B. Hutchins, P. J. Fuller and B. Wilson.

Team 2—N. L. McKenzie, J. Dell and S. M. Slack Smith.

Team 3—W. K. Youngson and L. A. Smith.

Team 4—A. Chapman and R. E. Johnstone.

The location of the teams at different times is given in Table 2.

A. S. George and K. F. Kenneally alternated between Team 1 and 4, and 2 and 3 respectively. Their location at various times is given in Table 3.

Details of the supplementary surveys are given in Table 4. The helicopter used was a Bell Jet Ranger owned by Bristow Helicopters Pty. Ltd. The helicopter was ably

¹ Western Australian Wildlife Research Centre, Department of Fisheries and Wildlife, P.O. Box 51, Wanneroo, W.A. 6065.

TABLE 1
NAMES ADOPTED FOR FEATURES IN THE PARK

Site	Name	Origin
A1	Mogurnda Creek	After <i>Mogurnda mogurnda</i> , a freshwater fish common in the Creek.
A2	Tadarida Scarp	After <i>Tadarida loriae</i> , (Little Northern Scurrying Bat). The only specimen of this species was collected at this site.
	Tadarida Creek	
	Lorikeet Creek	
	Boiga Falls	The Varied and Red-collared Lorikeets (<i>Psitteuteles versicolor</i> and <i>Trichoglossus haematodus rubritorquis</i>) were very common at this site.
A3	Pseudomys Hills	After <i>Boiga fusca</i> (Brown Tree Snake).
A4	Dromaius Creek	An undescribed species of <i>Pseudomys</i> (Native Mouse) was found at this site.
B1	Glider Gorge	After <i>Dromaius novaehollandiae</i> (Emu) which was common in the area.
	Orchid Creek	A very distinctive feature in the Carson Escarpment. After the Sugar Glider (<i>Petaurus breviceps</i>).
	Dulcis Falls	After the Orchid <i>Dendrobium dicuphum</i> which was common at this site.
B2	Nymphaea Creek	After <i>Malurus dulcis rogersi</i> , the beautiful Lavender Flanked Wren found in the Gorge.
	Finches Creek	After the large purple water lily of the genus <i>Nymphaea</i> which was found in the creek.
B3	Cracticus Falls	At this site 6 different species of finches were observed.
	Petrogale Gorge	After the Silver-backed Butcher bird (<i>Cracticus torquatus argenteus</i>) seen at this site.
B4	Solea Falls	After the Short-eared Rock Wallaby, <i>Petrogale brachyotis</i> , seen in the gorge.
	Petrophassa Creek	Solea is Latin for horseshoe which describes the shape of the falls.
C1	Elasmias Creek	After the White-quilled Rock Pigeon, <i>Petrophassa albipennis</i> which was common in the area.
	Elasmias Falls	A large number of aboriginal snails of the genus <i>Elasmias</i> were found amongst the vine thickets that lined the creek.
	Christella Falls	After the fern <i>Christella dentata</i> which had not previously been recorded from W.A.
	Colochasia Creek	A large number of the uncommon aroid <i>Colochasia antiquorum</i> were found along the creek.
C2	Euro Gorge	Euros (<i>Macropus robustus</i>) were observed in the general area.
C3	Planigale Creek	The only specimen of <i>Planigale maculata</i> (a carnivorous marsupial mouse) was found at this site.
C4	Carlia Creek	After <i>Carlia johnstonei johnstonei</i> a species of skink common in the area.
	Coucal Gorge	The Pheasant Coucal, <i>Centropus phasiantrus macrourus</i> was observed at this site.
C5	Robin Gully	Only locality where the Buff-sided Robin, <i>Poecilodryas superciliosa cerveniventris</i> was found.
	Schizaea Creek	The fern <i>Schizaea digitata</i> was found at this site. It is the first record of the species for W.A.
	Dysphania Gorge	The large orange coloured moth (see plate 10) <i>Dysphania fenestrata</i> was found here.
	Forest Creek	The only locality in the Park where a tall closed-forest grows.
	Galaxy Swamp	C5A. Hence its name.
Base Camp	Old Doongan Creek	After the Old Doongan Homestead, the expedition's base camp.

TABLE 2
LOCATION OF TEAMS

Team	Dates	Location
Team 1	3/8/75 - 9/8/75	A1
	9/8/75 - 16/8/75	B1
	16/8/75 - 22/8/75	C1
	18/8/75 - 22/8/75	C5
(Common, Upton and Hutchins only at C5)		
Team 2	3/8/75 - 9/8/75	A2
	9/8/75 - 15/8/75	B2
	15/8/75 - 22/8/75	C2
Team 3	3/8/75 - 9/8/75	A3
	9/8/75 - 15/8/75	B3
	15/8/75 - 22/8/75	C3
Team 4	3/8/75 - 9/8/75	A4
	9/8/75 - 15/8/75	B4
	15/8/75 - 22/8/75	C4

piloted by Joe Ward and serviced by engineer Paul Richardson. The Bell Jet Ranger was smaller than the Alouette III which was used on the Prince Regent Survey, but the main problem was not the weight of the supplies and equipment but rather their bulk. Maximum payload with full fuel tanks was 250 kg with an endurance of 2½ hours and a maximum speed of 85 knots. Because turbine powered helicopters develop maximum power

under cool environmental conditions, the flight schedule was arranged so that the helicopter flew in the morning as much as possible.

As with the previous survey all supplies were prepacked at Wanneroo. Fuel was carted by contract from Derby and left next to a steep banked creek about 40 km from Old Doongan. The Department of Fisheries and Wildlife's four-wheel-drive truck was used to haul the fuel the rest of the way to Base Camp. Arrangements were made to have the mail plane from Wyndham deliver mail and fresh vegetables to Old Doongan on its regular weekly run.

Dr. B. R. Wilson and Mrs. S. M. Slack-Smith were programmed to arrive at Old Doongan on 9 August and to be placed in the field the next day but were delayed by a pilot's strike and were not flown out to join their teams until 13 August. Thus 13 people were maintained in the field during the first week and 15 in the second and third weeks. Dr. F. G. Smith arrived on 17 August and operated from Old Doongan.

All shifts and resupplies were accomplished in one day except for the shift to C sites. In this case Team 1 had to be shifted a day later. On 18 August part of Team 1 was transferred to C5 due to the area around C1 being burnt out shortly after the team's arrival there. The rest of the team remained at C1.

During the survey, Base Camp was visited by the noted wildlife photographer, Michael Morcombe, and his colleague Malcolm Lewis. An opportunity was taken during the supplementary entomological survey to fly

TABLE 3
LOCATION OF BOTANISTS

Dates	A. S. George	K. F. Kenneally
3/8/75 - 6/8/75	A4	A2
6/8/75 - 9/8/75	A1	A3
9/8/75 - 12/8/75	B1	B3
12/8/75 - 15/8/75	B4	B2
15/8/75 - 18/8/75	C4	C2
18/8/75 - 22/8/75	C1	C3

them into the Park to take photographs of various features for the National Parks Authority and the Department of Fisheries and Wildlife. As well, they took pictures of some of the more interesting specimens caught during the survey. Some of their photographs are published in this report.

ACKNOWLEDGEMENTS

On behalf of all members of the survey the author expresses appreciation for the assistance and cooperation given by Mr and Mrs A. Doyle of Doongan Station, Mr M. Gugerl of Gugerl Transport, Derby and the staff of Bristow Helicopters Pty. Ltd.—particularly Joe Ward and Paul Richardson. Appreciation is also extended to the Amax mining company, the owners, and Australian

Agricultural Consulting and Management Co. Pty. Ltd., the managers of Doongan Station, for permission to use the Old Doongan homestead. We also thank Mr T. Evans and Mr A. Mangini who assisted with the loading and driving of the truck.

Special thanks go to Mr H. G. Hall for his hard work, fine cuisine and ready humour, without which the expedition would have been the poorer.

This study would not have been possible without the financial assistance of the Commonwealth Department of Environment, Housing and Community Development, the Australian Biological Resources Study, the National Parks Authority of Western Australia and the Western Australian Department of Fisheries and Wildlife.

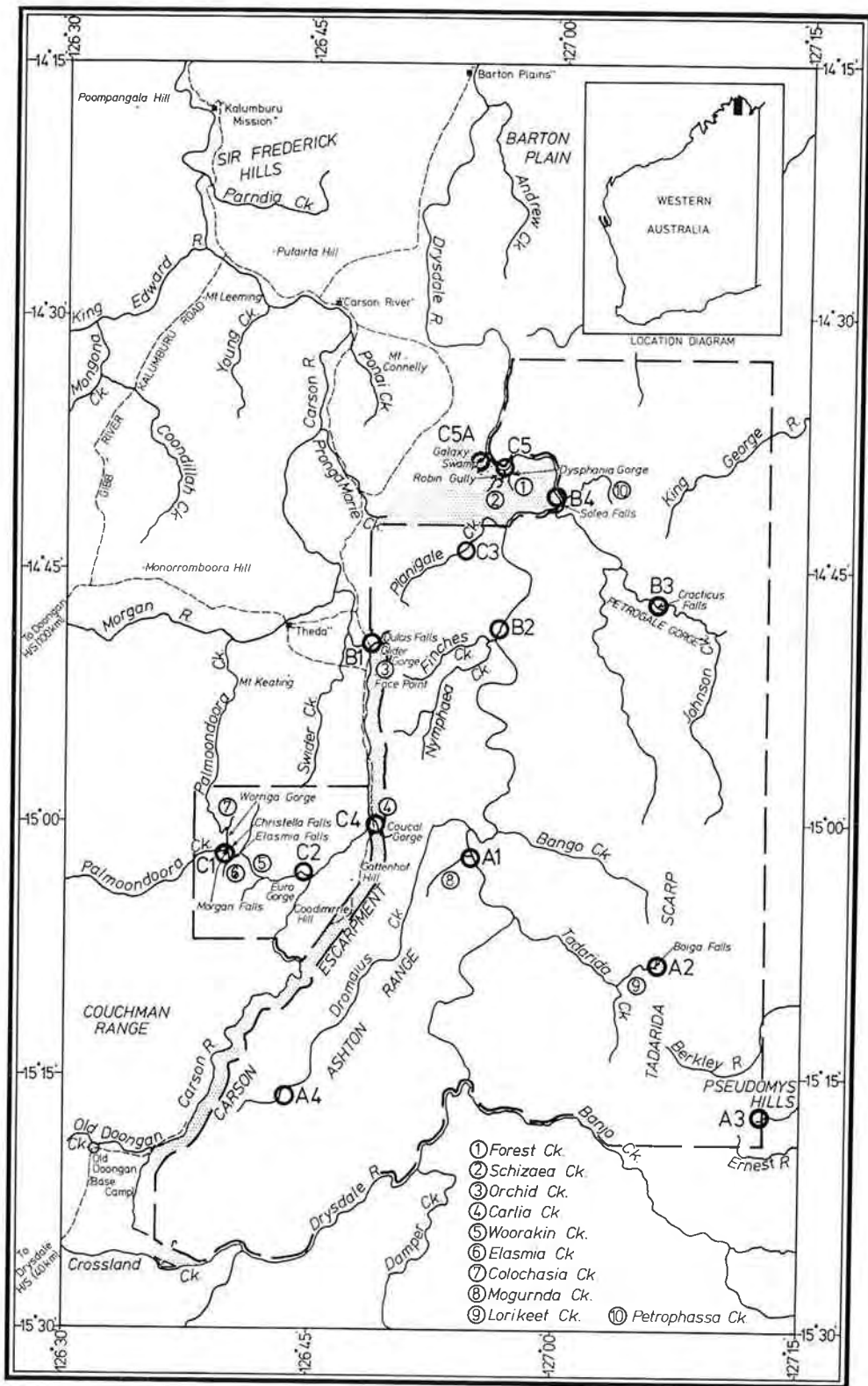
The Department of Lands and Surveys drew the map for Figure 1.

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TABLE 4
SUPPLEMENTARY SURVEYS

Date	Sites Visited	Purpose	Personnel
5/8/75	Drysdale River at B4 Cape Londonderry area	Collection of plants and animals General survey of area	A. A. Burbidge A. S. George
7/8/75	(a) North-west Gully 14°34'S, 127°02'E (b) Upper Berkeley River 15°06'S, 127°14'E (c) Upper King George River 14°37'S, 127°14'E	Birds	L. A. Smith R. E. Johnstone
10/8/75	(a) Upper King George River 14°37'S, 127°14'E (b) Berkeley River 15°11'S, 127°13'E	Fish	J. B. Hutchins A. Chapman
13/8/75	(a) North-west Gully 14°34'S, 127°02'E (b) Southern Ashton Range 15°11'S, 126°48'E	Snails	B. R. Wilson S. M. Slack-Smith
14/8/75	Dysphania Gorge 14°39'S, 126°57'E	Insects	I. F. B. Common M. S. Upton
19/8/75	Western Area of Park	Vegetation Mapping	F. G. Smith A. S. George
20/8/75	Eastern Area of Park	Vegetation Mapping	F. G. Smith H. G. Hall
21/8/75	Dysphania Gorge 14°39'S, 126°57'E	Botany	A. S. George K. F. Kenneally
		Birds	L. A. Smith
		Mammals	W. K. Youngson
Galaxy Swamp 14°37'S, 126°55'E	Snails	S. M. Slack-Smith	
	Botany	A. S. George K. F. Kenneally	
	Birds	L. A. Smith	



LEGEND

CAMPsites C3 ○

RESERVE BOUNDARY ————

ROADS ————

RIVERS, CREEKS ————

PROPOSED EXTENTIONS - - - - -

HOMESTEAD H/S



Figure 1—Drysdale River National Park showing topography and campsites.

PART III

THE DRYSDALE RIVER NATIONAL PARK ENVIRONMENT

by E. D. KABAY¹, A. S. GEORGE² and K. F. KENNEALLY²

INTRODUCTION

This section of the report provides a composite picture of the physical environment both of the park as a whole and of the collection sites. As well, the major floristic elements in the vegetation communities at the collection sites are documented. A vegetation map, described in Part IV, delineates the vegetation communities of the park while Part V itemises the flora found at the various localities.

CLIMATE

Köppen (1936) described the North Kimberley as tropical savannah with a distinct dry season between June and September during which very little, if any, rain falls. Though the Bureau of Meteorology (Anon. 1975) has updated Slatyer's (1960) climatic description of the North Kimberley Region, meteorological data for the Park itself are very limited. Theda Station 11 km east of the Park (14°30'S, 126°44'E) has recorded rainfall between 1965 and 1974, while Carson River Station, 20 km north-west of the Park (14°30'S, 126°43'E) has records from 1970 to 1973.

Rainfall figures for the two stations are tabulated in Table 1.

District was below average especially for the last three months preceding the survey—May, June and July 1975—and this was reflected in the flow patterns of the creeks and rivers. On 27 July the Drysdale River at Drysdale Crossing was flowing while by 24 August it had dried up at this point. In the Park itself the Drysdale River was still flowing at sites A1, B2 and C5. On 1 August Morgan Falls had a very small flow of water which had ceased by 16 August. The Carson River had dried up into isolated pools by 31 July. However, in the Park all creeks which drained sandstone country were reported by team members to be still flowing slightly. One of the features of the rainfall in the North Kimberley, where cyclones and thunderstorms are common, is the occurrence of sudden downpours which can cause local flooding during the 'wet'.

As daily temperature and humidity data are not collected in the inland area of the northern part of the North Kimberley, no information is available concerning these parameters for the Park. However, Slatyer (1960) says that, though the conditions (temperature and humidity) on the coast (e.g. at Derby) are less extreme than those experienced inland (e.g. at Gibb River), the differences are of a "rather small order and do not change the general picture". Table 2 tabulates the mean monthly

TABLE 1
COMMONWEALTH BUREAU OF METEOROLOGY RAINFALL FIGURES FOR NORTH KIMBERLEY

Location	Years	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Theda	1965-74	261	263	196	35	33	0	0	6	1	54	84	132	1 072
Carson River	1970-73	137	296	354	75	0	0	0	0	0	21	70	236	1 189

Mean Monthly and Annual Rainfall (mm)

In comparison with the data for the Prince Regent River Reserve (Miles *et al.* 1975), the figures support the contention of Slatyer (1960) that there is a north west-south east decrease in both the amount and intensity of rainfall in the Kimberley, as well as in the number of wet days per year. Thus, while the Drysdale River National Park (DRNP) is north-east of the Prince Regent River Nature Reserve (PRRNR) it is sufficiently inland from the coast for its yearly rainfall to be slightly less than that for the PRRNR. Three-quarters of the PRRNR lies within the 1200 and 1400 mm mean annual rainfall isohyets with the remaining southern quarter having a mean annual rainfall of between 1000 mm and 1200 mm. The DRNP on the other hand straddles the 1000 mm isohyet (Anon. 1975). Heavy dews occur in the Park area during the dry period (Morgan 1955). On several occasions substantial dews were recorded at Old Doongan and at the collection sites during the survey.

The Bureau of Meteorology reported (Anon. 1974/1975) that the 1974/75 rainfall for the North Kimberley

maximum and minimum temperatures for Kalumburu (45 km north of the Park, on the coast) and Mitchell Plateau (180 km west, inland from the coast). It also lists the 9 a.m. and 3 p.m. mean monthly relative humidity for both stations. Mitchell Plateau would tend to reflect the climatic conditions of DRNP while Kalumburu would mirror the wetter parts of PRRNR. Morgan (1955), during his survey of the area, recorded that, from May to August, maximum temperatures of up to 30°C followed by minima between 2°C and 7°C were experienced. On one occasion during June a low of -3°C was recorded. By the end of August maximum temperatures were approaching 38°C and by the end of September 40°C.

GEOLOGY AND PHYSIOGRAPHY

The geology of the area in which DRNP is located has been examined by both Derrick (1968) who discussed the geology of the Ashton area and Gellatly and Sofoulis (1969) who carried out a similar study in the Drysdale and Londonderry areas: the former study includes the southern part of the Park while the northern half of the Park is included in the latter paper.

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² Western Australian Herbarium, Department of Agriculture, Jarrah Road, South Perth, W.A. 6151.

TABLE 2
AVERAGE MONTHLY MAXIMUM AND MINIMUM TEMPERATURES (°C)

Station	Period	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Kalumburu	30 year average	33.9	33.5	34.0	34.3	32.8	31.9	31.9	33.6	35.7	37.2	37.7	36.4	34.4
		24.6	24.5	32.9	21.3	17.8	14.9	13.4	15.1	18.4	22.2	24.5	25.0	20.5
Mitchell Plateau	1970-74	33.6	32.6	32.4	32.4	31.6	30.0	30.6	33.2	35.1	36.7	36.1	33.3	33.4
		22.3	22.0	21.3	18.6	12.8	10.8	8.3	12.1	16.6	20.0	21.5	22.5	17.4

AVERAGE MONTHLY 9 a.m. AND 3 p.m. RELATIVE HUMIDITY (%)														
Station	Period	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Kalumburu	30 year average	71	74	70	60	48	43	38	37	41	45	50	61	53
		62	66	60	47	39	33	28	28	35	42	47	54	48
Mitchell Plateau	1970-74	70	74	70	59	39	36	31	38	40	44	52	66	52
		57	63	57	45	30	28	22	27	34	40	43	55	42

Geologically, the Park is an eastward continuation of a geological series that runs north/south, slopes east/west and has its older western boundary in the PRRNR. Together these series form part of the physiographic Kimberley Plateau Province of Wright (1964) which overlies the Western Shield. Three of the sub-provinces are represented in the Park; the Prince Regent Plateau, Gibb Hills and Karunjie Plateau.

On the western edge of the Park, in the section isolated by a stock route, part of the Prince Regent Plateau is represented. Unlike the PRRNR where this plateau constitutes the main physiographic unit, in the DRNP it occupies only a small area. It consists of the very old (Proterozoic) sedimentary King Leopold Sandstones. The area is extremely rugged, very dissected with faults and features numerous gorges and waterfalls—Worriga Gorge and Morgan Falls being examples.

The Gibb Hills subprovince also occupies part of the western isolated section of the Park and lies to the east of the Prince Regent Plateau. Thus, like the Plateau, this subprovince is only slightly represented in the Park. Geologically it is formed by the sub-aerial extrusion of the basaltic Carson Volcanics over the King Leopold Sandstones. The part of the volcanics which are found in the Park form an area in which mesas and terraces are common due to the differences in the weathering pattern of the interbedded sandstones and volcanics. The area is less rugged than the previous sub-province and is characterised by undulating rocky plains and rounded hills capped by tertiary laterite e.g. Gattenhof and Goodirrie Hills.

The Karunjie Plateau represents the major physiographic subprovince within the Park. It is characterised by the shallowly dipping or horizontal rocks of the Warton Sandstones, Elgee Siltstones and Pentecost Sandstones. Due to variation in the erosive character of the various rock strata, cuestas, mesas and erosional escarpments are common.

The Warton Sandstones are deposited conformably over the volcanics and occupy the western edge of the main Park. The lower beds form the Carson Escarpment whose formation is due to the erosion of the volcanics at their junction with the more resistant sandstones. The upper beds have gentle dip slopes which are represented as sand-covered plains through which little of the bedrock outcrops.

The Elgee Siltstones are poorly represented due to their erosion from the more resistant surrounding sandstones.

They are generally calcareous and are prominent on scarps and at the bottom of valleys. Within the Park they occur at the base of the Ashton Range.

The Pentecost Sandstones conformably overlie the siltstone and occupy the remaining half of the Park. They consist of three members. From west to east they are the Lower, Middle and Upper Pentecosts. The sandstones form cuestas and scarps which range from well defined high features in the lower members to less defined and sand-covered plains in the upper members. The Lower occur on top of the Ashton Range and to the west of the Drysdale River; the Middle dominate most of the Park; and the Upper, which are very eroded and so are poorly represented, occur in the south-east quarter of the Park.

The above geological formations present in the sub-provinces belong to the Kimberley Stratigraphic Group. Also within the Karunjie Plateau subprovince is the Bastion Group and the Hart Dolerites.

The Bastion Group conformably overlies the previously mentioned strata of the Kimberley Group and in the Park is represented by the Mendena Formation. This formation occurs in the south-east corner of the Park as small low mesas rising out of the flat plains. These mesas, the Pseudomys Hills, have a siltstone base and are capped by quartz sandstone.

The Hart Dolerite intrudes into the sequence of both Groups. However, only in the King Leopold Sandstones at the base of Worriga Gorge is this dolerite exposed within the Park.

Folding and faulting occurred after this intrusion and were followed by a period of unconformity during which erosion of all groups occurred. During the Tertiary a laterite surface developed which tilted slightly northward, after which the current drainage system was developed. This eroded through the laterite to the Precambrian strata producing the present superimposed river system. The laterite is presently represented as remnants, capping some mesas. Very few of these occur in the Park and those that do are found mainly over the King Leopolds and the Carson Volcanics.

The Cainozoic soils overlie flat mature land surfaces and are developed as extensive tracts over the Warton Sandstones, Carson Volcanics and the Pentecosts. They are yellow where they overlie sandstone and red brown to grey where they overlie the volcanics. Colluvium occurs on scree slopes at the bottom of the sandstone scarps.

TABLE 3

A SUMMARY OF PLANT COMMUNITIES FOUND IN THE DRYSDALE RIVER NATIONAL PARK

(after Specht, Roe and Boughton, 1974)

The site of each community is noted by C5a, A2f, etc. (See below)

CONSERVATION AREA

Drysdale River National Park
Co. Wyndham, East Kimberley
Lat. 14° 56' S
Long. 126° 52' E
Area: 424 342 ha
R.I.:A

PLANT COMMUNITIES

Tall closed-forest

- (1) *Melaleuca leucadendron*, *Carallia brachiata*,
Metrosideros eucalyptoides. C5a

Closed-forest

- (1) Semi-deciduous mesophyll vine forest.
Diospyros nitens, *D. ferrea*, *Cassine melanocarpa*,
Canarium australianum, *Ficus racemosa*, *Carallia*
brachiata, *Albizia lebbek*, *Timonius timon*. C1i
- (2) *Eucalyptus miniata*, *E. tetradonta*. A2f
- (3) *Melaleuca leucadendron*, *Pandanus* sp. B2a, B2c,
B3d, B3f, C2e

Low closed-forest

- (1) *Canarium australianum*, *Pouteria sericea*, *Vitex*
glabrata, *Alphitonia excelsa*, *Randia cochinchin-*
ensis, *Ficus platypoda*, *Diospyros nitens*. B1b
- (2) *Syzygium suborbiculare*, *Carallia brachiata*, *Alphi-*
tonia excelsa, *Glycosmis pentaphylla*. C4d
- (3) *Melaleuca virens*, *Cassine melanocarpa*, *Planchon-*
ella pohlmanniana, *Alphitonia excelsa*. C5b

Open-forest

- (1) *Eucalyptus miniata*, *E. apodophylla*, *Erythrophleum*
chlorostachys. C4f

Low open-forest

- (1) Semi-deciduous microphyll vine thicket.
Alphitonia excelsa, *Pouteria sericea*, *Bombax*
ceiba var. *leiocarpum*, *Planchonella arnhemica*,
Micromelum minutum. C1f
- (2) *Eucalyptus latifolia*, *E. miniata*, *E. nesophila*, *E.*
polycarpa, *E. tetradonta*. A1d
- (3) *Banksia dentata*, *Pandanus spiralis*, *Eucalyptus*
ptychocarpa. A1f
- (4) *Eucalyptus bleeseri*, *E. latifolia*, *E. miniata*, *E.*
oligantha, *E. tetradonta*. A4a
- (5) *Melaleuca viridiflora*, *Eucalyptus apodophylla*, *E.*
ptychocarpa. A4c
- (6) *Melaleuca viridiflora*, *Eucalyptus ptychocarpa*
Banksia dentata, *Terminalia grandiflora*, *Eugenia*
bleeseri. C4b
- (7) *Celtis philippensis*, *Cassine melanocarpa*, *Ficus*
platypoda, *Dolichandrone heterophylla*, *Vitex glab-*
rata, *Gardenia megasperma*, *Bombax ceiba* var.
leiocarpum, *Gyrocarpus americanus*. C4c
- (8) *Eucalyptus miniata*, *E. tetradonta*. C1a
- (9) *Eucalyptus tectiflora*, *E. grandifolia*, *E. aff. leuco-*
phloia. C2g

Woodland

- (1) *Eucalyptus tectiflora*, *E. latifolia*, *E. foelscheana*.
B1c

- (2) *Melaleuca viridiflora*, *Eucalyptus apodophylla*,
Nauclea coadnata, *Pandanus spiralis*, *Terminalia*
grandifolia, *T. platyphylla*. B1d
- (3) *Eucalyptus miniata*, *E. tetradonta*, *E. ? latifolia*.
A2h, B4b
- (4) *Eucalyptus bleeseri*, *E. zygophylla*, *Erythrophleum*
chlorostachys, *Brachychiton* sp. A2b
- (5) *Eucalyptus miniata*, *E. bleeseri*. B3k
- (6) *Eucalyptus bleeseri*, *E. tetradonta*, *E. confertiflora*.
C3d

Low woodland

- (1) *Eucalyptus latifolia*, *E. miniata*, *E. nesophila*, *E.*
polycarpa, *E. tetradonta*. A1d
- (2) *Eucalyptus bleeseri*, *E. latifolia*, *E. miniata*, *E.*
oligantha, *E. tetradonta*. A4a
- (3) *Eucalyptus* aff. *leucophloia*, *E. sp.* (bloodwood),
Owenia vernicosa, *Buchanania obovata*. B1a, C4a
- (4) *Eucalyptus* aff. *leucophloia*, *E. miniata*, *E. herb-*
ertiana, *Owenia vernicosa*, *Acacia kelleri*. B4a
- (5) *Eucalyptus latifolia*, *E. tectiflora*, *Erythrophleum*
chlorostachys, *Cochlospermum fraseri*, *Buchanania*
obovata. C4c
- (6) *Eucalyptus jensenii*, *E. zygophylla*, *E. tetradonta*,
Callitris intratropica, *Erythrophleum chlorostachys*.
A3b
- (7) *Eucalyptus tectiflora*, *E. foelscheana*, *Hakea arbor-*
escens, *Grevillea mimosoides*. C2e, C4g
- (8) *Eucalyptus perplexa*, *E. spp.* (bloodwoods), *Cal-*
litris intratropica. A4e
- (9) *Eucalyptus miniata*, *E. tetradonta*. C1a
- (10) *Eucalyptus tectiflora*. C1d
- (11) *Melaleuca viridiflora*. C5b

Open-woodland

- (1) *Melaleuca leucadendron*, *Sesbania formosa*,
Nauclea coadnata, *Pandanus aquaticus*. C1e
- (2) *Eucalyptus polycarpa*, *E. miniata*, *E. bleeseri*. B2d
- (3) *Eucalyptus miniata*, *E. tetradonta*. A3c
- (4) *Eucalyptus miniata*, *E. bleeseri*. B3k
- (5) *Eucalyptus bleeseri*, *E. tetradonta*, *E. confertiflora*.
C3d

Low open-woodland

- (1) *Eucalyptus latifolia*, *E. miniata*, *E. nesophila*, *E.*
polycarpa, *E. tetradonta*. A1d
- (2) *Pandanus spiralis*, *Grevillea pteridifolia*, *Melaleuca*
viridiflora, *Banksia dentata*. A1g
- (3) *Eucalyptus bleeseri*, *E. latifolia*, *E. miniata*, *E.*
oligantha, *E. tetradonta*. A4a
- (4) *Melaleuca? viridiflora*, *Eucalyptus apodophylla*, *E.*
latifolia, *Grevillea pteridifolia*. A4b
- (5) *Eucalyptus tectiflora*, *E. latifolia*, *E. foelscheana*.
B1c
- (6) *Planchonella arnhemica*, *Ficus virens*, *Ficus leuco-*
tricha, *F. platypoda*, *Denhamia obscura*. C3c
- (7) *Eucalyptus miniata*, *E. tetradonta*. A3e
- (8) *Eucalyptus tetradonta*, *E. confertiflora*, *E. latifolia*,
Callitris intratropica, *Terminalia latipes*. A4d

TABLE 3—continued

Open-scrub	Tall open-shrubland
(1) <i>Acacia plectocarpa</i> , <i>A. kelleri</i> , <i>Grevillea agrifolia</i> , <i>G. pteridifolia</i> . C4e	(1) <i>Eugenia eucalyptoides</i> , <i>Calytrix brachychaeta</i> , <i>Buchanania obovata</i> . C1e
(2) <i>Xanthostemon paradoxus</i> , <i>Ficus platypoda</i> , <i>Cannarium australium</i> , <i>Stenocarpus cunninghamii</i> , <i>Gardenia pantonii</i> . B4e	Low open-shrubland
Tall shrubland	(1) <i>Acacia brevifolia</i> , <i>A. translucens</i> , <i>Bossiaea bos-siaeoides</i> , <i>Burtonia subulata</i> , <i>Mirbelia viminialis</i> , <i>Triumfetta plumigera</i> . A2a
(1) <i>Acacia holosericea</i> , <i>A. tumida</i> , <i>A. sericata</i> , <i>A. kelleri</i> , <i>Grevillea pteridifolia</i> . A1b	Closed-herbland
(2) <i>Melaleuca argentea</i> , <i>Terminalia bursarina</i> , <i>Pouteria sericea</i> , <i>Calytrix brachychaeta</i> , <i>Grevillea agrifolia</i> , <i>Xanthostemon paradoxus</i> . A1c	(A) Closed-grassland
(3) <i>Eugenia eucalyptoides</i> , <i>Terminalia bursarina</i> , <i>Barringtonia acutangula</i> , <i>Calytrix brachychaeta</i> . B4c	(1) <i>Heteropogon contortus</i> , <i>Elytrophorus spicatus</i> , <i>Eragrostis</i> spp. A4b
	(2) <i>Ectrosia</i> sp., <i>Eragrostis</i> sp. C4b
	(3) <i>Themeda australis</i> , <i>Setaria surgens</i> , <i>Cymbopogon bombycinus</i> , <i>C. procerus</i> , <i>Eriachne sulcata</i> , <i>Triodia</i> sp. A3a, A3f
	(4) <i>Cymbopogon procerus</i> , <i>Triodia pungens</i> . B3i

The other type of soil—the ferruginous/lateritic soils—occur less frequently than the former and are located in isolated pockets in the centre of the Park on the glauconitic Middle Pentecosts. Finally, Quarternary alluvium is confined to beds of rivers and creeks. In places, such as A1 on the Drysdale River where the river has eroded down to bedrock through the small flood plain deposits, the latter are left as upraised terraces.

The Park is drained mainly by the Drysdale River, with the Carson River draining the extreme western edge and the separated section, the Berkeley River the south-eastern section and the King George River the north-east part.

DESCRIPTION OF SITES

The principal vegetation formations around each site are described in terms of geology, structure and floristics. The formations have been classified according to Specht (1970). Assessment of structure and dominance was qualitative, but correlated well with the aerial photo interpretation of Smith (Part IV of this bulletin). In contrast to the Prince Regent River expedition, provision was made for us to visit all sites. While this allowed better assessment of the whole area, it reduced the time at each site to a maximum of three days, so that floristic sampling was less thorough. The formations are coded (A1a, A1b, etc.) to facilitate cross-referencing in later Parts of the bulletin.

The plant communities of the Park are summarised in Table 3, in more detail than was available when the table in Specht *et al.* (1974) was prepared. It should be noted that several areas included in the table and in the ensuing descriptions are not at present part of the Park but are recommended for addition to it. They are Forest Creek (C5), Galaxy Swamp, and some sections of the Stock Route at B1 and C4. The site at which each community was recorded is given in the table.

No attempt has been made to estimate the area covered by each community. Broadly speaking, much of the Park is covered by low open-forest, low woodland and low open-woodland, the upper stratum sometimes being tall enough to bring it into the categories of open-forest, woodland and open-woodland. Various *Eucalyptus* species tend to dominate these formations, but there is admixture of other genera. The understorey is usually dominated by grasses with scattered shrubs, but the latter sometimes predominate. The structure and floristics

appear to vary according to the geology and ground water availability.

The presence of water on or close to the surface makes an immediate and striking impact on the vegetation. This can be seen in the fringing formations along creeks and rivers: they are usually narrow and quite different from adjacent drier areas.

Three formations deserve special comment. One is the low closed-forest (sometimes low open-forest) which occurs on suitable rocky sandstone screes in gullies, especially along the Carson Escarpment (B1, C4) and along Forest Creek (C5). It is akin to the semi-deciduous microphyll vine thicket recorded in the Prince Regent River Reserve (Miles *et al.* 1975) but, probably due to the lower rainfall, is less diverse floristically and contains fewer vines. Other areas are known to occur around the Mitchell Plateau, on the far north coast and on some offshore Kimberley islands. However they are usually small pockets of a few hectares or less, and it is important that as many be preserved as possible. A number of species are known in W.A. only from this formation, e.g. the Rutaceous species *Glycosmis pentaphylla* and *Micromelum minutum*. Typically Australian genera such as *Eucalyptus*, *Calytrix* and *Grevillea* are lacking, the floristic affinity being rather with Indo-Malaysia.

The second unusual formation is a pocket of closed-forest covering 1 to 2 ha in Worriga Gorge (C1). There are robust lianes with stems up to 10 cm thick, and the formation can be classified as semi-deciduous mesophyll vine forest, the first time it has been recorded in W.A. Floristic composition is similar to that of the low closed-forest mentioned above with the addition of four or five species of lianes which have not as yet been identified.

Similarly, the record of tall closed-forest along Forest Creek (C5) is the first of this formation in the Kimberley. Again, it is small, about 1 ha, and is floristically poor, but it is impressive and in marked contrast to the surrounding areas. One of the tree species has not yet been identified, while another (*Metrosideros eucalyptoides*) is known in W.A. from only one other locality near the Mitchell Plateau.

A1 Mogurnda Creek (Figures 1, 2)

The campsite was located on the west bank of the Drysdale River in 15°02'S, 126°55'E where the altitude above sea level is approximately 230 m. The geological formation is Lower Pentecost Sandstone (Pkpl). The river

here forms a pool about 2 km long, 150 m wide and up to 5 m deep. A freshwater creek, Mogurnda Creek, enters the Drysdale just downstream from the camp.

- (a) The west bank is sandy alluvium (Qa) and is fringed with Silver Cadjeput (*Melaleuca argentea*) and River Pandanus (*Pandanus aquaticus*), with some Freshwater Mangrove (*Barringtonia acutangula*), and scattered herbs and grasses. Aquatic plants include *Nymphaea gigantea*, *Nymphoides hydrocharoides* and *Vallisneria spiralis*.
- (b) Behind the fringing vegetation a steep sandy bank carries a tall shrubland of the wattles *Acacia holosericea*, *A. tumida*, *A. sericata* and *A. kelleri* with some *Grevillea pteridifolia* and an occasional emergent River Gum (*Eucalyptus camaldulensis*). The spinifex *Plectrachne pungens* is common. The east bank of the river is mostly rocky but supports a similar fringing vegetation.
- (c) Both upstream and downstream from the long pool the river in late winter forms a series of broken pools and small rapids over a rocky bed. The vegetation is chiefly a tall shrubland of *Melaleuca argentea*, *Terminalia bursarina*, *Pouteria sericea*, *Calytrix brachychaeta*, *Grevillea agrifolia* and *Xanthostemon paradoxus*. Near the water are some dense stands of *Pandanus aquaticus*. There are areas of bare rock and sand.
- (d) Away from the river the land is gently undulating except for a prominent sandstone ridge to the south east of the camp. The soil is either sandy or rocky. The vegetation is low woodland, occasionally low open-forest or low open-woodland. The trees are dominated by *Eucalyptus* species, especially *E. latifolia*, *E. miniata*, *E. nesophila*, *E. polycarpa* and *E. tetradonta*. Other trees are *Brachychiton diversifolium*, *Buchanania* sp., *Callitris intratropica*, *Denhamia obscura*, *Erythrophleum chlorostachys*, *Gardenia* sp., *Owenia vernicosa*, *Petalostigma pubescens*, *Planchonella arnhemica* and *Terminalia* sp. A rather sparse shrub layer includes *Bossiaea bossiaeooides*, *Distichostemon hispidulus*, *Grevillea refracta*, *Jacksonia argentea*, *Triumfetta* spp. and *Verticordia cunninghamii*. The ground flora at this dry season is dominated by grasses, especially ephemeral *Sorghum* in sand and the spinifex *Plectrachne bynoei* in rocky areas.
- (e) Mogurnda Creek enters the Drysdale just below the campsite. Slowly flowing in the dry season, it is lined with Cadjeput (*Melaleuca leucadendron*) and River Gums (*Eucalyptus camaldulensis*) near the river, and higher up with *Pandanus spiralis*, *Eucalyptus ptychocarpa* and *Grevillea pteridifolia*. The sandy banks are mostly covered with grasses, while numerous herbs occur in the bed and in pools. Aquatic species are *Blyxa echinosperma*, *Eriocaulon setaceum*, *Limnophila chinensis*, *Triglochin pterocarpa* and *Utricularia exoleta*. Marsh plants include *Phylidrum lanuginosum*, *Ludwigia suffruticosa*, *Xyris complanata* and *Scirpus mucronatus*.
- (f) About 400 m up Mogurnda Creek and on its north side is a swamp supporting a low open-forest of *Banksia dentata*, *Pandanus spiralis* and *Eucalyptus ptychocarpa* with emergent *E. apodophylla*. There is a dense understorey chiefly of grasses.
- (g) Another small swampy flat lies between the Drysdale River and the sandstone ridge beyond the east bank of the river. Here there is a low open-woodland of



Figure 1—View east across the Drysdale River at AI. Sandy bank in foreground with *Grevillea agrifolia* (left) and *Acacia tumida* (right). *Melaleuca argentea* and *Pandanus aquaticus* on water's edge. Low open-woodland beyond farther bank.



Figure 2—Mogurnda Creek (AI). Trees include *Pandanus spiralis*, *Grevillea pteridifolia*, *Melaleuca leucadendron* and *Eucalyptus ptychocarpa*. Dense grasses along banks and *Phylidrum lanuginosum* in pools.

Pandanus spiralis, *Grevillea pteridifolia*, *Melaleuca viridiflora* and *Banksia dentata*, again with a low but dense ground cover of grasses and herbs.

- (h) West of the camp a billabong occupies a flood channel of the river. The bottom is partly rocky, partly mud, with steep sandy banks. A few tall *Eucalyptus camaldulensis* line the banks together with low shrubs of *Barringtonia acutangula*. The sandy banks are densely covered with grasses including *Arundinella nepalensis* and *Vetiveria pauciflora*. Many aquatic and marsh plants occur in and around the water.

They include *Nymphaea gigantea*, *Nymphoides indica*, *N. hydrocharoides*, *Marsilea* ? *mutica*, *Caldesia oligococca*, *Dysophylla verticillata*, *Utricularia* sp., *Pseudoraphis abortiva*, *Eriocaulon quinquangulare* and *Limnophila* sp.

A2 Boiga Falls (Figures 3, 4, 5)

The A2 campsite (15°08'S, 127°06'E) was situated at an altitude of 400 m on top of Boiga Falls within a run-off depression on Tadarida Scarp. The falls (which were dry at the time of visiting) form the headwaters of Lorikeet Creek which drains into Tadarida Creek, this in turn flowing to the Drysdale River.

- (a) The plateau above the scarp consists mainly of rocky, sandy soils (Czs) with some massive outcrops of Upper Pentecost Sandstone (Pkp). The depression on the scarp where the campsite was situated supports a low open-shrubland of *Acacia brevifolia*, *A. translucens*, *Bossiaea bossiaeooides*, *Burtonia subulata*, *Mirbelia viminalis* and *Triumfetta plumigera* with *Cochlospermum fraseri* as an occasional emergent. Scattered spinifex (*Triodia* sp.), *Solanum* sp., *Phyllanthus* sp., *Petalostigma quadriloculare*, *Gonocarpus leptothecus*, and a woolly species of fern (*Cheilanthes vellea*) form the main ground cover.
- (b) On either side of the depression on sandy (Czs) soils *Eucalyptus bleeseri* and *E. zygophylla* form a woodland to low open-woodland. Beneath the tree layer



Figure 3—View west from the edge of Boiga Falls (A2) over the low eucalypt woodland through which runs Lorikeet Creek.



Figure 4—Boiga Falls (A2). A massive sandstone cliff face, dry at the time of our visit. The plateau above the falls supports a low open-woodland to low open-shrubland. A dense stand of trees and shrubs occurs on the rock ledges below the cliff face

Erythrophleum chlorostachys and *Brachychiton* sp. form sub-dominants along with *Acacia translucens* and *Petalostigma pubescens*. Spinifex (*Triodia* sp.), is the main ground cover particularly around rocky outcrops, although on sandy, open areas *Cymbopogon procerus* also occurs.

- (c) The edge of the sandstone cliff forms almost a sheer drop over Boiga Falls but is flanked by well-formed scree slopes of Upper Pentecost Sandstone (Pkp) leading in from the valleys on either side. The cliff edge supports a dense stand of mixed species. These include *Owenia vernicosa*, *Terminalia latipes*, *Ficus platypoda*, *Grevillea agrifolia*, *Gardenia* sp., and *Exocarpos latifolius*.
- (d) The Upper Pentecost scree slopes consist of massive sandstone boulders. The vegetation of the scree is similar to that of the cliff edge but includes species such as *Planchonella arnhemica*, *Acacia humifusa*, *Callitris intratropica*, *Eucalyptus clavigera*, *Buchanania obovata* with the grasses *Cymbopogon procerus* and *Coelorhachis rottboellioides* commonly occurring.
- (e) Below Boiga Falls there is a massive sandstone (Pkp) scree which is a seasonal water course. At the base of the cliff is a seepage area. This damp environment (particularly on shaded rock ledges) supports *Ficus virens* (growing from rock crevices), the ferns *Lindsaea ensifolia* and *L. ? orbifolia* and the ephemeral trigger-plant, *Stylidium muscicola*. On the exposed rock



Figure 5—Lorikeet Creek (A2). Restricted to a series of remnant pools at the time of our visit. The banks support a dense growth of fern (*Blechnum orientale*) and *Osbeckia australiana*.

ledges at the base of the cliff, trees and tall shrubs such as *Alstonia actinophylla*, *Fenzlia phebaloides* and *Canarium ? australianum* occur.

- (f) The valley below Boiga Falls narrows and the sand over sandstone (Pkp_m) supports a closed-forest of *Eucalyptus miniata* and *E. tetradonta* through which flows (in the wet) Lorikeet Creek. At the time of our visit Lorikeet Creek was restricted to a series of remnant pools with a dense growth of fern (*Blechnum orientale*) and *Osbeckia australiana* covering the creek banks.
- (g) Further downstream the valley widens out into what would be a seasonal swamp flat after the wet as evidenced by the dense stand of grasses (mainly *Cymbopogon procerus* and *Sclerandrium truncatiglume*) and ephemeral herbs (*Stylidium pachyrrhizum*, *Drosera* spp.) most of which had dried off. Along the creek bank small clumps of *Eucalyptus houseana*, *Pandanus spiralis* var. *convexus* and *Melaleuca viridiflora* occur as common emergents on the swamp flat. The remnant pools support few aquatics, *Eriocaulon setaceum* being the most common. On the sandy creek bank *Philydrum lanuginosum*, *Xyris complanata*, *Dicliptera glabra*, *Thysanotus chinensis* and *Borreria ? australiana* are common herbs.
- (h) The valley eventually widens out into a broad plain of Middle Pentecost Sandstone (Pkp_m), supporting a low woodland of *Eucalyptus miniata* and *E. tetradonta*.

A3 Pseudomys Hills (Figures 6, 7, 8)

The A3 campsite (15°17'S, 127°12'E) was situated on sandy soils (Czs) derived from Upper Pentecost Sandstone (Pkp_u) near the headwaters of the Forrest River and adjacent to the Pseudomys Hills. The Pseudomys Hills rise 40 m from the surrounding plain and consist of banded layers of siltstone and sandstone, forming mesas. This series of mesas constitutes the only Mendena Formation (Ptm) in the Park.

- (a) The campsite was under a small clump of eucalypts (*Eucalyptus microtheca* and *E. grandifolia*) on the edge of a closed grassland (*Themeda australis*, *Setaria surgens*, *Cymbopogon bombycinus*, *Eriachne* sp., *Triodia* sp.) forming part of the watershed from Pseudomys Hills to the headwaters of the Forrest River. Tree and shrub emergents are scattered and comprise species such as *Dolichandrone filiformis*, *D. heterophylla*, *Erythrophleum chlorostachys*, *Terminalia canescens*, *Sterculia viscidula*, *Cochlospermum fraseri* and *Acacia translucens*.
- (b) On either side of the watershed a low woodland of *Eucalyptus jensenii*, *E. zygophylla* and *E. tetradonta* occurs. Associated with the woodlands are stands of *Callitris intratropica* and *Erythrophleum chlorostachys*. Where the sandstone (Pkp_u) outcrops a scattered shrub layer of *Calytrix conferta*, *Bossiaea bossiaeoidea* and *Petalostigma pubescens* occurs with the grasses *Cymbopogon procerus*, *Triodia* sp. and *Themeda australis* forming the main ground cover.
- (c) The Pseudomys Hills lie to the north of the campsite. The plateau on top of the mesa consists of broken sandstone boulders whereas the scree slopes are covered in large boulders of siltstone. The tops of the mesas support an open-woodland of *Eucalyptus miniata* and *E. tetradonta* with grasses forming a dense ground cover. Occasionally along the ridges and scree slopes, clumps of *Callitris intratropica*, *Gardenia* sp. and *Eucalyptus perfoliata* are present.



Figure 6—Pseudomys Hills (A3). View south from the edge of the mesa overlooking the closed-grassland surrounded by low eucalypt woodland.



Figure 7—Pseudomys Hills (A3). The plateau on top of the mesa supports an open-woodland of *Eucalyptus miniata* and *E. tetradonta* with a dense grass ground cover.



Figure 8—Pseudomys Hills (A3). Siltstone scree slopes of the mesa showing a dense belt of *Melaleuca minutifolia*.

- (d) The siltstone scree slopes are covered in hummock grass (*Triodia* sp.) and Kangaroo Grass (*Themeda australis*) with low shrubs of *Bossiaea bossiaeoidea* and *Verticordia cunninghamii*. Fringing the scree slopes is a dense belt of *Melaleuca minutifolia* which becomes mixed with *Melaleuca viridiflora*, *Cochlospermum fraseri* and *Calytrix conferta* as it descends the watershed.

- (e) Toward the headwaters of the Forrest River sandy soils (Czs) support a low open-woodland of *Eucalyptus miniata* and *E. tetradonta*.
- (f) Fringing the banks of Forrest River is a closed grassland (*Eriachne sulcata*, *Themeda australis*, *Cymbopogon procerus*) with *Pandanus* sp. *Eucalyptus houseana*, *E. latifolia*, *E. apodophylla*, *Melaleuca viridiflora* and clumps of *Grevillea viscidula* lining the banks or occurring as emergents. The area of grassland near the creek was still quite damp, the mud supporting many ephemeral species such as *Mitrasacme* spp., *Stylidium* spp., *Byblis liniflora*, *Thysanotus chinensis*, *Utricularia* spp. and *Xyris* spp. The boundary between wet and dry areas was clearly defined, the ephemeral species being replaced by hardier perennial species such as *Evolvulus alsinoides*, *Buchnera ramosissima*, *Hypericum gramineum* and *Stemodia caerulea*.
- (g) The remnant pools of the river contain many aquatics such as *Nymphaea indica*, *Nymphaea gigantea* and *Eriocaulon setaceum*. *Philydrum lanuginosum* forms dense stands in the shallow pools.

A4 Dromaius Creek (Figure 9)

The A4 locality lies in 15°16'S, 126°43'E on the plain between the southern end of the Ashton Range and Dromaius Creek. The Creek meanders northwards across the plain and eventually reaches the Drysdale River. In the dry season the creek becomes a series of pools. The altitude on the plain is about 310 m and on top of the range about 400 m.

- (a) The plain consists of alluvial soils derived from sandstone (Czs) and the principal vegetation formations are low open-forest, low woodland and low open-woodland. *Eucalyptus* species are the dominant trees and include *E. bleeseri*, *E. latifolia*, *E. miniata*, *E. oligantha* and *E. tetradonta*. Other trees are *Acacia aulacocarpa*, *Brachychiton diversifolium*, *Callitris intratropica*, *Erythrophleum chlorostachys*, *Grevillea pteridifolia*, *Pandanus spiralis*, *Petalostigma pubescens* and *Terminalia grandiflora*. An open shrub layer includes such species as *Acacia translucens*, *Bossiaea bossiaeioides*, *Burtonia subulata*, *Hakea arborescens*, *Planchonia australis* and *Verticordia cunninghamii*. There is a moderately dense cover of grasses and herbs such as *Plectrachne pungens*, ephemeral *Sorghum*, *Eriachne obtusa*, *Helichrysum apiculatum*, *Blumea integrifolia*, *Platyzoma microphyllum*, *Mitrasacme* spp. and *Polycarphaea staminodina*.
- (b) Among the low open-forest and low woodland are pockets of closed grassland on fine clay which is probably waterlogged in the wet season, and there is an extensive such area about 2 km south of the campsite. The grasses include *Heteropogon contortus*, *Elytrophorus spicatus* and *Eragrostis* spp., while typical herbs are *Xyris complanata*, *Byblis liniflora*, *Thysanotus chinensis*, *Buchnera linearis* and *Stackhousia viminea*. There are open thickets, sometimes forming low open-woodland, consisting chiefly of *Melaleuca* ? *viridiflora*, *Eucalyptus apodophylla*, *E. latifolia* and *Grevillea pteridifolia*.
- (c) Along Dromaius Creek is a fringing low open-forest or woodland dominated by *Melaleuca viridiflora*, *Eucalyptus apodophylla*, *E. ptychocarpa* and *Pandanus* sp. Grasses form a dense understorey, consisting especially of *Coelorrhachis rottboellioides*. A few aquatics are present in the pools, e.g. *Nymphaea*

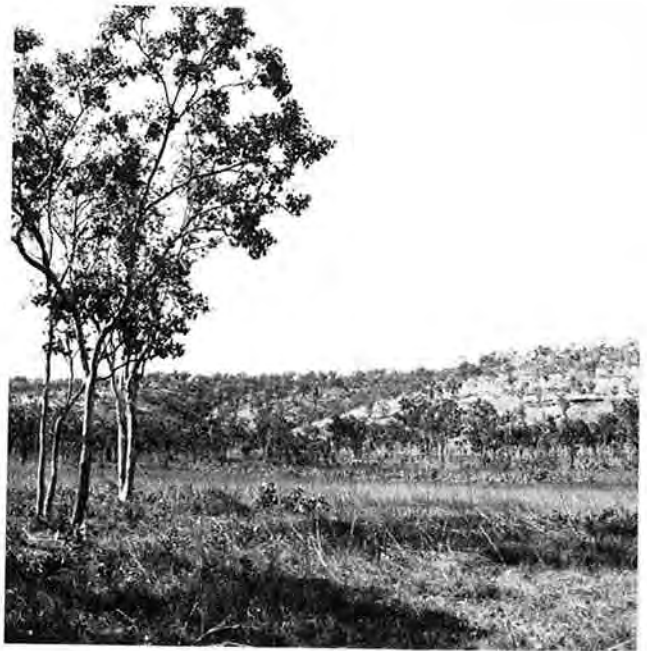


Figure 9—Alluvial plain at A4, with the Ashton Range beyond. Low open-forest and closed-grassland on plain, tall open-shrubland on scarp.

gigantea, *Nymphoides hydrocharoides*, *N. indica*, *Linnophila chinensis*, *Utricularia* sp. and *Eriocaulon setaceum*.

- (d) The western scarp of the Ashton Range consists of Elgee Siltstone (Pke) and near A4 rises almost 100 m above the plain. The scarp is rocky and scree-like and supports low open-woodland and tall open-shrubland over grassland. The trees and shrubs include *Eucalyptus tetradonta*, *E. confertiflora*, *E. latifolia*, *Callitris intratropica*, *Cochlospermum fraseri*, *Acacia plectocarpa*, *Terminalia latipes*, *Buchanania* sp. and *Gardenia* sp. Ephemeral *Sorghum* is the dominant grass.
- (e) The top of the range is plateau-like and consists of Lower Pentecost Sandstone (Pkpl). Here there is a low woodland and low open-forest (in places woodland) over grassland. *Eucalyptus* species are dominant and include *E. perplexa* and three bloodwoods as yet unidentified. *Callitris intratropica* is present but appears much reduced by fire. A rather sparse shrub layer includes *Distichostemon hispidulus*, *Grevillea agrifolia*, *Hibbertia lepidota* and *Mirbelia viminialis*.

B1 Orchid Creek (Figures 10, 11, 12, Colour plates 7, 8)

This locality is in 14°49'S, 126°49'E, where Orchid Creek leaves the Carson Escarpment and winds across the plain to the Carson River. Near the head of the deep gully (Glider Gorge) cut by the creek into the Escarpment is Dulcis Falls, a waterfall about 50 m high above which the creek dries up in the dry season. Seepages give rise to a number of pools in the gully and along the creek. The Carson Escarpment here is a rampart about 120 m high, in places sheer cliffs, in others with small bluffs and steep screes below. The height above sea level is about 240 m atop the Escarpment, 120 m on the plain below. To the west, the Carson River is a prominent watercourse winding northward across basaltic plains with frequent rocky outcrops in its bed. At the time of our visit it was a series of pools with slight flow between them.

(a) On the Warton Sandstone (Pkw) plateau in very rocky soil the vegetation is low woodland and tall shrubland grading to low open-forest away from the Escarpment. *Eucalyptus* sp. aff. *leucophloia* is a common tree, an undetermined bloodwood less so. Other trees are *Owenia vernicosa*, *Buchanania obovata*, *Planchonia australis*, *Gardenia* sp. and *Xanthostemon paradoxus*, while along the rocky edge of the plateau are found *Callitris intratropica* and *Ficus* sp. The understorey consists of *Sorghum* and *Triodia* with an open shrub layer of such species as *Strychnos lucida*, *Santalum lanceolatum*, *Acacia* spp., *Fenzlia pheba-lioides* and *Homalocalyx ericaeus*. About 1 km north of Glider Gorge is a population of an un-described *Eucalyptus* allied to *E. alba*.



Figure 10—Aerial view of the Carson Escarpment and Glider Gorge at B1. Low woodland on plateau and below escarpment. Low closed-forest in gullies. Orchid Creek runs out of the Gorge.



Figure 11—Low closed-forest in Glider Gorge (B1). Note rocky floor, climbers and cliff behind.



Figure 12—View south along the Carson River near B1, with *Pandanus aquaticus* and *Melaleuca leucadendron*, etc. *Eriachne festucacea* on basaltic rocks in foreground. Carson Escarpment in distance.

(b) On the very rocky soils of the screes and gullies of the Escarpment the formation varies, perhaps according to available ground water, from low closed-forest through low open-forest to low woodland. No species are dominant in the closed-forest, but representative trees are *Canarium australianum*, *Pouteria sericea*, *Vitex glabrata*, *Alphitonia excelsa*, *Randia cochinchinensis*, *Ficus platypoda* and *Diospyros nitens*. Along Orchid Creek, in the gully, are *Pandanus spiralis* and *Syzygium suborbiculare*. In seepages on rock ledges occur the ferns *Lindsaea ensifolia* and *Lygodium japonicum*, together with the mat-like grass *Micraria subulifolia*. The epiphytic orchid *Dendrobium dicuphum* is common. Wet crevices of Dulcis Falls support the fern *Nephrolepis hirsutula*, the grasses *Paspalum commersonii* and *Sclerandrium truncatiglume* and the fig *Ficus virens*. In closed areas there is little ground flora, but climbers such as *Tinospora smilacina*, *Flagellaria indica* and *Smilax australis* are present. In more open areas other trees occur, such as *Eucalyptus confertiflora*, *Stenocarpus cunninghamii* and *Atalaya variifolia*, and there is a ground cover chiefly of grasses.

(c) The plain below the Escarpment consists of loamy or rocky Carson Volcanics (Pkc) and is gently undulating. There are low rock outcrops which are quite bare, but otherwise the vegetation is woodland, low woodland and low open-woodland. The dominant trees are usually *Eucalyptus*, especially *E. tectifica*, *E. latifolia* and *E. foelscheana*, but in some areas *Terminalia grandiflora* is dominant. Other trees are *Erythrophleum chlorostachys*, *Sterculia viscidula*, *Planchonia australis*, *Ficus opposita* and *Grevillea mimosoides*. Towards the base of the Escarpment are such species as *Verticordia cunninghamii*, *Grevillea heliosperma* and *Petalostigma pubescens*. A dense ground cover of grasses includes *Sorghum* sp., herbs such as *Platyzoma microphyllum*, *Helichrysum apiculatum* and *Ptilotus exaltatus*.

The epiphytic orchid *Cymbidium canaliculatum* inhabits a few tree forks.

- (d) Woodland and low woodland occur along Orchid Creek where it crosses the plain to the Carson River. The trees include *Melaleuca viridiflora*, *Eucalyptus apodophylla*, *Nauclea coadnata*, *Pandanus spiralis*, *Terminalia grandiflora* and *T. platyphylla*. There is a dense ground cover of grasses, while herbs occur along the creek bed and in pools.



Figure 13—Nymphaea Creek (B2) near its junction with the Drysdale River.

- (e) The Carson River is fringed irregularly with a narrow belt of trees of *Melaleuca leucadendron*, *Ficus coronulata*, *Sesbania formosa*, *Terminalia platyphylla*, *Pandanus aquaticus* and *Barringtonia acutangula*. *Eriachne festucacea* is a common grass in the rocky bed of the river, and *Myriophyllum verrucosum* is common in the pools.

B2 Nymphaea Creek (Figures 13, 14, 15)

The B2 campsite (14°49'S, 126°55'E) was situated near the junction of Nymphaea Creek and the Drysdale River.

- (a) The vegetation of the river banks is a closed-forest of Cadjeputs (*Melaleuca leucadendron*, *M. argentea*) with Screw-Pine (*Pandanus* sp.), River Gum (*Eucalyptus camaldulensis*) and *Nauclea coadnata*.
- (b) Nymphaea Creek although only slowly flowing through sandy (Czs) soils at the time of our visit, widens out in many places to form shallow pools or wet, swampy areas. The pools and creek banks are fringed with Cadjeputs (*Melaleuca argentea*, *M. leucadendron*, *M. viridiflora*), Screw-pine (*Pandanus juleensis*), *Jacksonia thesioides*, *Acacia holosericea*,

A. plectocarpa, *A. tumida* and the Freshwater Mangrove, *Barringtonia acutangula*. The shallow pools support aquatics such as *Eriocaulon* spp., *Triglochin procera* and *Nymphaea gigantea*. The swampy fringe areas of the creek form a grassland with species such as *Sclerandrium truncatiglume*, *Ectrosia leporina*, *Eragrostis ? brownii*, *Eriachne festucacea* and *Dimeria ornithopoda* being common. The grassland is rich in herbs such as *Stylidium* spp., *Mitrasacme* spp., *Drosera* spp., *Utricularia* spp., *Byblis liniflora*, *Limnophila chinensis*, *Nelsonia brunelloides*, *Centrolepis exserta*, *Blumea tenella*, *Philydrum lanuginosum*, *Hemiarrhena plantaginea*, *Xyris* spp., and *Buchnera linearis*.

- (c) Further up Nymphaea Creek a large swamp (Czs soils) supports a closed-forest of Cadjeput (*Melaleuca leucadendron*). Associated with this are Screw-pine (*Pandanus* sp.), *Melaleuca viridiflora*, *Eucalyptus ptychocarpa*, *Banksia dentata* and *Grevillea pteridifolia*. Areas of closed-grassland are commonly interspersed with the closed-forest but do not support the ephemeral species as in B2 b, although the grass species are the same.
- (d) On either side of Nymphaea Creek the sand over sandstone (Czs) supports an open-woodland of eucalypts (*Eucalyptus polycarpa*, *E. miniata*, *E. bleeseri*) with patches of *Callitris intratropica*, *Buchanania obovata*, *Acacia brevifolia*, *A. dunnii*, *Calytrix achaeta*, and *Petalostigma pubescens* occurring where the sandstone outcrops.



Figure 14—Nymphaea Creek (B2). Edge of the closed Cadjeput (*Melaleuca leucadendron*) forest with grassland in the foreground.



Figure 15—Patches of *Callitris intratropica* in the sandstone within areas of open eucalypt woodland. Near Nymphaea Creek (B2).

- (e) Downstream from the campsite the Drysdale River has braided its bed and numerous levees and inter-levee pools occur. The levee banks support dense stands of Cadjeputs (*Melaleuca* spp.) and *Pandanus* sp. while the grasses *Vetiveria pauciflora*, *Digitaria longiflora* and *Sclerandrium truncatiglume* are common, extending from the river bank to the open-woodland.
- (f) At B2 the Drysdale River flows through a gap in the Ashton Range, and across the river, opposite the campsite, Elgee siltstones (Pk1) are exposed in the scree slopes of the steep-sided hills. These hills consist of Lower Pentecost Sandstones (Pkpl). The main tree species are *Eucalyptus tetrodonta*, *E. bleeseri*, *E. confertiflora*, *Cochlospermum fraseri*, *Persoonia falcata*, *Planchonella arnhemica*, *Terminalia canescens*, *Xanthostemon paradoxus*, *Owenia vernicosa*, *Erythrophleum chlorostachys*, *Stenocarpus cuminghamii*, *Callitris intratropica* and *Gardenia* sp. Shrub species such as *Distichostemon hispidulus*, the fern *Platyzoma microphyllum* and the hummock grass (*Triodia* sp.) are common on the slopes.

B3 Cracticus Falls (Figures 16, 17, Colour plate 11)

The B3 campsite (14°47'S, 127°05'E) was established at the base of Cracticus Falls on Johnson Creek in Petrogale Gorge.

- (a) The floor of the gorge above Cracticus Falls consists of Lower Pentecost Sandstone (Pkpl) and at the time



Figure 16—Petrogale Gorge (B3). The plunge pool at the base of Cracticus Falls fed by Johnson Creek. The vegetation of the southern gorge wall and the main sandstone plateau can be seen in the distance.

of our visit, contained large, shallow, residual pools. In most places the dried bed of Johnson Creek has been worn smooth but in other areas the floor is littered with large sandstone boulders undercut from the gorge wall. Because of the seasonal rush of water, permanent vegetation in the creek bed is scarce and is restricted to Cadjeputs (*Melaleuca leucadendron*, *M. argentea*, *M. viridiflora*), River Gum (*Eucalyptus camaldulensis*), *Eugenia eucalyptoides* and the Freshwater Mangrove (*Barringtonia acutangula*).

- (b) In the remnant pools numerous aquatics such as *Eriocaulon* spp., *Valisneria spiralis*, *Nymphoides* spp., *Myriophyllum trachycarpum*, *Utricularia exoleta* and *Nymphaea gigantea* are common. The wet alluvial sand banks (Qa) and sand-filled crevices within the sandstone creek bed support herbs such as *Ludwigia suffruticosa*, *Polygonum attenuatum* and *Goodenia lamprosperma* while on the mud are *Limnophila fragrans* and *Microcarpaea minima*.
- (c) On the rock ledges immediately above the creek bed *Ficus leucotricha* var. *megacarpa*, *Hibiscus* sp., *Distichostemon hispidulus* and the hummock grass *Plectrachne bynoei* occur.



Figure 17—Petrogale Gorge (B3). Dense closed-forest of Cadjeputs (*Melaleuca argentea* and *M. leucadendron*) and *Eugenia eucalyptoides*, on the edge of the plunge pool below Cracticus Falls.

- (d) Below Cracticus Falls the creek descends into a deep plunge pool before flowing on into a narrow gorge. At the edge of the large plunge pool a dense stand of Cadjeputs (*Melaleuca leucadendron*, *M. argentea*) and *Eugenia eucalyptoides* forms a fringing closed-forest. Because of the depth of water the pool is devoid of aquatics.
- (e) The rock ledges and scree slopes surrounding the pool support the Screw-pine (*Pandanus yuleensis*), *Calytrix brachychaeta*, *Planchonella pohlmanniana*, *Clerodendrum tomentosum*, *Acacia kelleri*, *A. dunnii* and the Rock Fig (*Ficus platypoda*).
- (f) Where the creek enters the narrow steep-sided sandstone gorge (cut to about 30 m below the surrounding plateau) a dense closed-forest of Cadjeputs (*Melaleuca leucadendron*, *M. argentea*, *M. viridiflora*) and *Eugenia eucalyptoides* occurs. Where the *Melaleuca leucadendron* emerges above the gorge wall, creepers such as *Passiflora foetida*, *Flagellaria indica*, *Adenia heterophylla* ssp. *australis* and *Smilax australis* are common in its canopy. On the shaded gorge floor, black mud banks and shallow pools support aquatics such as *Blyxa aubertii*, *B. echinosperma*, *Valisneria spiralis* and *Myriophyllum trachycarpum*, while *Xyris*

pauciflora, *Ludwigia suffruticosa* and the grasses *Elytrophorus spicatus* and *Sclerandrum truncatiglume* are common.

- (g) Eastwards up Johnson Creek, following the creek bed, there is a thick band of vegetation on the rugged scree slopes (Pkpl) where the gorge widens out. The vegetation is mainly *Xanthostemon paradoxus*, *Ficus* spp., *Livistona* sp., *Canarium australianum* and *Pouteria sericea*. The creepers *Smilax australis*, *Capparis* spp., are common, as is the Precatory Bean (*Abrus precatorius*).
- (h) Seepage areas along the shaded sandstone (Pkpl) ledges at the base of the cliff wall are characterised by ephemeral species (*Stylidium muscicola*, *Nicotiana benthamiana*) and fern allies (*Cheilanthes* sp., *Selaginella ciliaris*).
- (i) Beside Johnson Creek on the elevated flats there is a large area of sand over sandstone (Pkpl) which is primarily a closed-grassland, the common species being *Cymbopogon procerus* and *Triodia pungens*. Tree and tall shrub emergents such as *Buchanania obovata*, *Terminalia latipes*, *Petalostigma pubescens*, *Grevillea viscidula* and *Sterculia viscidula* occur. Beyond the closed-grassland a massive scree slope rises to the base of a sheer cliff, with the main plateau directly above.
- (j) The vegetation of the scree (Pkpl) is a mixed community of *Livistona* sp., *Erythrophleum chlorostachys*, *Eucalyptus miniata*, *E. clavigera*, *Terminalia latipes* and *Owenia vernicosa*. Shrub species such as *Atylosia cinerea*, *Pachynema junceum* and *Hibbertia lepidota* are common as are the grass species *Cymbopogon procerus* and *Triodia pungens*.
- (k) On the main sandstone plateau (Middle Pentecosts; Pkpm) above Petrogale Gorge, *Livistona* sp., *Stenocarpus cunninghamii*, *Buchanania obovata* are common along the cliff edge. The plateau supports a woodland to open-woodland of eucalypts (*Eucalyptus miniata*, *E. bleeseri*) together with *Terminalia* sp., *Livistona* sp., *Erythrophleum chlorostachys* and *Santalum lanceolatum*.

B4 Solea Falls (Figures 18, 19, Colour plate 3)

Solea Falls lies on the Drysdale River in 14°40'S, 127°00'E. The altitude above the falls is about 120 m. The horseshoe-shaped waterfall, about 30 m high, is spectacular even in the dry season. The plunge pool below is about 150 m long, 100 m wide and 10–15 m deep. Above and below the falls the river bed is strewn with boulders and in places the water during the dry season flows beneath them. On the west side are some loose sand banks. About 1 km south of the falls is a long permanent pool, and into this from the east flow Johnson Creek and Petrophassa Creek. Just west of the falls is a flood channel of the Drysdale with a pool remaining at its lowest point. On either side of the river the country is gently undulating but with a rugged surface. Between Johnson and Petrophassa Creeks is a flat sandy plain. Geologically the area consists of Warton Sandstone (Pkw).

- (a) The vegetation away from the river is mostly low woodland, tall shrubland and tall open-shrubland. In the upper storey there are no dominants and the trees and shrubs include *Eucalyptus* aff. *leucophloia*, *E. miniata*, *E. herbertiana*, *Owenia vernicosa*, *Acacia kelleri*, *A. dumii*, *A. tumida*, *Persoonia falcata*, *Ficus leucotricha*, *Eugenia bleeseri*, *Brachychiton* sp., *Verti-*



Figure 18—View south-east across the B4 site. Tall open-shrubland on sandstone hills in foreground, with the Drysdale River and Solea Falls beyond. Tall trees in right distance are *Melaleuca leucadendron* along Galola Creek.

- cordia cunninghamii*, *Grevillea cunninghamii* and *Xanthostemon paradoxus*. A fan palm (*Livistona loriphyllo*) is frequent in places. There are two viscid spinifexes, *Triodia pungens* and *Plectrachne pungens*.
- (b) On the alluvial sand (Qa) near the river between Petrophassa and Johnson Creeks is a woodland dominated by *Eucalyptus*, especially *E. miniata*, *E. tetrodonta* and *E. ? latifolia*. Smaller trees are *Planchonella arnhemica*, *Buchanania obovata*, *Petalostigma pubescens*, *Grevillea pteridifolia* and *Verticordia cunninghamii*, while *Bossiaea bossiaeooides* is a common undershrub. Grasses and herbs form a rather dense ground cover.
- (c) Along the Drysdale River is a fringing formation of varying composition. By the long pool south of the falls, *Melaleuca leucadendron* and *M. argentea* are common, with dense stands of *Pandanus aquaticus*. There are some *Eucalyptus camaldulensis*. This formation extends a little way up Johnson Creek. In rocky areas, sometimes with the water flowing "underground", there is a tall shrubland or open-shrubland dominated by *Eugenia eucalyptoides* and *Terminalia bursarina* with some *Barringtonia acutangula* and *Calytrix brachychaeta*. Aquatic plants in the river include *Nymphoides* spp., *Utricularia inflexa* and *Triglochin pterocarpa*.
- (d) Petrophassa Creek is lined with *Melaleuca leucadendron* in its lower course, changing to *M. viridiflora*, *Pandanus spiralis* and *Banksia dentata* higher up. The creek supports quite a rich aquatic and marsh flora, including species of *Blyxa*, *Limnophila*, *Eriocaulon*, *Cyperus*, *Drosera*, *Mitrasacme*, *Xyris*, *Marsilea*, *Stylidium*, *Mimulus* and *Hemiarrhena*.
- (e) Just below Solea Falls on the east side of the Drysdale is a pocket of open-scrub on a boulder scree. The trees and shrubs include *Xanthostemon paradoxus*, *Ficus platypoda*, *Canarium australianum*, *Stenocarpus cunninghamii*, *Gardenia pantoni*, *Owenia vernicosa* and *Clerodendrum tomentosum*.



Figure 19—The Drysdale River above B4. *Melaleuca argentea* and *Pandanus aquaticus* on right bank. *Melaleuca leucadendron* and *Pandanus* on left bank, with *Eucalyptus* woodland beyond.

C1 Morgan Falls (Figures 20, 21, Colour Plates 1, 2)

This site is at Morgan Falls where Palmoondoor Creek falls into Worriga Gorge. It lies in 15°02'S, 126°40'E, and the altitude atop the falls is about 280 m. The creek, flowing from the west, descends 60 m in two massive steps into the gorge where it turns due north. The gorge is spectacular, with vertical sandstone cliffs along its east side and very steep slopes and cliffs along the west side. Opposite Morgan Falls is a smaller waterfall, Christella Falls. Both were reduced to trickles at the time of our visit though the creek bed contained many permanent pools. A southern extension of Worriga Gorge is occupied by a permanent stream, Elasmias Creek. The plateau and gorge consist of King Leopold Sandstone (Pkl) but in the bottom of the gorge are a few outcrops of Hart Dolerite (Pdh). Several remnants of laterite occur on the plateau. Most areas are very rocky.

(a) On the plateau and scree slopes of the gorge the vegetation is mostly low-woodland and low open-forest dominated by *Eucalyptus* species, especially *E. miniata*, *E. tetradonta* and, along the edge of the gorge, *E. aff. leucophloia*. Other trees here include *Callitris intratropica*, *Owenia vernicosa*, *Erythrophleum chlorostachys*, *Petalostigma pubescens*, *Gardenia* sp. and *Sterculia viscidula*. Most of the understorey was burnt by the fire which passed through the area just after the arrival of the survey team. However the following shrubs were recorded: *Bossiaea bossiaeoides*, *Calytrix microphylla*, *C. achaeta*, *Grevillea agrifolia*, *Jacksonia argentea*, *Triumfetta* sp. and *Acacia dunnii*. Ephemeral *Sorghum* is common, as well as the spinifex *Plectrachne bynoei*.

(b) A variable fringing formation occurs along Palmoondoor Creek above Morgan Falls. *Pandanus aquaticus* and *P. ? spiralis* form dense thickets around permanent pools. In more open areas *Calytrix brachychaeta* and *Acacia plectocarpa* are frequent. A few *Melaleuca leucadendron* occur along the creek. Aquatic and marsh plants include *Vallisneria spiralis*,

Nymphoides spp., *Dysophylla verticillata*, *Ebermaiera glauca*, *Eriocaulon* spp., *Utricularia chrysantha* and *Goodenia lamprosperma*.

- (c) Shrubs and small trees inhabit rock crevices around Morgan Falls, e.g. *Ficus virens*, *F. platypoda*, *Calytrix microphylla*, *Stenocarpus cunninghamii*, *Xanthostemon paradoxus* and *Eucalyptus* aff. *leucophloia*. The spinifex *Triodia pungens* is common on dry ledges, while in sheltered crevices *Micraira subulifolia* occurs. Beneath the overhangs of the fall are the ferns *Nephrolepis hirsutula* and *Lygodium microphyllum*.
- (d) Some lower slopes of the gorge consist of basaltic soil which supports a low woodland dominated by *Eucalyptus tectifera*, with a dense ground cover of grasses. There are a few *Erythrina vespertilio*. At the north end of Worriga Gorge is a small perennial tributary, Colochasia Creek, along which is a population of *Colochasia antiquorum* growing in black loam with *Blechnum orientale* and *Cyclosorus interruptus* under *Pandanus* sp.
- (e) The floor of Worriga Gorge is extremely rocky and has many permanent pools. The vegetation is varied. There are fringes of open-woodland with *Melaleuca leucadendron*, *Sesbania formosa* and *Nauclea coadnata* over dense stands of *Pandanus aquaticus*. In drier areas a tall shrubland or tall open-shrubland is dominated by *Eugenia eucalyptoides* with a few *Calytrix brachychaeta* and *Buchanania obovata*. There are small stands of the perennial grasses *Arundinella nepalensis* and *Coelorachis rottboellioides*. *Nymphaea gigantea* and *Nymphoides* spp. are common in the pools.
- (f) Pockets of low open-forest akin to semi-deciduous vine thicket occupy the lowest slopes of the gorge. The trees include *Alphitonia excelsa*, *Pouteria sericea*, *Bombax ceiba*, *Planchonella arnhemica* and *Micromelum minutum*, with the creepers *Abrus precatorius* and *Sarcostemma australe*.
- (g) Several seepages occur on the lower cliffs of the eastern side of the gorge and support lush populations of ferns. They include *Blechnum orientale*,



Figure 20—View east across Worriga Gorge at C1. Low woodland on plateau, open-woodland and open-shrubland in gorge. Christella Falls right-centre.



Figure 21—Semi-deciduous vine forest near Elasmias Creek in Worriga Gorge (C1).

Lygodium microphyllum, *Dicranopteris linearis* and *Lygodium cernuum*. *Melastoma malabathricum* is a common shrub, and several species of *Stylidium* occupy rock ledges. *Eucalyptus ptychocarpa* is sometimes present.

- (h) The vertical sandstone cliffs are almost bare, except for a few shrubs and small trees such as *Eucalyptus brachyandra* and *Ficus leucotricha*.
- (i) Along Elasmias Creek is a small but striking area of closed-forest forming a semi-deciduous mesophyll vine forest of mixed composition. The trees include *Diospyros nitens*, *D. ferrea*, *Cassine melanocarpa*, *Canarium australianum*, *Ficus racemosa*, *F. virens*, *Carallia brachiata*, *Albizia lebbek*, *Timonius timon*, etc. There are robust lianes, as yet unidentified. There is little understorey but a thick leaf litter covers the ground. The fern *Doryopteris concolor* occurs here, dry and dormant at the time of our visit.
- (j) At the edge of the vine forest, Elasmias Creek supports a luxuriant growth of ferns, especially *Stenochlaena palustris*, *Lygodium microphyllum* and *Cyclosorus interruptus*. Ferns are a feature of Worriga Gorge with 13 species recorded, making it the richest single area for them in Western Australia. The records of *Doryopteris* and *Christella dentata* are the first of these genera in the State.

C2 Euro Gorge (Figures 22, 23)

The C2 campsite (15°03'S, 126°44'E) was established at the end of Euro Gorge on Woorakin Creek about 1 km from where the creek enters the Carson River. At this site the gorge is narrow with steep faces, few scree slopes and with large sheets of bare rock exposed on the gorge floor. Woorakin Creek was flowing slowly and shallow pools cut into the King Leopold Sandstone were common at the time of our visit.

- (a) Fringing the creek and pool banks are dense stands of Screw-pine (*Pandanus aquaticus*) and Cadjeput (*Melaleuca leucadendron*) together with *Alphitonia excelsa*, *Santalum lanceolatum*, *Acacia holosericea*,

A. plectocarpa, *A. retinervis*, *Canarium australianum* and *Verticordia cunninghamii*. On the wet sand banks, herbs such as *Osbeckia australiana*, *Bergia pedicellaris*, *Ludwigia suffruticosa*, *Crotalaria crassipes* and *Philydrum lanuginosum* are common. The shallow pools support aquatics such as *Blyxa echinosperma*, *Isoetes* sp. and *Nymphoides indica*.

- (b) Further upstream, the gorge narrows and supports a dense stand of Cadjeput (*Melaleuca leucadendron*), some over 30 m tall, Screw-pine (*Pandanus aquaticus*) with the ferns *Lygodium microphyllum* and *Blechnum orientale*. *Smilax australis* and *Passiflora foetida* are common scrambling amongst a dense growth of Sedge (*Scleria* sp.) and climbing up into the tree canopies. A seepage in the sandstone cliff was covered in a dense growth of the scrambling fern *Dicranopteris linearis* with *Lindsaea ensifolia* growing among it.
- (c) The sandstone (Pkl) cliff faces and ledges of the gorge support tall trees (up to 11 m) of *Ficus virens* var. *sublanceolata* (heavily in fruit at the time of our visit) and *Ficus leucotricha* (also in fruit). On the edges of the gorge *Eucalyptus* aff. *leucophloia*, *Buchanania obovata*, *Brachychiton* sp. and *Owenia vernicosa* are common trees.
- (d) Downstream toward the junction with the Carson River, Woorakin Creek widens forming a mosaic of broad deep pools (some 30 m x 70 m and up to 4 m



Figure 22—View east over Carson Volcanics towards Carson River near Euro Gorge (C2) with *Grevillea mimosoides* and *Hakea arborescens* in foreground.



Figure 23—Near Euro Gorge (C2). Dark outcrops of Carson Volcanics supporting a low open-woodland with the grasses *Themeda australis* and *Cymbopogon procerus* forming the main ground cover.

deep) and muddy areas where pools have dried out. The alluvial creek and levee banks support a mixed plant community. Fringing the creek Cadjeputs (*Melaleuca leucadendron* and *M. argentea*) and Screw-pine (*Pandanus spiralis* var. *convexus*) are most common but patches of *Eucalyptus ptychocarpa*, *Banksia dentata*, *Ficus racemosa*, *Brachychiton australe*, *Sterculia viscidula* and *Bombax ceiba* var. *leiocarpum* also occur. In places the banks are covered in a dense growth of Kangaroo Grass (*Themeda australis*) and *Cymbopogon procerus*. The muddy areas are rich in semi-aquatic species such as Nardoo (*Marsilea* sp.), *Limnophila indica*, *Najas tenuifolia*, *Lobelia quadrangularis*, *Rotala diandra* and *Ebermaiera glauca*.

- (e) The banks of the Carson River support a dense closed-forest of Cadjeputs, (*Melaleuca leucadendron*, *M. argentea*) Screw-pine (*Pandanus* sp.), *Terminalia latipes*, *Ficus coronulata*, *Brachychiton australe* and *Eucalyptus ptychocarpa*. It was possible to move through the dense thickets of Screw-pine following feral cattle pads.
- (f) East of the Carson River the dark outcrops of the Carson Volcanics (Pkc) are encountered. These basalt soils support a low woodland to low open-woodland of *Eucalyptus tectifica* and *E. foelscheana* together with *Hakea arborescens*, *Grevillea mimosoides*, *Celtis philippensis*, *Cochlospermum fraseri*, *Terminalia canescens*, *Gardenia* sp., *Brachychiton* sp., *Acacia translucens*, *A. sutherlandii* and *Stemodia viscosa*. The grasses *Themeda australis* and *Heteropogon contortus* formed the main ground cover.
- (g) In contrast to the Carson Volcanics the rugged plateau of King Leopold Sandstone supports a low open-forest of *Eucalyptus tectifica*, *E. grandiflora* and *E. aff. leucophloia* with *Erythrophleum chlorostachys* and *Terminalia latipes* also occurring. On the areas of flat sandstone usually devoid of soil, a scattered shrub layer of *Acacia deltoidea*, *A. stigmatophylla*, *Jacksonia argentea*, *Grevillea agrifolia*, *Hakea arborescens*, *Hibbertia lepidota*, *Phyllanthus* sp. and *Calytrix brachychaeta* is well developed.

C3 Planigale Creek (Figure 24)

The C3 campsite (14°43'S, 126°54'E) was established near a large shallow pool on Planigale Creek about 4.5 km in a direct line from where the creek enters the Drysdale River.

- (a) The creek bed both upstream and downstream of the pool was dry with flat sheets or angular boulders exposed of Warton Sandstone (Pkw). The residual pool contained no aquatics although the bottom was sandy. In many places Cadjeputs (*Melaleuca leucadendron* and *M. argentea*), the Freshwater Mangrove (*Barringtonia acutangula*), *Eugenia eucalyptoides*, *Acacia latifolia*, *A. kelleri* and *Grevillea pteridifolia* grow on the sandy levee banks or in the rock fissures of the creek bed. The grasses *Triodia microstachya* and *Eragrostis* sp. are also common in rock fissures where alluvial sand has been deposited.
- (b) Downstream Planigale Creek forms a series of braided pools again lined with Cadjeputs and the Screw-pine (*Pandanus yuleensis*). These pools contain numerous aquatics such as *Nymphaea gigantea*, *Nymphoides indica*, *Eriocaulon* spp., *Aponogeton elongatus*, *Myriophyllum trachycarpum* and *Limnophila fragrans*. Perennial herbs such as *Philydrum lanuginosum* and *Xyris* spp. are also common.

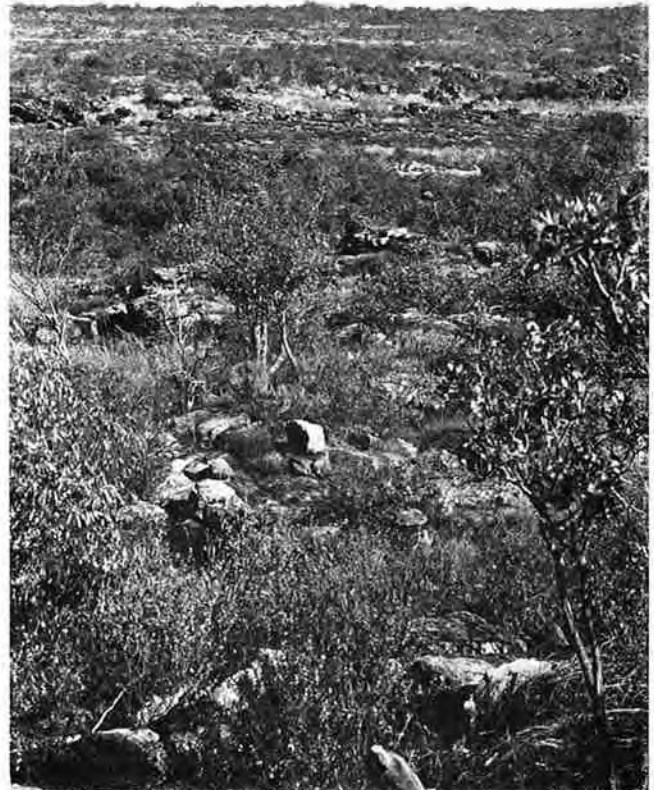


Figure 24—Planigale Creek area (C3). Flat plain dissected by massive sandstone outcrops.

- (c) Away from Planigale Creek the surrounding plain is flat but broken by a series of massive sandstone (Pkw) outcrops. The vegetation of the outcrops is a low open-woodland dominated by tree and shrub species such as *Planchonella arnhemica*, *Ficus virens*, *F. leucotricha*, *F. platypoda*, *Denhamia obscura*, *Acacia dunnii*, *Buchanania obovata*, *Grevillea refracta*, *Pouteria sericea*, and *Atylosia ? cinerea*. The climbers *Smilax australis*, *Flagellaria indica*, *Tinospora smilacina* and *Parsonsia velutina* are common, tangled among the canopies of the trees and straggling across the sandstone boulders. The grass *Micraria* aff. *subulifolia* forms dense mats on the floors of shaded caves.
- (d) The flat areas between the sandstone (Pkw) outcrops support a woodland to open-woodland dominated by *Eucalyptus bleeseri*, *E. tetradonta* and *E. confertiflora*. Other tree and shrub species are *Terminalia latipes*, *Grevillea cunninghamii*, *Santalum lanceolatum*, *Buchanania obovata*, *Stenocarpus cunninghamii*, *Verticordia cunninghamii*, *Plagiocarpus axillaris* and *Calytrix achaeta*. There are dense patches of Kangaroo Grass (*Themeda australis*) and *Cymbopogon procerus* and these open grassy areas become more common as one approaches Planigale Creek.
- (e) The dry, deeply dissected creek beds, tributaries of Planigale Creek, support small stands of *Eucalyptus ptychocarpa*, *E. ? herbertiana*, *E. tetradonta*, *Livistona* sp., and *Acacia dunnii* with *Bossiaea bossiaeoidea*, *Petalostigma pubescens*, *Ricinocarpus* sp., *Glycosmis trifoliata* and *Burtonia subulata* being common shrubs.

C4 Carlia Creek (Figures 25, 26, 27, Colour plate 15)

The C4 campsite was located some 20 km south of B1, again where a small stream (Carlia Creek) leaves the Carson Escarpment, in 15°02'S, 126°49'E. The Escarpment here is mostly a steep scree, but some high cliffs occur about 2 km north of the creek. A deep gully (Coucal Gorge) has been carved by the creek into the scarp. The scarp and plateau consist of Warton Sandstone (Pkw), while the plain below is of loam derived from Carson Volcanics (Pkc) with alluvial outwash along the foot of the Escarpment. To the west the Carson River flows north across the plain, with basalt outcrops in its bed.



Figure 25—View south along the Carson Escarpment at C4. Low woodland on plateau, woodland on plain.



Figure 26—Low open/closed-forest on the Carson Escarpment north of C4. Tree at left is *Gyrocarpus americanus*, that in centre is *Bombax ceiba* in flower.



Figure 27—The Carson River near C4. A large pool with fringing *Pandanus aquaticus*, *Ficus racemosa*, *Tristania ? suaveolens*, *Eucalyptus camaldulensis*, etc.

- (a) On the plateau is a low woodland and tall shrubland grading to open-forest eastwards. Eucalypts are prominent, especially *E. aff. leucophloia*, *E. confertiflora* and two other undetermined bloodwoods. Other frequent trees are *Owenia vernicosa*, *Buchanania obovata*, *Callitris intratropica* and *Petalostigma pubescens*. The principal shrubs are *Acacia* spp., *Verticordia cunninghamii*, *Calytrix* spp., *Bossiaea bossiaeoidea*, *Jacksonia ? argentea* and *Boronia lanuginosa*. Spinifex (? *Plectrachne* sp.) and ephemeral *Sorghum* are common grasses.
- (b) About 1 km south of the camp, near the edge of the plateau above the scarp is a seepage area still damp at the time of our visit. It is a small area of closed grassland, with a low open-forest on the slope above. Besides various grasses such as *Eragrostis* and *Ectrosia* there are many herbs in the grassland, e.g. *Stylidium*, *Drosera*, *Utricularia*, *Xyris*, *Ophioglossum*, *Goodenia* and *Mitrasacme*. *Pandanus spiralis* occurs around the margins. The low open-forest is dominated by *Eucalyptus ptychocarpa* and *Melaleuca viridiflora*, with an admixture of *Banksia dentata*, *Terminalia grandiflora* and *Eugenia bleeseri*.
- (c) The screens of the Escarpment carry low woodland with areas of low open (rarely closed)-forest. Trees of the woodland are mostly *Eucalyptus latifolia*, *E. tectifera*, *Acacia* spp., *Erythrophleum chlorostachys*, *Cochlospermum fraseri*, *Terminalia* sp. and *Buchanania obovata*. There are a few shrubs such as *Solanum dioicum* and *Psoralea pustulata* but the understorey consists mainly of grasses including *Sclerandrium truncatiglume* and *Cenchrus elymoides*. The low open-forest is of mixed composition and generally lacks eucalypts. Representative trees are *Celtis philippensis*, *Cassine melanocarpa*, *Ficus platypoda*, *Dolichandrone heterophylla*, *Vitex glabrata* and *Gardenia megasperma*, with *Bombax ceiba* and *Gyrocarpus americanus* as deciduous emergents. There are a few climbers and scrambling shrubs such as *Adenia heterophylla*, *Jasminum didymum* and *Caparis* sp.

- (d) In Coucal Gorge on the Escarpment is a similar but more extensive low open- or closed-forest. The trees found here include *Syzygium suborbiculare*, *Carallia brachiata*, *Alphitonia excelsa*, *Glycosmis pentaphylla* and *Randia cochinchinensis*. *Pandanus* sp. is common along the creek which contains several permanent pools. The ferns *Lindsaea ensifolia* and *Blechnum orientale* grow around these. In more open areas are shrubs such as *Fenzlia phebalioides*, *Boronia lanuginosa* and *Stenocarpus cunninghamii*.
- (e) At the entrance to the gully there is open-scrub dominated by *Acacia* species, especially *A. plectocarpa* and *A. kelleri*, together with *Grevillea agrifolia*, *G. pteridifolia* and a few *Eucalyptus ptychocarpa*. A dense ground cover of grasses includes *Triodia pungens* and *Plectrachne bynoei*.
- (f) In the alluvial soil along the foot of the Escarpment to the north of the gully are open-forest and low open-forest, with little understorey except for a dense ground cover of grasses. The trees include *Eucalyptus miniata*, *E. apodophylla*, *Erthrophleum chlorostachys*, *Ficus opposita*, *Petalostigma pubescens*, *Sterculia viscidula*, *Verticordia cunninghamii*, *Cochlospermum fraseri*, *Terminalia* sp., *Grevillea pteridifolia* and *Pandanus* sp.
- (g) Towards the Carson River in loamy basaltic soil the low woodland is dominated by eucalypts, especially *E. tectifera* and *E. foelscheana*, with admixture of *Hakea arborescens* and *Erythrina vespertilio* and the shrubs *Acacia stigmatophylla*, *A. sutherlandii* and *Grevillea mimosoides*. Grasses again form a dense ground cover.
- (h) The Carson River and nearby tributaries have a narrow fringing formation which includes tall trees such as *Ficus racemosa*, *Tristania ? suaveolens*, *Sesbania formosa*, *Terminalia* sp., *Timonius timon* and *Eucalyptus camaldulensis*. There are dense stands of *Pandanus aquaticus*. The perennial grass *Eriachne festucea* is common in the river bed, and there are small sedges such as *Cyperus* sp. and *Fimbristylis* sp.



Figure 28—View up Dysphania Gorge (C5). Low closed-forest along creek, closed-scrub on left hand slope, low woodland on opposite slope and on hills.



Figure 29—Rugged sandstone hills at C5 with low woodland. Tree at left is *Eucalyptus miniata*, palms are *Livistona loriphylla*. Area burnt 1–2 years before and *Triodia* not yet prominent.

C5 Forest Creek (Figures 28, 29, Colour plate 4)

This campsite was located on Forest Creek, a small tributary of the Drysdale River, in 14°39'S, 126°56'E. The stream is perennial for some distance and issues from two gorges in the low hills south of the river. Forest Creek occupies the eastern gully (Dysphania Gorge) and Schizaea Creek the western (Robin Gully). The hills consist of Warton Sandstone (Pkw) and have an extremely rugged surface of sandstone blocks. The elevation of the campsite is about 100 m above sea level.

- (a) A striking feature of the locality is a narrow belt of tall closed-forest along the creek just before it reaches the river. The trees are *Melaleuca leucadendron*, *Carallia brachiata*, *Metrosideros eucalyptoides* and one as yet undetermined. There is only a layer of leaf litter on the ground.
- (b) In the two gullies where the streams are perennial is a low closed-forest, while closed-scrub occurs on the south-facing slope of Forest Creek. The composition is very mixed. The trees include *Melaleuca virens*, *Cassine melanocarpa*, *Planchonella pohlmanniana*, *Alphitonia excelsa*, *Pandanus* sp., *Eucalyptus ptychocarpa* and *Denhamia obscura*. *Melastoma malabathricum* is common by the creek. The fern *Schizaea digitata* occurs in both gullies. Other ferns in wet areas include *Lycopodium cernuum*, *Lygodium microphyllum*, *Lindsaea ensifolia* and *Dicranopteris linearis*. Aquatic species in the creek are *Blyxa aubertii*, *Aponogeton elongatus* and *Limnophila fragrans*. *Banksia dentata* occurs along Schizaea Creek in its upper reach where it descends over terraces. In the drier closed-scrub along Forest Creek, are small trees such as *Pouteria sericea*, *Planchonia australis*, *Stenocarpus cunninghamii*, *Xanthostemon paradoxus*, *Glycosmis trifoliata*, *Vitex glabrata* and *Rapanea ? porosa*, the last being the first record for the genus in Western Australia. *Sarcostemma australe* and *Flagellaria indica* occur as creepers.
- (c) On the dry, rocky, sandstone hills there is a low woodland, occasionally woodland. Eucalypts are

the dominant trees, especially *E. miniata*, *E. tetrodonta* and *E. herbertiana*. Fan palms (*Livistona* sp.) are very common. Other trees are *Owenia vernicosa* and *Buchanania obovata*, while common shrubs are *Acacia dunnii*, *Bossiaea bossiaeoidea*, and, on the dry north-facing slope of the gully above Forest Creek, *Grevillea cunninghamii*, *Jacksonia argentea* and *Boronia lanuginosa*. A spinifex (? *Plectrachne* sp.) is very common.

- (d) Along the Drysdale River at this locality is a fringing formation dominated by the Cadjeputs *Melaleuca leucadendron* and *M. argentea*.

C5A Galaxy Swamp (Figure 30)

A visit of one hour was made to this swamp which lies to the west of Forest Creek (C5), in approximately 14°37'S, 126°55'E. It is on an almost flat alluvial plain west of the Drysdale River and north of an extensive belt of Warton Sandstone hills. There is an area of permanent water covering about 2 ha surrounded by a swampy area which would be flooded in the wet season.

- (a) In black mud around the permanent water is a dense belt of *Eleocharis* sp. with admixture of *Cyperus holoschoenus*, *Vetiveria pauciflora* and *Oryza australiensis*. *Nymphaea gigantea* occurs in the open water.
- (b) A fringe of low woodland of varying width around the water is dominated by *Melaleuca viridiflora*. The low ground cover beneath it contains ephemeral and perennial herbs such as *Scirpus ? supinus*, *Xyris pauciflora*, *Limnophila* sp., *Nymphoides hydrocharoides*, *Eriachne glauca* and *Stylidium schizanthum*. The soil is clayey, becoming muddy where wet.
- (c) Surrounding the swamp on sand is a low open-forest dominated by Eucalypts including *E. miniata*. Other trees are *Banksia dentata* and *Pandanus spiralis*, while there is a ground storey principally of grass but including a number of herbs such as *Drosera indica*, *Mitrasacme commutata*, *Blumea integrifolia* and *Mimulus linearis*.



Figure 30—Galaxy Swamp (C5A). Cadjeputs are *Melaleuca viridiflora*, grass in foreground is *Vetiveria pauciflora*.

THE EFFECT OF FERAL EUROPEAN CATTLE ON THE VEGETATION

Frequent summer fires as well as the trampling and grazing effect of feral European cattle (*Bos taurus* Linnaeus) appear to be widespread in the Kimberley. Their combined effect on the vegetation and native fauna is yet to be fully ascertained. Damage caused by feral Bali cattle (*Bos javanicus* d'Alton) has also been recorded for the Northern Territory by Frith and Calaby (1974). Feral cattle, both singly and in groups, were encountered at nine of the collecting sites and evidence of their presence recorded at the remainder (McKenzie *et al.*; this bulletin). Many small groups were observed from the air and well-defined pads are often seen.

The cattle favour the fringing formations of rivers, creeks and swamps as is evidenced for example by the severe trampling and grazing effects observed on the grasslands fringing the sandy alluvial flats.

Damage is caused to *Pandanus spiralis* thickets fringing the banks of the Carson River near Woorakin Creek, and eroded areas created by cattle dust-bathing between the woodland and riverine communities are common.

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PART IV

VEGETATION MAP OF THE DRYSDALE RIVER NATIONAL PARK

By F. G. SMITH¹

MAP PREPARATION

The vegetation map was prepared from air photo interpretation, checked by helicopter traverses of the park. The classifications used follow those of the Western Australian Vegetation Mapping Committee as used by Smith for the 1:250 000 vegetation maps, Pemberton-Irwin Inlet, Augusta-Busselton and Collie.

Vegetation has been mapped on the basis of structural criteria of the tallest stratum. Criteria used in the structural classification are life-form, height and density. There are three height classes for trees—over 30 m, 10 to 30 m, and under 10 m. There are two height classes for shrubs—over 2 m, and up to 2 m. Herbs, which include grasses, sedges and hummock grasses, form another life-form class.

There are four density classes based on projective foliage cover. Crown area cover is not used, because it does not allow for the difference in the amount of light passing through the canopy of forests of similar crown cover but vastly different foliage cover. Because the amount of light passing through the main or top canopy

has a big influence on the structure of the understorey, the use of projective foliage cover should give a better basis of comparison of plant formations. However, projective foliage cover is exceedingly difficult to estimate with any exactitude in the more open formations.

Considerable difficulty in classification was experienced because much of the woodland in the area is about 10 m high and could be either Low Woodland or Low Open-Forest up to 10 m or Woodland or Open-Forest over 10 m. high. Similarly, the foliage cover of the upper storey is about 30 per cent, making it difficult to access whether it is Open-Forest or Woodland.

Floristic descriptions of the formations recorded at each collecting site are provided in Part III of this bulletin. The sites are marked on the vegetation map. It should be noted that a formation as mapped will tend to contain small areas of other formations whose areas are too small to be mapped. These are described for each site in Part III.

REFERENCE

Smith, F. G. (1972). Vegetation Map: Pemberton-Irwin Inlet. W. Aust. Department of Agriculture.

¹ National Parks Authority of Western Australia, Hackett Drive, Crawley, W.A. 6009.

SEE MAP INSIDE BACK COVER

PART V

THE FLORA OF THE DRYSDALE RIVER NATIONAL PARK NORTH KIMBERLEY, WESTERN AUSTRALIA

by A. S. GEORGE¹ and K. F. KENNEALLY¹

INTRODUCTION

On the expedition to the Drysdale River National Park, we visited all thirteen camp sites. We spent 2–3 days at each site except for C5 at which we had a half day. A brief visit of one hour was made to Galaxy Swamp, just west of C5. The break-down of sites was as follows: ASG: A1, A4, B1, B4, C1, C4; KFK: A2, A3, B2, B3, C2, C3. We both visited C5 and Galaxy Swamp (see Kabay; this publication). The time at each site was limited and, as with the Prince Regent River expedition, we were there in the dry season. We sampled as many formations as possible, recorded structure and dominant species and collected all taxa seen. Many plants were sterile, and some have still not been identified.

Fires burnt out extensive areas around two sites (C1, C2) during the expedition, making it difficult to sample and record them.

Over 1700 plant collections were made. Fungi and lichens are poorly represented; they were less frequent than at the Prince Regent River, and lack of time precluded thorough collecting. A photographic record was made in both colour and black-and-white of most vegetation formations and of many individual species.

NOTES ON THE COLLECTION

The following list contains all the taxa so far identified, if only to family. It totals 594 taxa, in which there are 15 fungi, 14 lichens, 2 bryophytes, 25 ferns and fern allies, 1 gymnosperm and 537 flowering plants (129 monocots, 408 dicots). The monocots belong to 64 genera in 22 families, and the dicots to 229 genera in 77 families.

In terms of species numbers, the Poaceae are the largest family in the Park, closely followed by the Myrtaceae, though collecting in the wet season would add greatly to the former. The Papilionaceae and Cyperaceae are next, with lesser numbers again of Mimosaceae, Euphorbiaceae, Rubiaceae, Asteraceae and Scrophulariaceae. The remaining families are represented by less than 15 species. Table 1 lists the number of taxa in the larger families.

TABLE 1
NUMBER OF TAXA IN THE LARGER FAMILIES IN THE
DRYSDALE RIVER NATIONAL PARK

Poaceae	.....	53
Myrtaceae	.....	52 (Eucalyptus 31)
Papilionaceae	.....	35
Cyperaceae	.....	32
Mimosaceae	.....	27 (Acacia 26)
Euphorbiaceae	.....	20
Rubiaceae	.....	18
Asteraceae	.....	16
Scrophulariaceae	.....	15

¹ Western Australian Herbarium, Department of Agriculture, Jarrah Road, South Perth, W.A. 6151

Once again there are many records previously unpublished for Western Australia. The list includes 35 taxa, but the undetermined material contains others. Eight of the new records are genera not previously known to occur in the State, viz *Homalocalyx* (Myrtaceae), *Metrosideros* (Myrtaceae), *Micraira* (Poaceae), *Plagiocarpus* (Papilionaceae), *Pseudopogonatherum* (Poaceae), *Rapanea* (Myrsinaceae), *Syzygium* (Myrtaceae) and *Viscum* (Viscaceae). The occurrence of *Rapanea* is of particular interest: the genus is widespread in tropical and sub-tropical countries and in Australia is known from north Queensland to eastern Victoria but has so far not been recorded in the Northern Territory.

Ferns and fern allies

Due to the relative dryness of the area ferns are rare over most of the Park, being restricted chiefly to moist, sheltered habitats. Only *Platyzoma microphyllum* occurs in dry sandy open-woodland. Seepages on cliffs and permanent pools or creeks in rocky gullies usually support one or more species of ferns. The most commonly seen are *Lygodium microphyllum*, *Lindsaea ensifolia*, *Blechnum orientale* and *Selaginella ciliaris*. Worriga Gorge (C1) has the richest fern populations in the Park due to its sheltered habitats with adequate permanent water. Here 13 species were recorded, two of them for the first time in W.A. (*Christella dentata* and *Doryopteris concolor*). At the edge of the vine forest in the gorge, the growth of *Stenochlaena palustris*, *Lygodium microphyllum*, *Cyclosorus interruptus* and *Blechnum orientale* forms the most luxuriant population of ferns yet seen in the State (colour plate 2, this bulletin).

Four species collected at other sites are also new records. *Lygodium japonicum* was found in seepages on sandstone cliffs in Glider Gorge (B1). Two collections made by P. G. Wilson in 1973 from a similar habitat on the south west island of the Osborne group, in Admiralty Gulf, have also been determined as this species. The *Ophioglossum* recorded among closed-grassland at C4 is a small leafless plant about 2 cm tall. Several of the specimens are fertile, but they do not match *O. coriaceum* A. Cunn., the common species of southern W.A. and the only one previously recorded for the State. *Schizaea digitata* was found in both arms of Forest Creek (C5), though it was uncommon. There appears to be no published record of the species for Australia. There has also been no published record for W.A. of *Isoetes muelleri*, though there is another recent collection from the Kimberley—Galvins Gorge, late 1974, A. C. Beaglehole (C. Marsden, pers. comm.). In all, 25 ferns and fern allies were collected in the Park.

Aquatic plants

The aquatic and semi-aquatic flora was quite varied due to the diverse nature of the pools, creeks and rivers as to size, depth, substrate and associated vegetation. In view of the recent publication of "Aquatic Plants of Australia" by H. I. Aston (1973), it seems appropriate to provide a table of those species which we consider to

be aquatic in the Park, using Aston's definition (p. 1) but noting that the water in which the plants occur may not be permanent.

Table 2 lists 30 taxa and indicates that the Park contains a more diverse aquatic flora than that of the Prince Regent River Reserve. Although the latter receives a higher rainfall, the areas visited by us there in 1974 were mostly unsuited to aquatic plants, though it is likely that further collecting will add to the total for the Reserve.

TABLE 2

AQUATIC PLANTS RECORDED IN THE DRYSDALE RIVER NATIONAL PARK

<i>Aponogeton elongatus</i> F. Muell. ex Benth.
<i>Blyxa aubertii</i> Rich.
<i>Blyxa echinosperma</i> (Clark) Hook.f.
<i>Caldesia oligococca</i> (F. Muell.) Benth.
<i>Dysophylla verticillata</i> Benth.
<i>Ebermaiera glauca</i> Nees
<i>Eriocaulon setaceum</i> L.
<i>Fimbristylis</i> sp. (ASG 13543)
<i>Fuirena umbellata</i> Rottb.
<i>Isoetes muelleri</i> A. Br.
<i>Limnophila chinensis</i> (Osbeck.) Merr.
<i>Limnophila indica</i> (L.) Druce
<i>Limnophila</i> sp. (ASG 13551, 13737, 14161)
<i>Marsilea angustifolia</i> R.Br.
<i>Marsilea</i> ? <i>mutica</i> Mett.
<i>Microcarpaea minima</i> (Koen.) Merr.
<i>Myriophyllum dicoccum</i> F. Muell.
<i>Myriophyllum trachycarpum</i> F. Muell.
<i>Myriophyllum</i> sp. aff. <i>trachycarpum</i> (ASG 13545)
<i>Myriophyllum verrucosum</i> Lindl.
<i>Naias tenuifolia</i> R.Br.
<i>Nymphaea gigantea</i> Hook.
<i>Nymphoides hydrocharoides</i> (F. Muell.) Kuntze
<i>Nymphoides indica</i> (L.) Kuntze
<i>Nymphoides minima</i> (F. Muell.) Kuntze
<i>Pseudoraphis abortiva</i> (R.Br.) Pilger
<i>Triglochin procera</i> R.Br. var. <i>dubia</i> (R.Br.) Benth.
<i>Utricularia exoleta</i> R.Br.
<i>Utricularia stellaris</i> L.f.
<i>Vallisneria spiralis</i> L.

Several other plants should be mentioned here, since they are aquatic at first but flower well after the surface water has disappeared. They include *Limnophila fragrans*, a number of *Eriocaulon* species and *Goodenia lamprosperma*. The last has a rosette of leaves with floating lamina (like *Potamogeton*) which are replaced by the usual self-supporting leaves after the water dries up. The inflorescence develops later.

The semi-aquatic fern *Ceratopteris thalictroides* was found beneath a small waterfall in Worriga Gorge.

Comparison with the Prince Regent River Nature Reserve

Comparison with the Prince Regent River floristic list (George and Kenneally, 1975), shows that approximately 39 per cent of the taxa in the Park were recorded also in the PRRNR. Although this figure, based on two field trips, is a preliminary one, it indicates the difference in

floristics between the reserves and underlines their value in conserving a wide range of Kimberley plants. Table 3 highlights some of the differences.

TABLE 3

NUMBER OF TAXA IN SEVERAL FAMILIES AND GENERA SHOWING COMPARISON BETWEEN DRYSDALE RIVER NATIONAL PARK AND PRINCE REGENT RIVER NATURE RESERVE

	Total DRNP	Total PRRNR	Common to both
Poaceae	53	30	15
Myrtaceae	52	27	20
Eucalyptus	31	15	11
Mimosaceae	27	23	15
Acacia	26	21	14

There is also a marked difference in the number of Cyperaceae in the lists (DRNP 32, PRRNR 9) but when the Prince Regent list was published many collections of this family had not been determined and the species numbers are now similar.

ARRANGEMENT OF THE LIST OF SPECIES

The fungi and lichens are arranged alphabetically. The ferns, gymnosperms, monocots and dicots are arranged alphabetically within families which are themselves alphabetical in each section. New records are marked by a dagger (†). In the habitat notes, "obs." indicates a sight record only. Under the site headings, "GS" refers to Galaxy Swamp.

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Figure 1—The fern *Nephrolepis hirsutula* (Forst.) Pr. at Dulcis Falls (B1). ASG 13657.



Figure 2—The fan palm *Livistona loriphylla* near Solea Falls (B4). ASG 13758.



Figure 3—Two species of *Eriocaulon* in silt among sandstone rocks in the bed of Palmoondoor Creek above Morgan Falls (C1). Left: *E. cinereum* R.Br.; right: *E. quinquangulare* L.



Figure 4—*Stenocarpus cunninghamii* R.Br. in flower and fruit at Solea Falls (B4). ASG 13418.

LIST OF PLANT SPECIES

SPECIES	SITE														GS
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5		
FUNGI															
<i>Ganoderma applanatum</i> (Pers.) Pat. On stem of living <i>Acacia tumida</i> (B2); on Eucalypt (C2).						X					X				
<i>Ganoderma lucidum</i> (Leys. ex Fr.) Karst. On base of trunk of <i>Terminalia grandiflora</i>					X										
<i>Gloeophyllum abietinum</i> (Fr.) Karst. On dead fallen wood, flood debris beside Planigale Creek.												X			
<i>Gloeophyllum concentricum</i> G. H. Cunn. On dead wood among low open-woodland							X								
<i>Lycoperdon</i> sp. KFK 4210 Common fungus occurring in leaf litter under <i>Calytrix brachychaeta</i>								X							
<i>Osmoporus brunneo-leucus</i> (Berk.) G. H. Cunn. On dead fallen wood in low open-woodland.								X							
<i>Osmoporus strigatus</i> (Berk.) G. H. Cunn. Bracket fungus on dead stem of <i>Owenia vernicosa</i> .				X											
<i>Panus fasciatus</i> (Berk.) Pegler On dead wood (B2); on dead wood, flood debris beside Carson River (C2).							X				X				
<i>Phellinus caryophylli</i> (Raciborski) G. H. Cunn. In vine forest.									X						
<i>Phellinus nilgheriensis</i> Mont. On dead log by creek.									X						
<i>Phellinus setulosus</i> (Lloyd) Imazeki On bloodwood <i>Eucalyptus</i> (B4); on trunk of living <i>Xanthostemon</i> (C5).								X						X	
<i>Phellinus spadiceus</i> (Berk.) G. H. Cunn. On <i>Acacia aulacocarpa</i> (A4); on dead limb of <i>Eucalyptus</i> near creek (B1).					X	X									
<i>Polyporus arcularius</i> Fr. <i>Pseudofavolus tenuis</i> (Hook.) G. H. Cunn.		X											X		
<i>Pycnoporus sanguineus</i> (L. ex Fr.) Murr. On dead wood (A4); on dead wood beside Carson River.				X							X	X			
<i>Stereum strigosum-zonatum</i> (Schw.) G. H. Cunn. On dead limb of <i>Eucalyptus oligantha</i> .				X											
LICHENS															
<i>Buellia disciformis</i> (Fr.) Mudd. Lichen on sandstone (A2) (C3).		X										X			
<i>Buellia subdisciformis</i> (Leight) Vain Lichen on sandstone		X													
<i>Caloplaca fulgens</i> Koerb. Lichen on sandstone		X													
<i>Candellaria xanthostigma</i> (Pers. ex Ach.) Lett. Lichen on sandstone (A2) (C2).		X									X				
<i>Diploschistes</i> sp. A Lichen on sandstone.		X													
<i>Diploschistes</i> sp. B Lichen on sandstone.		X													
<i>Parmelia</i> (<i>Melanoparmelia</i>) sp. Lichen on sandstone (A2) (A3).		X	X												
<i>Parmelia</i> (<i>Parmelia</i>) sp. Lichen on sandstone.		X													
<i>Parmelia</i> (<i>Xanthoparmelia</i>) sp. A Lichen on sandstone.		X													

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Pertusaria</i> sp. Lichen on sandstone.		X													
<i>Pyxine petricola</i> Nyl. Lichen on <i>Buchanania</i> , in low woodland.												X			
<i>Pyxine</i> sp. A Lichen on sandstone.		X													
<i>Pyxine</i> sp. B Lichen on sandstone, cliff edge.		X													
<i>Relicina amphithrix</i> Hale Lichen on <i>Erythrophleum</i> , in low woodland.				X											
BRYOPHYTA															
<i>Anthoceros</i> sp. ASG 14100 Below waterfall in gorge.									X						
<i>Octoblepharum albidum</i> Hedw. Moss in low closed-forest at head of Woorakin Creek (C2); in seepage at foot of sandstone cliff, in low closed-forest (C4); on damp gully walls of Schizaea Creek (C5).										X		X	X		
PTERIDOPHYTA															
Ferns and Fern Allies															
ADIANTACEAE															
<i>Adiantum philippense</i> L. Dormant; in seepage at base of sandstone cliff (C1) (C4).									X			X			
BLECHNACEAE															
<i>Blechnum orientale</i> L. Caespitose rhizomatous fern; fronds to 1 m long; fertile. Beside creek in narrow gorge (A2) (C4) (C5); in black loam in seepages below sandstone cliff (C1); forming dense stand in narrow sandstone gorge (C2).		X							X	X		X	X		
<i>Stenochlaena palustris</i> (Burm.f.) Bedd. Climbing/scrambling fern; fronds coriaceous. By stream at edge of vine forest.									X						
GLEICHENIACEAE															
<i>Dicranopteris linearis</i> (Burm.f.) Underwood Scrambling fern on sandstone seepage areas (C1) (C2) (C5).									X	X			X		
GYMNOGRAMMACEAE															
<i>Platyzoma microphyllum</i> R.Br. In wet areas beside creek under <i>Pandanus</i> (A2); in sand in low woodland (A4) (B1) (B4). On edge of open-woodland among broken siltstone by creek (B2).		X		X	X	X		X							
ISOETACEAE															
† <i>Isoetes muelleri</i> A.Br. Aquatic. In pool 1.5 m deep.										X					
LINDSAEACEAE															
<i>Lindsaea ensifolia</i> Sw. On seepage area of sandstone gorge, common (A2) (B1) (C1) (C2) (C4) (C5).		X		X					X	X		X	X		
<i>Lindsaea</i> ? <i>orbiculata</i> (Lam.) Mett. Rare on seepage area of sandstone cliff ledge.		X													

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
LYCOPODIACEAE														
<i>Lycopodium cernuum</i> L. Bright green fern. In black loam in seepages at foot of sandstone cliff (C1); by creek in closed-forest (C5).									X					X
MARSILEACEAE														
<i>Marsilea angustifolia</i> R.Br. Stems underground; leaflets broad on aquatic plants, narrow where emergent or on drying sand. By creek (B4); in sand, in low woodland near swamp (Galaxy Swamp).								X						X
<i>Marsilea ? mutica</i> Mett. ASG 13553 KFK 4402 Aquatic. In billabong (A1). Creeping fern. On edge of Carson River (C2).	X									X				
OLEANDRACEAE														
† <i>Nephrolepis hirsutula</i> (Forst.) Pr. Fern in wet crevices on sandstone cliff (B1); among sandstone rocks in gorge (C1).					X				X					
OPHIOGLOSSACEAE														
† <i>Ophioglossum</i> sp. ASG 13916 Minute herb; leafless; fertile. In seepage at top of scarp, around sandstone rocks in closed- grassland.												X		
PARKERIACEAE														
<i>Ceratopteris thalictroides</i> (L.) Brongn. Fern under low waterfall in gorge.									X					
SCHIZAEACEAE														
† <i>Lygodium japonicum</i> (Thunb.) Sw. Climbing fern. On sandstone cliff, and in rocky sandstone gully in low closed-forest.					X									
<i>Lygodium microphyllum</i> (Cav.) R.Br. Scrambling fern in sandstone gorge among <i>Pandanus</i> (A2) (C2); in seepages on sandstone cliff above river (B4); by creek at edge of vine forest, and at foot of sandstone cliff (C1); on creek bank (C5).		X						X	X	X				X
† <i>Schizaea digitata</i> (L.) Sw. Common in wet moss wall of gorge; among sandstone rocks near creek, in low closed-forest.														X
SELAGINELLACEAE														
<i>Selaginella ciliaris</i> (Retz.) Spring Under sheltered seepage area on sandstone scarp (A2) (A4) (B3) (C4); sheltered damp ledges of Morgan Falls (C1).		X		X				X	X				X	
<i>Selaginella</i> sp. KFK 4033, 4042 Small erect plant. On damp mud among closed-grassland on edge of Forrest River			X											
SINOPTERIDACEAE														
<i>Cheilanthes tenuifolia</i> (Burm.f.) Swartz. In damp sand in shelter of sandstone rocks by pool (B4); growing from fissures in sandstone (C2).								X		X				

SPECIES	SITE														GS
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5		
<i>Cheilanthes vellea</i> (R.Br.) F.Muell. Woolly fern, dry and dormant. Common in sand and among <i>Triodia</i> clumps (A2); on rocky scarp of Ashton Range (A4); near water seepage at base of sandstone cliff (B3).		X		X			X								
<i>Cheilanthes</i> sp. KFK 4408 In dried creek bed near junction of Woorakin Creek and Carson River.										X					
† <i>Doryopteris concolor</i> (Langsd. & Fischer) Kuhn..... Rhizomatous fern, becoming dormant. Among sandstone rocks in vine forest.										X					
THELYPTERIDACEAE															
† <i>Christella dentata</i> (Forsk.) Brownsey & Jermy Rhizomatous fern. Under waterfall in gorge.										X					
<i>Cyclosorus interruptus</i> (Willd.) Ching Rhizomatous fern. Among sandstone rocks by creek, at edge of vine forest.										X					
GYMNOSPERMAE															
CUPRESSACEAE															
<i>Callitris intratropica</i> Baker & Smith Trees up to 12 m. In sand, in low open-forest (A1) (A4); on sandstone (A3) (B3); on sandstone scarp, in low open-woodland (A4); on plain and on sandstone plateau in low woodland (B1) (B4) (C1) (C4); on siltstone (B2); in sandstone creek bed (C3).	X	X	X	X	X	X	X	X	X		X	X			
MONOCOTYLEDONAE															
ALISMATACEAE															
<i>Caldesia oligococca</i> (F.Muell.) Benth. Aquatic; lvs floating; infl. emergent with white fls. In billabong (A1); in black drying mud (Galaxy Swamp).	X														X
AMARYLLIDACEAE															
<i>Crinum ? flaccidum</i> Herbert Bulbous herb; in leaf only. On damp sandstone ledge by waterfall.										X					
APONOGETONACEAE															
<i>Aponogeton elongatus</i> F.Muell. ex Benth. Aquatic; only inflorescence emergent; fls yellow (C3) (C5).											X		X		
ARACEAE															
<i>Colocasia antiquorum</i> Schott..... Rhizomatous perennial herb. In black loam by creek in low woodland.										X					
ARECACEAE															
† <i>Livistona loriphylla</i> Beccari Palm to 3 m; leaves cleanly abscised; fls cream, strongly sweetly scented. On sandstone (B3) (C3) (C5); in tall shrubland (B4).							X	X			X		X		

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
CENTROLEPIDACEAE														
<i>Centrolepis banksii</i> R. & S. Caespitose reddish ephemeral. On damp river bank (A1) (B1).	X				X									
<i>Centrolepis exserta</i> (R.Br.) R. & S..... Ephemeral herb. On mud at edge of Drysdale River (A3) (B2); on sandy creek bank (A4) (B1) (B4); in sand, in low woodland near swamp (Galaxy Swamp).			X	X	X	X		X						X
<i>Centrolepis</i> aff. <i>pusilla</i> R. & S. ASG 13911 Small sedge. In seepage at top of scarp, in closed-grassland.												X		
CYPERACEAE														
<i>Cyperus aquatilis</i> R.Br. Ephemeral sedge. In mud of swamp (A3) (C3); in damp rocky soil along creek (C1); in black drying mud of swamp (Galaxy Swamp).			X						X		X			X
<i>Cyperus difformis</i> L. On edge of Woorakin Creek near junction with Carson River.										X				
<i>Cyperus holoschoenus</i> R.Br. Perennial sedge. On damp sandy river bank (A1) (B3) (C3); in black mud on edge of swamp (Galaxy Swamp).	X						X				X			X
<i>Cyperus</i> sp. ASG 13194, 13444, 13487 Rhizomatous sedge. On river bank (A1); in sandy creek bed (A4) (B4).	X			X				X						
<i>Cyperus</i> sp. ASG 13442 Fls green. On sandy creek bank.				X										
<i>Cyperus</i> sp. ASG 13464, 13610 Ephemeral sedge. In damp sand under <i>Melaleuca argentea</i> by river.	X													
<i>Cyperus</i> sp. ASG 13712 Caespitose sedge; fls brown and green. In rocky sand in river bed (B1) (C4).					X							X		
? <i>Cyperus</i> sp. ASG 14066 Perennial caespitose sedge; fls brown. In sandstone crevices near creek.									X					
<i>Cyperus</i> spp. KFK 4314, 3073, 3088, 4271, 3022 Beside creek (A2) (A2) (A2) (B2) (B2).		X				X								
<i>Eleocharis</i> sp. ASG 13739 Ephemeral herb. In sand between spinifex clumps, in tall shrubland.								X						
<i>Eleocharis</i> sp. ASG 13958 Small sedge. In river bed.												X		
<i>Eleocharis</i> sp. ASG 14137 Perennial sedge. In black mud, in wet swamp.														X
<i>Fimbristylis arthrotyloides</i> W. V. Fitzg. Caespitose sedge. Among sandstone boulders under open-woodland.											X			
<i>Fimbristylis</i> ? <i>littoralis</i> Gaud. ASG 13954 In damp sandy/rocky river bed.												X		
<i>Fimbristylis</i> aff. <i>pauciflora</i> R.Br. KFK 4088 In wet areas of remnant pools of Forrest River.			X											
<i>Fimbristylis</i> sp. KFK 4387 Semi-aquatic. On edge of creek.										X				

SPECIES	SITE														GS
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5		
<i>Fimbristylis</i> sp. ASG 13195, 13858, 13619, 14106 Small caespitose sedge. On sandy creek bank (A4) (B1); on peaty banks matted with roots, in sandstone gully in low closed-forest (C4) (C5).				X	X							X	X		
<i>Fimbristylis</i> sp. ASG 13283, 13584 Caespitose perennial sedge. In wet creek bed (A1); in closed-grassland (A4).	X			X											
<i>Fimbristylis</i> sp. ASG 13465 Small caespitose sedge. In damp sand by river.	X														
<i>Fimbristylis</i> sp. ASG 13470, 13983.... Caespitose ephemeral sedge, dry. On dry sandy bank near river (A1); on wet sandstone ledge by waterfall (C1).	X								X						
<i>Fimbristylis</i> sp. ASG 13543 Sedge. In billabong, in fl. at water's edge.	X														
<i>Fimbristylis</i> sp. ASG 13603, 14089 Caespitose perennial sedge. In rocky basaltic loam by creek (B1); in black loam by seepage below cliff in gorge (C1).					X				X						
<i>Fimbristylis</i> sp. ASG 13644, 13619 Caespitose sedge. In rocky sandstone gully in low closed-forest.					X										
<i>Fimbristylis</i> sp. ASG 14058 Sedge. On water's edge, along rocky creek on plateau.									X						
<i>Fuirena ciliaris</i> (L.) Roxb. Ephemeral sedge; fls green. In sand in woodland (A4); in sand beside creek (A3) (B2) (C1); on mud by river (B4).			X	X		X		X	X						
<i>Fuirena umbellata</i> Rottb. Aquatic sedge. In creek (A1) (C1).	X								X						
<i>Lipocarpa microcephala</i> Kunth. Ephemeral sedge; fls green. In damp sand near river (A1); by creek (C1) (C3).	X								X		X				
<i>Scirpus articulatus</i> L. Erect sedge. On mud flats near junction of Woorakin Creek and Carson River.										X					
<i>Scirpus mucronatus</i> L. subsp. <i>robustus</i> (Miq.) T.Koyama Caespitose perennial sedge. In wet sandy creek bed (A1) (A4).	X			X											
<i>Scirpus ? supinus</i> L. KFK 4121 On wet mud (B3); in drying mud of swamp (Galaxy Swamp).							X							X	
<i>Scleria</i> sp. KFK 4336 Perennial sedge up to 2 m, dense stand in seepage in sandstone gorge.										X					
ERIOCAULACEAE															
<i>Eriocaulon cinereum</i> R.Br. Ephemeral herb; in damp sand by river (A1). Semi-aquatic herb. In damp areas of drying creek bed (B2) (B4) (C1).	X					X		X	X						
<i>Eriocaulon</i> aff. <i>cinereum</i> R.Br. ASG 13480 In damp sand by river.	X														
<i>Eriocaulon pygmaeum</i> Soland. Semi-aquatic herb on mud banks.										X					

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Eriocaulon quinquangulare</i> L. In billabong and on bank (A1); on mud banks among sandstone rocks in creek bed (C1).	X								X						
<i>Eriocaulon setaceum</i> L. Aquatic herb; inflorescence emergent. Common in pools (A1 obs.) (A2) (A3) (A4) (B1) (B2) (B3) (B4) (C1 obs.).	X	X	X	X	X	X	X	X	X						
<i>Eriocaulon</i> sp. KFK 4089, 4120, 4270, 4493, ASG 13479, 13504, 13762, 13816, 14067 Semi-aquatic herb. Beside pools (A1) (A3) (B2) (B3) (B4) (C3)	X		X			X	X	X			X				
FLAGELLARIACEAE															
<i>Flagellaria indica</i> L. Climbing liane; fls cream. In rocky sandstone gully, in low closed-forest (B1 obs.); in sandstone (B3) (C3); in gorge in low-woodland near creek (C1).					X		X		X		X				
HAEMODORACEAE															
<i>Haemodorum</i> ? <i>flaviflorum</i> W. V. Fitzg. Dry herb, in old fruit. In closed-grassland				X											
HYDROCHARITACEAE															
<i>Blyxa aubertii</i> Rich. Aquatic; fls white, emergent. Common in shaded pools (B3) (B4) (C5).							X	X						X	
† <i>Blyxa echinosperma</i> (Clark.) Hook.f. Aquatic; fls white, emergent. In pools of creek (A1) (B4); more robust than <i>B. aubertii</i> and occurring with it (B3).	X						X	X							
<i>Vallisneria spiralis</i> L. Aquatic, along edge of river (A1); variable, in remnant pool of creek (B3) (C1).	X						X		X						
JUNCAGINACEAE															
<i>Triglochin procera</i> R.Br. var. <i>dubia</i> (R.Br.) Benth. Erect, tuberous, aquatic herb up to 0.5 m; fls yellowish green; styles green; fruits green, cylindrical. In sand, in pools of creek (A1) (B2); among sandstone rocks in river (B4).	X					X		X							
LILIACEAE															
<i>Asparagus racemosus</i> Willd. Climber, ± dead, with fruit. In rocky loam in low woodland.					X										
<i>Smilax australis</i> R.Br. Climber with tendrils and thorns. In dry sandy low woodland (A1); in rocky sandstone gully, in low closed-forest (B1); on sandstone cliff (B3) (C2) (C3) (C5); in vine forest (C1).	X				X		X		X	X	X			X	
<i>Thysanotus chinensis</i> Benth. Herb with small rhizome; fls blue-mauve. In damp areas near creek (A2) (A3) (B2); in closed-grassland (A4) (B4).		X	X	X		X		X							

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Tricoryne elatior</i> R.Br. Diffuse rhizomatous herb; fls yellow. In damp closed-grassland near creek (A2); in sand in open-forest (A4); in low woodland (B4).				X				X							
NAJADACEAE															
<i>Najas tenuifolia</i> R.Br. Aquatic, on mud banks of river.										X					
ORCHIDACEAE															
<i>Cymbidium canaliculatum</i> R.Br. Epiphytic plant in burnt out hollows of Eucalypt (A3); (B1 obs.) (C1 obs.) (C4 obs.)			X		X				X			X			
<i>Dendrobium dicuphum</i> F.Muell. Epiphytic orchid on <i>Pandanus</i> , <i>Tristania</i> and <i>Syzygium</i> , in low closed-forest in gully (B1); by creek at edge of vine forest (C1 obs.); on <i>Syzygium</i> in low closed-forest (C4); on <i>Pouteria</i> in low closed-forest (C5).					X				X			X	X		
PANDANACEAE															
<i>Pandanus aquaticus</i> F.Muell. Slender tree to 6 m; lvs ± bright green; aerial rootlets on stem; fruit very small, fallen. Common on river banks (A1) (B1) (B4 obs.) (C1) (C2).	X				X			X	X	X					
<i>Pandanus spiralis</i> R.Br. var. <i>convexus</i> (St. John) Stone Tree to 5 m; fruit red. On edge of swamp (A2) (C2) (Galaxy Swamp); foliage bluish; fr green. In sand, in open-woodland near creek (A4).		X		X						X				X	
<i>Pandanus spiralis</i> R.Br. var. <i>darwiniensis</i> (St. John) Stone Tree to 6 m; fruit green turning yellowish. In sand in tall open-shrubland (A1) (A4).	X			X											
<i>Pandanus spiralis</i> R.Br. nr. var. <i>thermalis</i> (St. John) Stone ASG 13677 Tree to 8 m; fr. red. In sand in woodland near creek and along rocky creek bed (B1); in seepage in valley at top of scarp (C4).					X							X			
<i>Pandanus</i> sp. ASG 14084 Tree to 8 m; fr. red. In black loam by creek, in low woodland.									X						
PHILYDRACEAE															
<i>Philydrum lanuginosum</i> Banks & Solander ex Gaertn. Perennial herb; fls yellow. In pools and creek beds (A1 obs.) (A2) (A4) (B1 obs.) (B2) (B3) (C1 obs.) (C2) (C3).	X	X		X	X	X	X		X	X	X				
POACEAE															
<i>Aristida ingrata</i> Domin ± dry caespitose perennial grass. In sandy-clay at edge of gully below escarpment (B1); in rocky sand in woodland at foot of scarp (C4).					X							X			

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Arundinella nepalensis</i> Trin. Caespitose perennial grass. In sand by billabong (A1); by creek in gorge (C1).	X								X					
<i>Cenchrus elymoides</i> F.Muell. Caespitose perennial grass. Below sandstone boulders on scarp, in low open-woodland.												X		
<i>Coelorhachis rottboellioides</i> (R.Br.) Stapf. Caespitose perennial grass; fl. culms to 3 m high. Among sandstone boulders below Boiga Falls (A2); common in sand in open-woodland, especially near creek (A4); by creek (C1).		X		X					X					
<i>Cymbopogon bombycinus</i> (R.Br.) Domin Ephemeral grass, dry. In sand in woodland (B1); on sandstone flats with <i>Triodia</i> (A3).			X		X									
<i>Cymbopogon procerus</i> (R.Br.) Domin Caespitose grass. Common along the sandstone cliff base below Boiga Falls (A2); on sandstone flats (C3).		X									X			
<i>Digitaria longiflora</i> (Retz.) Pers. Rhizomatous grass. On rocky basaltic creek bank (B1); on white river-washed sand beside creek (B2).					X	X								
<i>Dimeria ornithopoda</i> Trin. Ephemeral grass. In wet crevices on sandstone cliff (B1) (C1); on wet area beside creek (B2).					X	X			X					
<i>Ectrosia danesii</i> Domin Perennial grass. In sandy-loam near swamp, in low woodland (Galaxy Swamp); in sand, in woodland (A4).				X										X
<i>Ectrosia leporina</i> Benth. Ephemeral grass. In sand over sandstone by billabong (A1); in sand in low woodland (A4); beside creek (B2) (C3); in damp sand near river (B4); in gorge, near cliff (C1); in seepage at top of scarp, in grassland among low open-woodland (C4).	X			X		X		X	X		X	X		
<i>Ectrosia schultzi</i> Benth. Caespitose grass. In sand by creek (A1); at edge of swamp (Galaxy Swamp)	X													X
<i>Elytrophorus spicatus</i> (Willd.) A.Camus Bright green ephemeral grass. In damp sand by river (A1); dried, in closed-grassland (A4); in and around pools of rocky basaltic creek bed (B1); beside creek (B3) (C2); edge of swamp (Galaxy Swamp).	X			X	X		X			X				X
<i>Eragrostis japonica</i> (Thunb.) Trin. Ephemeral grass. On creek banks.					X									
<i>Eragrostis</i> aff. <i>setifolia</i> ASG 13184 Caespitose perennial grass. In sand in woodland.				X										
<i>Eragrostis speciosa</i> (R. & S.) Steud. Caespitose perennial grass. In sand, in tall open-shrubland (A1); in loam, in open-grassland among open-woodland (A4).	X			X										

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
† <i>Eragrostis tenax</i> Jedw. Dried grass. On sandy bank near river (A1); in seepage at top of scarp, in grassland with low open-woodland (C4).	X											X		
<i>Eragrostis</i> sp. ASG 13225 Ephemeral grass. In closed-grassland.				X										
<i>Eragrostis</i> sp. KFK 4231, 4312, 4461, ASG 13467, 13786 Caespitose perennial grass. In damp sand by river (A1) (B4); in dry closed-grassland (A4); in creek bed (B1); on white sand banks of creeks (B2) (C3).	X			X	X	X		X			X			
<i>Eriachne festucacea</i> F.Muell. Perennial grass. In damp sand by river (A1) (B1) (C4); along creek banks (A2).	X	X			X							X		
<i>Eriachne glauca</i> R.Br. Perennial grass. In black drying mud of swamp.														X
<i>Eriachne obtusa</i> R.Br. Perennial grass. In sand in open-forest.				X										
<i>Eriachne sulcata</i> Hartley Caespitose perennial grass. Common in closed-grassland by river.			X											
† <i>Eriachne triodioides</i> Domin Ephemeral grass 1 m high in small clumps, dry. On sandy bank near river.	X													
<i>Eriachne trisetata</i> Nees Caespitose perennial grass. In sandy-loam over sandstone along dry creek, in tall shrubland (B4); in loam at foot of sandstone cliff (C1); in sandstone gully in low closed-forest (C5).								X	X				X	
<i>Eriachne</i> sp. ASG 14109 Caespitose perennial grass. In sandstone gully, in low open-forest.													X	
? <i>Eriachne</i> sp. KFK 4099 Caespitose perennial grass. Common in closed-grassland by river.			X											
<i>Eriachne</i> sp. KFK 4310, 4562 Caespitose perennial grass. On wet banks of creek (B2); among <i>Triodia</i> (C3).						X					X			
<i>Eulalia fulva</i> (R.Br.) O.Kuntze <i>Heterachne abortiva</i> (R.Br.) Druce Ephemeral grass. In loam in grassland among open-woodland.				X	X									
<i>Heteropogon contortus</i> (L.) Beauv. ex R. & S. Perennial grass. In dry closed-grassland (A4); on Carson Volcanics under low open-woodland and along banks of Carson River (C2).				X						X				
† <i>Micraira</i> aff. <i>subulifolia</i> F.Muell. Stoloniferous perennial grass; fls over. On wet, shaded sandstone ledges in gully in low closed-forest (B1); on rock ledges by waterfall (C1); on shaded gorge floor (C2); forming dense mats on cave floors (C3).					X				X	X	X			
<i>Oryza australiensis</i> Domin Perennial grass. On drying mud in swamp.														X
<i>Panicum</i> sp. ASG 13218 Caespitose perennial grass; fls over. In sand, in low open-forest.				X										

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	SG	
<i>Paspalum commersonii</i> Lam. Caespitose perennial grass. In sand over sandstone by billabong (A1); on wet ledges of sandstone cliff (B1); creek banks in gorge (C1).	X				X				X						
<i>Plectrachne bynoei</i> C. E. Hubb. Spinifex in large, loose clumps. Common (A1); on rock ledges above Johnson Creek (B3); on rocky creek banks (C1); in low woodland (C4).	X						X		X			X			
<i>Plectrachne pungens</i> (R.Br.) C. E. Hubb. Spinifex in loose clumps; lvs bright green, viscid; fl. over. On dry sandy bank near river (A1); in sand in low woodland (A4); on sandstone rises in tall shrubland and low open-woodland (B4).	X			X				X							
? <i>Plectrachne</i> sp. KFK 3096 Spinifex forming loose clumps at bottom of Boiga Falls.		X													
† <i>Pseudopogonatherum contortum</i> (Brongn.) A. Camus Ephemeral grass. In rocky basaltic loam, in grassland by creek.					X										
<i>Pseudoraphis abortiva</i> (R.Br.) Pilger Stoloniferous perennial grass, aquatic. In billabong.	X														
<i>Sacciolepis indica</i> (L.) Chase Perennial grass; fruiting stems submerged and seed germinating on surface. In creek.	X														
<i>Sacciolepis myosuroides</i> (R.Br.) A. Camus Ephemeral grass. On wet areas beside creek (A3); in rocky basaltic loam by creek (B1).			X		X										
<i>Sclerandrium truncatiglume</i> (F.Muell.) Stapf & Hubb. Caespitose perennial grass. On wet ledges of sandstone cliff (B1); beside creek in deep alluvial sand (B2) (B3); in sandstone creek bed on scarp, in low woodland (C4).					X	X	X					X			
<i>Setaria surgens</i> Stapf Perennial grass. In grassland near river.			X												
<i>Themeda australis</i> (R.Br.) Stapf Caespitose perennial forming dense stands near campsite on Forrest River watershed (A3); forming dense stands with <i>Heteropogon contortus</i> on Carson Volcanics (C2).			X							X					
† <i>Triodia microstachya</i> R.Br. Spinifex, in large loose clumps. Common in alluvium in rock fissures by creek.											X				
<i>Triodia</i> aff. <i>mitchellii</i> Benth. ASG 13832 Spinifex; ± lax, viscid. On sandstone rises in tall shrubland.								X							
<i>Triodia pungens</i> R.Br. Spinifex in large, coarse clumps, very viscid. Forming hummock grassland above Cracticus Falls (B3); among sandstone rocks in tall shrubland and low open-woodland (B4) (C1); along rocky and sandy creek in low woodland (C4).							X	X	X			X			
? <i>Triodia</i> sp. KFK 4572, 4079 Spinifex forming dense clumps on sandstone under low open-woodland (A3) (C3).			X									X			

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Vetiveria pauciflora</i> S. T. Blake Caespitose perennial grass; sterile. In sand by billabong (A1); in river washed sand (B2); along creek banks (B3); in black mud by swamp (Galaxy Swamp).	X					X	X				X			X	
XANTHORRHOACEAE															
<i>Lomandra ? elongata</i> (Benth.) Ewart Caespitose perennial herb. In sand in open-woodland.				X											
XYRIDACEAE															
<i>Xyris complanata</i> R.Br. Caespitose, perennial herb; fls yellow. On edge of creek (A1) (A2) (A3) (B1) (B2) (B4) (C3); in closed-grassland (A4) (C4).	X	X	X	X	X	X		X			X	X			
<i>Xyris</i> aff. <i>oligantha</i> Steud. ASG 13827 Ephemeral herb; stems red. In sandy hollow in open-woodland near river (B4); on wet bank by creek (C1); in seepage in valley at top of sandstone scarp, among grass in low open-woodland (C4).								X	X			X			
<i>Xyris pauciflora</i> Willd. Perennial herb; fls yellow. In damp areas and along creek banks (A1) (A3) (B3). Ephemeral herb; fls yellow. In sandy mud among sandstone rocks by creek on plateau (C1); in black drying mud of swamp (Galaxy Swamp).	X		X				X		X					X	
<i>Xyris</i> aff. <i>pauciflora</i> Willd. KFK 4044 ? Perennial herb to 15 cm; fls yellow. In damp sand near creek.			X												
<i>Xyris</i> sp. ASG 13632 Plants single. In rocky basaltic creek bed.					X										
DICOTYLEDONAE															
ACANTHACEAE															
<i>Dicliptera glabra</i> Dcne. On sandstone scree slope in gorge (A2) (B2). Dead ephemeral, in rocky basaltic soil near creek in low woodland (B1).		X			X	X									
<i>Ebermaiera glauca</i> Nees Semi-aquatic; fls lilac. Common in and by pools along creek (C1) (C2).									X	X					
<i>Hypoestes floribunda</i> R.Br. Spindly, much branched plant up to 1.5 m; fls mauve or pink with white streaks. In sand over sandstone (A2); in rocky gully by creek in low closed-forest (B1); at base of sandstone cliff in low closed-forest (C4).		X			X							X			
<i>Nelsonia brunellodes</i> (Lam.) O.K. Prostrate, hirsute herb; fls white. In white sand near creek (A1) (B2); in low-woodland (A4).	X			X		X									
<i>Nelsonia campestris</i> R.Br. Ephemeral herb; fls white. In sand in river bed.					X										
AIZOACEAE															
<i>Glinus oppositifolius</i> (L.) DC. Prostrate ephemeral. In sand near river (A1) (B1).	X				X										

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Macarthuria</i> sp. nov. ASG 13767 Sprawling perennial herb. Among sandstone rocks, in tall shrubland.								X							
? <i>Trianthema</i> sp. ASG 13275 Prostrate perennial herb. At foot of siltstone scarp in low open-woodland.				X											
AMARANTHACEAE															
<i>Achyranthes aspera</i> L. Ephemeral herb; in fruit. On sandstone scarp, in low closed-forest.													X		
<i>Alternanthera?</i> <i>angustifolia</i> R.Br. ASG 13578 Ephemeral herb. In damp sand by river.	X														
<i>Alternanthera?</i> <i>denticulata</i> R.Br. var. <i>micrantha</i> Benth. ASG 13783 Ephemeral herb. In sand near river.								X							
<i>Gomphrena canescens</i> R.Br. Ephemeral herb; fls pink. In sand over sandstone in open eucalypt woodland (B2) (C3.)						X					X				
<i>Gomphrena diffusa</i> Spreng. Prostrate ephemeral herb; fls pale pink. In sand in woodland.				X											
<i>Gomphrena flaccida</i> R.Br. Ephemeral herb; fls pink. In rocky soil in woodland on Ashton Range (A4).				X	X										
<i>Ptilotus exaltatus</i> Nees Ephemeral herb 70 cm; fls pink.					X										
ANACARDIACEAE															
<i>Buchanania obovata</i> Engl. Tree or shrub to 8 m; bark rough; fls cream, scented. In sand, in low open-woodland (A1) (A4) (B1); on sandstone (A2) (C2) (C3); siltstone (B2); in woodland (B4); in rocky river bed in gorge (C1); on sandstone scarp and plateau, in low woodland (C4) (C5).	X	X	X	X	X			X	X	X	X	X	X	X	
APIACEAE															
<i>Trachymene hemicarpa</i> (F.Muell.) Benth. Perennial herb. In sand in woodland.				X											
APOCYNACEAE															
<i>Alstonia actinophylla</i> (A.Cunn.) K.Schum. Tall tree; bark corky. Common along base of sandstone cliff.		X													
<i>Carissa lanceolata</i> R.Br. Low, diffuse, spiny shrub up to 2 m. Common on sandstone (A3). Shrub to 3 m with several stems; bark grey, fissured. In low woodland on plain (B1).			X		X										
<i>Parsonsia velutina</i> R.Br. Climber. In closed-forest (B3); among sandstone rocks above river (B4); on sandstone cliff edge (C3); on sandstone slope of gully, in low closed-forest (C5).		X					X	X			X		X		
ASCLEPIADACEAE															
<i>Gymnanthera nitida</i> R.Br. Climber with latex; fls pale cream. On sandy bank by river (A1); in rocky basaltic creek bed (B1).	X				X										

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Marsdenia</i> sp. ASG 13651 Climber. In sandstone rocks in low woodland by clifftop.					X										
<i>Sarcostemma australe</i> R.Br. Leafless, many stemmed shrub, with latex. In rocky sandstone gully, in low closed-forest (B1); on sandstone scree in low woodland (C1 obs.); on sandstone (C3).					X				X		X				
ASTERACEAE															
<i>Blumea diffusa</i> Benth. Ephemeral herb; fls yellow. On sheltered ledges of sandstone cliff.									X						
<i>Blumea integrifolia</i> DC. Ephemeral herb; fls yellow. In sand, in woodland and closed-grassland (A4); in sand, in low woodland near swamp (Galaxy Swamp).				X										X	
<i>Blumea mollis</i> (G.Don) Merr. Aromatic ephemeral herb; fls pink. On sandy creek bank (B1) (C4). Diffuse herb on damp soil near Carson River (C2).					X					X		X			
<i>Blumea saxatilis</i> Zoll. et Mar. Ephemeral herb; fls yellow. In damp sand by creek (A1) (A3) (B1); in seepage on sandstone scarp, in low open-woodland (C4).	X		X		X								X		
<i>Blumea tenella</i> DC. Ephemeral herb; fls pink. In rocky basaltic loam by creek (B1); in sand near river (B4); near creek (C1).					X			X	X						
<i>Blumea ? tenella</i> DC. KFK 4308 Sprawling herb; fls yellow. Common on damp sand.						X									
<i>Calotis breviseta</i> Benth. Perennial herb; rays white. In sandy loam over sandstone, in low woodland (B1); in sand, in open-woodland near river (B4); in sand, in woodland below scarp (C4).					X			X				X			
<i>Epaltes australis</i> Less. Ephemeral herb; fls white. On sandy riverbank (A1); in sand in woodland (A4); in washed sand by creek (B2).	X			X		X									
<i>Helichrysum apiculatum</i> (Labill.) G.Don Perennial herb; fls yellow. In sand in woodland (A4); low open-forest (B1).				X	X										
<i>Pluchea rubelliflora</i> (F.Muell.) Robinson Ephemeral herb; fls pink. In sand, in woodland.				X											
<i>Pterigeron odorus</i> (F.Muell.) Benth. Perennial herb; aromatic; fls pink. In gravelly loam, in woodland near river.													X		
<i>Pterocaulon glandulosum</i> (Benth.) F.Muell. Erect herb to 1 m. In closed-grassland.			X												
<i>Pterocaulon sphacelatum</i> (Labill.) F.Muell. Perennial herb to 1.5 m; fls mauve. In sand over sandstone, on creek bank (A1); on sandstone scree slopes (A2); in sand in woodland (A4); on ledge of sandstone cliff (C1).	X	X		X					X						

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Pterocaulon verbascifolium</i> (Benth.) F.Muell. Erect herb to 1 m. Very common on sandstone (C2).					X					X					
? Genus ASG 13190 Perennial herb to 1 m; fls yellow. In sand in low woodland.				X											
? Genus ASG 13211, 13979 Perennial herb 70 cm. In sand in low open-forest (A4) (B1 s.n.) (C4).				X	X							X			
BARRINGTONIACEAE															
<i>Barringtonia acutangula</i> Gaertn. Shrub to 3 m; fls red, pendulous. On rocky or sandy river and creek banks (A1) (B1) (B3) (B4) (C3).	X				X		X	X			X				
<i>Planchonia australis</i> (F.Muell.) Kunth Erect tree to 4 m; leaves turning reddish, deciduous. Common on sandstone (A1 obs.) (A2) (A3); in sand in low open-forest (A4); on sandstone plateau in low woodland and on loamy plain in woodland (fls white) (B1).	X	X	X	X	X										
BIGNONIACEAE															
<i>Dolichandrone filiformis</i> Fenzl Tree to 3 m; bark tessellated; fruit brown and curved, up to 24 cm long.			X												
<i>Dolichandrone heterophylla</i> F.Muell. Shrub on dry sandstone. Common among <i>Melaleuca minutifolia</i> (A3). Tree 9 m; bark finely tessellated, dark grey. On sandstone scarp, in low open-forest (C4).			X									X			
BOMBACACEAE															
<i>Adansonia gregorii</i> F.Muell. 1 tree obs. in basaltic loam in low woodland.					X										
<i>Bombax ceiba</i> L. var. <i>leiocarpum</i> A.Robyns Deciduous tree up to 20 m, with thorns; fls deep red. In sandstone in vine forest (C1); on edge of Carson River (C2). Tree to 12 m, deciduous; bark fissured, grey; fls deep red. On sandstone scarp as emergent above low closed-forest (C4).									X	X		X			
BORAGINACEAE															
<i>Trichodesma zeylanicum</i> (Burm.) R.Br. Perennial herb; fls pale blue. Regenerating after fire in sandy open woodland.					X										
BURSERACEAE															
<i>Canarium australianum</i> F.Muell. Tree to 8 m. In low closed-forest (B1); common on sandstone along creeks (B3); on sandstone scree in low open-forest (B4). Tree 15 m; bark tessellated, grey. In loam/sandstone in vine forest (C1).					X		X	X	X						
<i>Canarium ? australianum</i> F.Muell. KFK 3008 Erect, spindly tree to 4 m; petioles ferruginous-tomentose. On sandstone cliff near seepage line.		X													

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
BYBLIDACEAE															
<i>Byblis liniflora</i> Salisb. Glandular-pubescent herb; in flower and fruit; fls pink, cream outside. By sandy creek bed (A1 obs.); in closed-grassland (A4); in sand near river(B4); in seepage at top of scarp, in closed-grassland (C4); in sand, in low woodland near swamp (Galaxy Swamp).	X		X	X	X	X		X				X		X	
CAESALPINIACEAE															
<i>Cassia mimosoides</i> L. Ephemeral herb to 30 cm; fls yellow. In damp creek bed (A3) (C5): in closed-grassland (A4); among grass by rocky basaltic creek bed (B1); in sand in open-woodland near river (B4).			X	X	X			X						X	
<i>Cassia</i> aff. <i>occidentalis</i> L. ASG 13970 Herb to 2 m; in fruit. On sandstone scarp, in low closed-forest.												X			
<i>Cassia oligoclada</i> F.Muell. Ephemeral herb. On sandy bank near river (A1). Small shrub; fls yellow. On sandstone among <i>Triodia</i> (A2).	X	X													
<i>Cassia venusta</i> F.Muell. Spindly perennial herb to 1 m; fls yellow. In sand in open-shrubland (A1); on sandstone (B3); in laterite/sandstone in low open-forest (C1).	X						X		X						
<i>Erythrophleum chlorostachys</i> (F.Muell.) Baill. Tree to 4 m with <i>E. tetradonta</i> on sandstone (A2) (A3) (B2). Shrub or tree to 10 m; bark corky. In sand in low open-forest (A4); among sandstone rocks in low woodland (B4) (C1); on sandstone (C2); on sandstone scarp in low open-forest (C4) and in sand in woodland (C4).		X	X	X		X		X	X	X		X			
CAMPANULACEAE															
<i>Wahlenbergia</i> sp. KFK 3054, ASG 13434, 14152 Diffuse herb; fls lilac/mauve. In sand over sandstone near creek, common (A2); among <i>Triodia</i> (A3) (A4); in sand, in low woodland near swamp (Galaxy Swamp).		X	X	X										X	
CAPPARIDACEAE															
<i>Capparis lucida</i> (Banks ex DC.) Benth. Shrub 3 m. On sandstone slope of gully, in low closed-forest.													X		
? <i>Capparis sepiaria</i> L. ASG 13284 Leafless shrub 50 cm. In sand in low open-woodland.				X											
<i>Capparis umbonata</i> Lindl. Shrub 4 m; bark fissured, grey; branchlets pendulous. On sandstone ridge, in low woodland.								X							
<i>Capparis</i> sp. KFK 4184, 4476, 4405, ? ASG 13730, 13751 Scrambling shrub with recurved spines. Common on sandstone (B3) (B4) (C3); in sandstone gully, in tall shrubland (B1).					X		X	X			X				

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Capparis</i> sp. ASG 13931 Shrub 3 m. On sandstone scarp, in low closed-forest.												X			
CARYOPHYLLACEAE															
<i>Polycarpaea longiflora</i> F.Muell. Ephemeral herb; fls red. On sandstone (A3); on sandstone plateau in low woodland (A4).			X	X											
<i>Polycarpaea staminodina</i> F.Muell. Dry ephemeral herb. In sand in low open-forest.				X											
<i>Polycarpaea</i> sp. ASG 14047 Tufted ephemeral herb; fls pale pink. On lateritic knoll in low woodland.									X						
CELASTRACEAE															
<i>Cassine melanocarpa</i> (F.Muell.) O.Kuntze Tree to 10 m; fruit green, shining. In loam/sandstone in vine forest (C1); on sandstone scarp in low open-forest (C4). Tree to 8 m, in low closed-forest in sandstone gorge (C5).									X			X	X		
<i>Denhamia obscura</i> (A.Rich.) Meisn. Shrub or tree 2-9 m; bark grey, lightly fissured; fruit orange. In sand over sandstone in low open-woodland (A1); in sandstone (A2) (C3) (C5); in sand in low open-forest (A4); in sand, in low open-forest above seepage on plateau (C4)	X	X		X							X	X	X		
CLEOMACEAE															
<i>Cleome viscosa</i> L. Erect, aromatic ephemeral herb. Among basalt rocks by creek.					X										
COCHLOSPERMACEAE															
<i>Cochlospermum fraseri</i> Planch. Openly branched shrub/tree to 3 m, deciduous; fls yellow, scented; pods inflated, green. Sandstone (A3); in sand in woodland and on siltstone scarp in tall open-shrubland (A4); in basaltic loam in low open-woodland (B1) (C4); on siltstone (B2) (C2).			X	X	X	X				X		X			
COMBRETACEAE															
<i>Terminalia bursarina</i> F.Muell. Tree 8 m; bark rough, corky. On dry sand banks in river bed (A1); in rocky river bed (B4).	X								X						
<i>Terminalia canescens</i> (DC.) Radlk. Tree to 5 m; in fruit. On sandstone rise, in tall shrubland.								X							
<i>Terminalia ? canescens</i> (DC.) Radlk. KFK 4157, 4106, 4364 Tree to 4 m; foliage silver. Common on sandstone (A3) (C2).			X							X					

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Terminalia grandiflora</i> Benth. Tree to 12 m with corky bark. In sand in open-forest by creek (A1); in fl. (cream) in sandy woodland (B1); in sand, in low open-forest above seepage on plateau (C4). Tree to 4 m; bark corky. In sand in woodland (A4).	X			X	X								X	
<i>Terminalia latipes</i> Benth. Tree to 10 m. Common on sandstone and along cliff edges (A2) (B3) (C2) (C3); on siltstone scarp in tall open-shrubland (A4).		X		X			X			X	X			
<i>Terminalia platyphylla</i> F.Muell. Tree to 10 m; bark grey, fissured; fruit fallen; exocarp fleshy. In basaltic sandy loam on creek bank.					X									
? <i>Terminalia</i> sp. ASG 13631, KFK 4066 Tree 6 m. Along basaltic creek bed.					X									
<i>Terminalia</i> sp. ASG 13940 Tree to 20 m; bark grey, fissured; fruit purple. On sandy creek banks in woodland.													X	
CONVOLVULACEAE														
<i>Evolvulus alsinoides</i> L. Small herb; fls blue. On dry <i>Triodia</i> flat.			X											
<i>Ipomoea</i> aff. <i>costata</i> F.Muell. ex Benth. ASG 13732 Shrub with arching stems to 2 m. In sand over sandstone in low woodland (B1); in sandstone gully in low closed-forest (C5).					X									X
<i>Ipomoea</i> ? <i>muelleri</i> Benth. ASG 13586, 13785 Prostrate herb. In sand over sandstone by creek (A1) (B4).	X							X						
<i>Ipomoea</i> sp. KFK 4489 Climber on <i>Acacia</i> sp. Plants dead, only fruits collected.											X			
<i>Merremia tridentata</i> (L.) Hall.f. ssp. <i>hastata</i> (Hall.f.) Oostr. Sprawling herb. In white sand near creek.						X								
DILLENIACEAE														
† <i>Hibbertia</i> ? <i>cistifolia</i> R.Br. ASG 13636 Shrub 1.5 m. In rocky loam in low open-forest.					X									
<i>Hibbertia kimberleyensis</i> C.A.Gardn. Erect herb up to 1 m; fls yellow. In damp sandstone gorge.														X
<i>Hibbertia ledifolia</i> Benth. Low shrub to 0.5 m. Common on sandstone.										X				
† <i>Hibbertia lepidota</i> R.Br. Straggly shrub to 50 cm; sterile. In sand, in low open-woodland (A1); common among <i>Triodia</i> between sandstone boulders (A2) (B3); on sandstone (C2) (C3). Shrub 1.5 m in old fruit. On sandstone plateau in woodland (A4). Shrub 1 m. Among sandstone rocks in low open woodland (B4).	X	X		X			X	X		X	X			

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
† <i>Hibbertia ? oblongata</i> R.Br. ASG 13564, 13748, 13834 Loose shrub 1 m; fls yellow. Among sandstone rocks in tall open-shrubland (A1); in low open-woodland (B4); by rocky creek bed, in low woodland (C4).	X							X				X			
† <i>Hibbertia ? scabra</i> R.Br. ex Benth. ASG 14102 Openly-branched shrub 2 m. In rocky sandstone creek bed in low closed-forest.													X		
† <i>Pachynema junceum</i> Benth. Straggly herb to 0.5 m; sterile. Common on open sandstone areas.							X								
DROSERACEAE															
<i>Drosera burmannii</i> Vahl Herb with rosette of reddish lvs; fls white. On damp areas (A3) (B4); on wet sandstone cliff on scarp, in low woodland (C4); in sand, in low woodland near swamp (Galaxy Swamp).			X					X				X		X	
<i>Drosera indica</i> L. Lax ephemeral herb; fls pink. Common on damp areas (A3) (B2); in damp sandy hollow near river (B4); in sand in low woodland near swamp (Galaxy Swamp). Fls white, anthers red; in seepage at top of scarp, in closed-grassland (C4).			X			X		X				X		X	
<i>Drosera petiolaris</i> R.Br. ex DC. Perennial herb with rosette; fls white. Common on damp areas (A2) (A3) (B2) (C1); in sand in open-forest (A4).	X	X	X			X			X						
<i>Drosera</i> aff. <i>petiolaris</i> R.Br. ASG 13676 Perennial herb, regenerating in burnt woodland.					X										
<i>Drosera</i> sp. ASG 13905 Lvs. red; fls pale pink. In seepage at top of scarp. in grassland among low open-woodland.													X		
EBENACEAE															
<i>Diospyros ferrea</i> (Willd.) Bakh. var. <i>humilis</i> (R.Br.) Bakh. Shrub 2 m; lvs shining. In loam/sandstone, in vine forest (C1). Tree 8 m; bark ± fissured, dark grey. In rocky sandstone gully, in low closed-forest (C4); and on scarp in low open-forest (fr. orange) (C4).									X			X			
<i>Diospyros nitens</i> W.V.Fitzg. Tree 6 m; grey bark. In rocky sandstone gully in low closed-forest (B1). Tree 15 m; bark slightly rough, dark grey. In loam/sandstone, in vine forest (C1).					X				X						
ELATINACEAE															
<i>Bergia pedicellaris</i> (F.Muell.) Benth. Small ephemeral herb; fls pink. On damp soil in drying creek bed (B1) (C1) (C2).					X				X	X					
ERYTHROXYLACEAE															
<i>Erythroxylum ellipticum</i> R.Br. Shrub to 3 m. Common on sandstone (A3); by dry rocky creek bed at foot of siltstone scarp in low open-woodland (A4).			X	X											

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
EUPHORBIACEAE														
<i>Antidesma ghaesembilla</i> Gaertn. Spreading shrub to 5 m. In sand, in low open-forest near creek (A1). Spreading tree 10 m with new lvs and fls. Along rocky/sandy creek bank in woodland (B1); in rocky sandstone gully, in low closed-forest (C4).	X				X								X	
<i>Bridelia</i> ? <i>tomentosa</i> B1. KFK 3087 Erect shrub to 2 m. Common on sandstone (A2) (B3).		X					X							
† <i>Chamaesyce hirta</i> (L.) Millsp. Ephemeral herb. On loamy river bank in open areas.					X									
† <i>Chamaesyce vachellii</i> (Hook et Arn.) Hara Ephemeral herb; fls white. In river bed (B1) (C1).					X				X					
<i>Glochidion</i> ? <i>disparipes</i> Airy Shaw Shrub 2m. In sand, in open-forest by creek.	X													
<i>Petalostigma pubescens</i> Domin Shrub or tree 1-6 m; fruit orange. In sand in low open-woodland (A1) (A4) (B1); on sandstone plateau in low woodland (C1 obs.). Common on sandstone (A2) (B2) (B3) (C2).	X	X		X	X	X	X		X	X				
<i>Petalostigma quadriloculare</i> F.Muell. Shrub to 0.5 m; fruit yellow. Common on sandstone between <i>Triodia</i> clumps (A2) (A3).		X	X											
<i>Phyllanthus baccatus</i> F.Muell. ex Benth. Semi-climber. In rocky sandstone gully, in low closed-forest (B1) (C4); on rocky basaltic creek-bank in low open-woodland (B1). Shrub to 1 m. Common on sandstone (C2). Shrub 2 m; fls pale green; fr. red. On sandy creek banks in woodland (C4).					X				X			X		
<i>Phyllanthus maderaspatensis</i> L. In sand in river bed (B1) (C4).					X								X	
<i>Phyllanthus minutiflorus</i> F.Muell. Small ephemeral herb. In damp sand of creek (A1) (B1) (B2); in seepage at top of scarp, in grassland with low open-woodland (C4).	X				X	X							X	
<i>Phyllanthus</i> aff. <i>minutiflorus</i> F.Muell. ASG 13792 In damp sand near river.								X						
<i>Phyllanthus</i> sp. KFK 3074, 4537, ASG 13882 In seepage on sandstone in low open-woodland (A2) (C4) (C5).		X										X	X	
<i>Phyllanthus</i> sp. KFK 3037, 4563 Low herb; leaves ? deciduous. Common on sandstone (A2) (C3).		X									X			
<i>Phyllanthus</i> sp. KFK 4369, ASG 13294 Erect spindly herb. On siltstone scarp in tall open-shrubland (A4); common on sandstone (C2).				X					X					
<i>Phyllanthus</i> sp. ASG 13625 Herb. In rocky creek bed.					X									
<i>Poranthera microphylla</i> Brongn. Ephemeral herb. In sandy-clay in grassy creek bed.				X										

SPECIES	SITE															
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS		
<i>Ricinocarpus</i> ? sp. nov. KFK 4460 Spindly herb up to 0.5 m. Common on sandstone.											X					
<i>Ricinocarpus</i> sp. ASG 13757 Slender shrub 70 cm. Among sandstone rocks in tall shrubland.								X								
<i>Ricinocarpus</i> sp. ASG 14118 Erect, little-branched shrub 1.5 m. On sandstone slope of gully, in low woodland.														X		
<i>Sebastiania chamaelea</i> (L.) Muell. Arg. Perennial herb. On sandy bank by river (A1); in sand in open-forest (A4).	X			X												
GENTIANACEAE																
<i>Canscora diffusa</i> R.Br. Delicate ephemeral herb. On sandstone ledges by waterfall										X						
GOODENIACEAE																
<i>Calogyne holtzeana</i> F.Muell. ex Specht Sprawling perennial herb. In shelter of low Eucalypt in closed-grassland (A4); on dry sandstone with <i>Triodia</i> (A3).			X	X												
<i>Dampiera candidans</i> F.Muell. Shrub/perennial herb to 70 cm; fls purple inside. Among sandstone rocks in tall open shrubland (A1); on sandstone outcrop (C2).	X										X					
<i>Goodenia bicolor</i> F.Muell. Robust herb; fls yellow. Damp area by creek.							X									
<i>Goodenia lamprosperma</i> F.Muell. Herb to 50 cm; rootstock woody; fls yellow. On damp sandy river bank (A1) (B4); common around remnant pools (B3); aquatic with floating lvs, fl. when water level falls; common along creek on plateau (C1).	X							X	X	X						
<i>Goodenia</i> sp. ASG 13285, 13905, KFK 4036 Ephemeral herb; fls yellow. In sand in open-grassland (A4); in seepage with grassland (C4).				X									X			
<i>Goodenia</i> sp. ASG 13522 Sprawling perennial herb; no fls. In damp sandy-clay, among dense grass in open-woodland	X															
<i>Goodenia</i> sp. ASG 13573, 13824 Ephemeral herb. In closed-grassland among low open-woodland on swamp flat (A1); in sand in open-woodland by river (B4).	X								X							
<i>Goodenia</i> sp. ASG s.n. Erect herb; in old fruit. Among sandstone rocks in shrubland.									X							
<i>Goodenia</i> sp. ASG 13675 Perennial herb; fls yellow. Regenerating in burnt woodland.					X											
<i>Scaevola macrostachya</i> Benth. Herb to 50 cm; fls white. On sandstone (A1) (B2)	X						X									

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
GYROCARPACEAE															
<i>Gyrocarpus americanus</i> Jacq. Tree to 12 m; bark ± smooth, pale brown; deciduous; in fruit. On sandstone scarp as emergent over low closed-forest.													X		
HALORAGACEAE															
<i>Gonocarpus chinensis</i> (Lour.) Orchard Perennial herb. On sandy creek banks (A4) (C1).				X					X						
<i>Gonocarpus leptothecus</i> (F.Muell.) Orchard Perennial herb. Growing in open-grass- land; common (A2); by creek (B1).		X			X										
† <i>Myriophyllum dicocum</i> F.Muell. Aquatic herb; stems red. In billabong.	X														
<i>Myriophyllum trachycarpum</i> F.Muell. Aquatic rooted in mud in shallow pools and along creek banks (C1) (C2) (C3).									X	X	X				
<i>Myriophyllum</i> sp. aff. <i>trachycarpum</i> ASG 13545 Aquatic. In billabong.	X														
<i>Myriophyllum verrucosum</i> Lindl. Aquatic; infl. emergent. In pools of Car- son River.					X										
HYPERICACEAE															
<i>Hypericum gramineum</i> Forst.f. Ephemeral herb; fls yellow. Common in rocky sandy ground beside creek (A3); in dry grassy creek bed (A4); in sand in open-woodland near river (B4).			X	X				X							
LAMIACEAE															
<i>Coleus scutellarioides</i> (L.) Benth. Perennial herb 1 m; fls blue. In damp sandy-clay among dense grass in open- woodland (A1); in wet crevices of sand- stone cliff on scarp, in shelter of low closed-forest (C4).	X												X		
<i>Dysophylla verticillata</i> Benth. Aquatic herb; infl. emergent; fls mauve. In billabong (A1); in rocky creek (C1).	X								X						
LAURACEAE															
<i>Cassytha filiformis</i> L. Parasite; fls pale green to white. On <i>Acacia tumida</i> on sandy bank near river (A1) (B4); on <i>Acacia</i> sp. in sandstone gorge (A2). Hirsute form (C3).	X	X						X			X				
LENTIBULARIACEAE															
<i>Utricularia</i> aff. <i>albiflora</i> R.Br. Minute herb; fls white. In seepage at top of scarp, in closed-grassland.													X		
<i>Utricularia caerulea</i> L. (previously recorded for W.A. as <i>U. charnleyensis</i>) Fls purple, pale outside. Among matted roots in seepage on sandstone scarp, in low woodland (C4); among moss banks and mud under low closed-forest (C5).													X	X	

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Utricularia chrysantha</i> R.Br. Slender herb with bright yellow fls. In river-washed sand of creek (A3) (B2) (C1 obs.); in damp loam among basaltic rocks by creek (B1).			X		X	X			X					
† <i>Utricularia exoleta</i> R.Br. Aquatic herb; fls yellow. In mud of remnant pool in sandstone (B3); in stagnant billabong and in pools of creek (A1); in swamp (Galaxy Swamp).	X						X							X
<i>Utricularia kimberleyensis</i> C.A.Gardn. Fls purple with yellow line at base of lower lip, pale mauve outside. In seepage at top of scarp, in closed-grassland.												X		
† <i>Utricularia stellaris</i> L.f. Aquatic; fls yellow. In pools of river.								X						
<i>Utricularia uliginosa</i> Vahl. Lvs submerged; fls blue, spur cream, upper calyx-lobe grey. On peaty banks matted with roots; by pools in sandstone gully, in low closed-forest (C4); by pools in Schizaea Creek (C5).												X	X	
LOBELIACEAE														
† <i>Isotoma armstrongii</i> E. Wimm. Ephemeral herb up to 20 cm; glabrous; fls blue with white throat. In damp sand beside creek.			X											
<i>Lobelia dioica</i> R.Br. Much-branched dioecious ephemeral herb; lower leaves many, densely hairy, the ascending stems and leaves becoming subglabrous. On black mud (Galaxy Swamp); in damp sand near river (B4).								X						X
<i>Lobelia quadrangularis</i> R.Br. Straggly herb; fls blue. On damp mud at edge of Carson River.										X				
LOGANIACEAE														
† <i>Mitrasacme ? ambigua</i> R.Br. ASG 13904 Delicate much-branched ephemeral herb; fls white. On sheltered ledge among sandstone rocks of seepage at top of scarp, in low open-woodland.												X		
† <i>Mitrasacme commutata</i> Leenh. Ephemeral herb; fls white. In sand among thick grass in open-woodland and near river (B4); in sand, in low woodland near swamp (Galaxy Swamp).								X						X
<i>Mitrasacme constricta</i> F.Muell. Herb; lvs and scapes orange; fls white, throat yellow. Common in river washed sand of Nymphaea Creek.						X								
<i>Mitrasacme exserta</i> F.Muell. Ephemeral herb; fls white. In sand among grass in open woodland near river.								X						
<i>Mitrasacme gentiana</i> F.Muell. Ephemeral herb; fls white. In sand in low woodland (A4); in sand near creek (B4).				X				X						

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Mitrasacme</i> aff. <i>laevis</i> Benth. Straggling herb; fls large, cream with orange centre. On damp flat.			X												
<i>Mitrasacme</i> aff. <i>lepidocalyx</i> W.V.Fitzg. KFK 4006, ? ASG 13187, 13598, 13502, 13795 Erect ephemeral herb; fls white, tinged pink on end of petals. Common in creek near closed-grassland (A3); in sand in low woodland (A4); in damp sand near river (B4).			X	X	X			X							
<i>Mitrasacme</i> aff. <i>lepidocalyx</i> W.V.Fitzg. KFK 4306 Erect herb; fls whitish in heads with two orange spots at the base of corolla lobes near throat. Common in swampy area of creek.						X									
<i>Mitrasacme nudicaulis</i> Benth. Diminutive herb; fls white. On wet, swampy flat.			X												
<i>Mitrasacme</i> sp. ASG 13599, 13901 Ephemeral herb; fls white. In rocky basaltic loam by creek (B1). In grassland among low open-woodland, in seepage at top of scarp (C4).					X							X			
<i>Strychnos lucida</i> R.Br. Shrub 2-4 m; fruit orange. In dry sandstone creek bed on plateau, in low woodland (B1); among sandstone rocks in tall shrubland (B4); on sandstone slope of gorge, in low closed-forest (C5).					X			X					X		
LORANTHACEAE															
<i>Amyema bifurcatum</i> (Benth.) Tiegh. Hemi-parasite; perianth scurfy white, red inside. On <i>Eucalyptus</i> sp.		X													
<i>Amyema miquelii</i> (Lehm. ex Miq.) Tiegh. Hemi-parasite; perianth tube red, base yellow. On <i>Eucalyptus tetradonta</i> (A2.) (A3)		X	X												
† <i>Decaisnina brittenii</i> (Blakely) Barlow Common on <i>Melaleuca argentea</i> and <i>Barringtonia acutangula</i> , in fringing forest.						X									
<i>Decaisnina signata</i> (F.Muell. ex Benth.) Tiegh. Hemi-parasite; fls flesh pink; reflexed perianth lobes yellow/green; staminal filaments green. On <i>Buchanania obovata</i> and <i>Erythrophleum chlorostachys</i> (A1) (A2).	X	X													
? <i>Decaisnina signata</i> (F.Muell. ex Benth.) Tiegh. KFK 4245 Hemi-parasite. On <i>Eucalyptus polycarpa</i> .						X									
<i>Dendrophthoe acacioides</i> (A.Cunn. ex Benth.) Tiegh. Hemi-parasite; fls orange-red. On <i>Acacia tumida</i> (A1); on <i>Acacia dunnii</i> and <i>Melaleuca minutifolia</i> (C3); on <i>Metrosideros eucalyptoides</i> (C5).	X										X			X	
LYTHRACEAE															
<i>Ammannia multiflora</i> Roxb. Small herb; fls white; fr. red. In sand (B1); in damp soil in dried creek bed (C2).					X					X					

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Rotala diandra</i> (F.Muell.) Koehne Ephemeral herb; fls blue. In damp sand by river (A1); on mud at edge of creek (B1) (C1) (C2).	X				X					X	X				
<i>Rotala roxburghiana</i> Wight Ephemeral herb; reddish in colour. In damp sand by river (A1) (C1); in sand at edge of swamp (Galaxy Swamp).	X									X					X
MALVACEAE															
<i>Gossypium populifolium</i> (Benth.) F.Muell. ex Tod. Prostrate per. herb; fls pink with red centre. In sand in woodland.				X											
<i>Hibiscus geranioides</i> A.Cunn. Spindly viscid plant. Common on sandstone.		X													
<i>Hibiscus microchlaenus</i> F.Muell. var. <i>leptocladus</i> (Benth.) Fryxell Spindly shrub; by creek.						X									
<i>Hibiscus</i> aff. <i>radiatus</i> Cav. KFK s.n. Shrub to 1m; fls yellow. On sandstone							X								
<i>Hibiscus</i> aff. <i>zonatus</i> F.Muell. ASG 13507, KFK 4115, 4282, 4495 Shrub to 2.5 m; fls bright pink. In sandy, dry creek bed, in low open-woodland (A1); on river bank (B2); in creek bed (B3); on sandstone (C3).	X					X	X				X				
? <i>Hibiscus</i> sp. ASG 14049 Sterile shrub 70 cm; pale green. In laterite over sandstone in low open-woodland.										X					
<i>Sida</i> sp. ASG 13569 Slender shrub 2 m; fls yellow. On sandy river flat.	X														
MELASTOMATACEAE															
<i>Melastoma malabathricum</i> L. Perennial herb to 3 m; fls deep pink. In loam over sandstone by creek and at foot of cliff (C1). Shrub to 2 m. In sandstone gully, in low closed-forest by creek (C5).										X					X
<i>Osbeckia australiana</i> Naud. Dense shrub to 1 m; fls deep pink. Forming thicket beside creek in sandstone gorge (A2) (C2); in white sand near creek (B2); on sandstone scarp, in seepage area in low open-woodland (C4).		X				X					X		X		
MELIACEAE															
<i>Owenia vernicosa</i> F.Muell. Shrub or tree to 8 m. In sand in low open-woodland (A1) (A4); along base of sandstone cliff (A2) (B3); on sandstone plateau in low woodland (B1) (B4) (C1) (C4); on scree slopes of flat topped hills (B2) (C2).	X	X		X	X	X	X	X	X	X	X		X		

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
MENISPERMACEAE															
<i>Tinospora smilacina</i> Benth. Vigorous liane; deciduous; bark becoming corky; fls pale green. In sand over sandstone in tall open-shrubland (A1) (C3); in sand in low open-forest (A4); in rocky sandstone gully, in low closed-forest (B1).	X			X	X						X				
MENYANTHACEAE															
<i>Nymphoides hydrocharoides</i> (F. Muell.) Kuntze Aquatic; fls yellow. In billabong (A1); along creek (A4) (C1 obs.); in swamp (Galaxy Swamp); (B3).	X			X					X					X	
<i>Nymphoides indica</i> (L.) Kuntze Aquatic; fls white. In billabong (A1); (A3) (B3) (C2) (C3); along creek (A4).	X		X	X			X			X	X				
<i>Nymphoides minima</i> (F. Muell.) Kuntze Aquatic herb; lvs ± convex above, red and rugose below; fls white. In creek in gorge.									X						
MIMOSACEAE															
<i>Acacia aulacocarpa</i> A. Cunn. ex Benth. Tree 4-10 m with cracked, fibrous but not peeling bark. Common on sandstone (A3); in sand, in open-forest (A4).			X	X											
<i>Acacia brevifolia</i> Benth. Shrub 2-4 m with smooth bark. On sandstone (A2); on siltstone scarp in low woodland (A4); in rocky creek bed (B1); common (B2) (B3).		X		X	X	X	X								
<i>Acacia delibrata</i> A. Cunn. ex Benth. Shrub 4 m with "minnie ritchie" bark (in curled strips). In rocky basaltic loam, in low open-forest.					X										
<i>Acacia deltoidea</i> A. Cunn. ex G. Don Shrubs to 2 m. Common on sandstone.										X					
<i>Acacia dunnii</i> (Maiden) Turrill Shrub to 4 m; little-branched; stems and leaves bluish/glaucous. In sandstone in low woodland and tall shrubland (B1 obs.) (B2) (B3) (B4) (C1 obs.) (C3) (C5 obs.).					X	X	X	X	X		X		X		
<i>Acacia hemignosta</i> F. Muell. Shrub 1.5 m. In sand, in open-forest.				X											
<i>Acacia holosericea</i> A. Cunn. ex G. Don Tree to 8 m with lightly fissured grey bark. On sandy or loamy river levee (A1) (A2) (B2) (B4) (C2) (C4).	X	X				X		X		X			X		
<i>Acacia humifusa</i> A. Cunn. ex Benth. Low dense shrub to 1 m. On edge of sandstone cliff, common (A2) (C2); on siltstone scarp in low woodland (A4). Shrub to 2 m, spreading. On rocky scarp with open-woodland (C4) (C5).		X		X						X		X	X		
<i>Acacia kelleri</i> F. Muell. Slender, openly-branched shrub to 7 m with pendulous branchlets. Common in sandstone in open-woodland (A1) (B3) (B4) (C3); in rocky creek bed in low woodland (C4).	X						X	X			X	X			

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Acacia laccata</i> Pedley Low shrub to 2 m, bark smooth. Very common on sandstone flat.			X											
<i>Acacia</i> sp. aff. <i>latescens</i> Benth. ASG 13274 Several-stemmed shrub to 2 m. In sand in open-forest.				X										
<i>Acacia latifolia</i> Benth. Erect, open shrub 2-4 m; bark smooth, glaucous. In sand over sandstone, in gully with tall shrubland (B4). Shrub to 2 m. Common in sand over sandstone (C3).								X			X			
<i>Acacia</i> aff. <i>leptophleba</i> F.Muell. ASG 13764 Shrub or tree to 6 m, with grey bark. In rocky sandstone, in tall shrubland.								X						
<i>Acacia nuperrima</i> E.G.Baker Spreading shrub to 50 cm. In lateritic loam, with low shrubland.									X					
<i>Acacia platycarpa</i> F.Muell. Low straggly shrub. In sandstone gorge; sterile.		X												
<i>Acacia plectocarpa</i> A.Cunn. ex Benth. Tree 4-10 m with fissured, dark grey bark. In rocky sandstone bank of river bed (A1) (C1); on siltstone scarp, in low woodland (A4); common on sandstone near creek and in gorge (B3) (C2); in rocky creek bed in low woodland (C4).	X			X			X		X	X		X		
<i>Acacia</i> ? <i>retinervis</i> Benth. KFK 4383, ASG 13868 Sprawling shrub to 1.5 m. In dried sandstone creek bed (C2). Shrub 3 m with silvery foliage; bark ± smooth and brown, becoming fissured and grey. In rocky sandstone with low woodland on plateau (C4).										X		X		
<i>Acacia sericata</i> A.Cunn. ex Benth. Tree 6 m with rough grey bark. On sandy river levee.	X													
<i>Acacia simsii</i> Benth. var. <i>multisiliqua</i> Benth. Shrub to 3 m. Scattered on sandstone plain.			X											
<i>Acacia stigmatophylla</i> A.Cunn. ex Benth. Small shrub on sandstone (C2). Shrub to 2 m; foliage ± bright green. Locally common, in basaltic loam in open-woodland (C4).										X		X		
<i>Acacia stipuligera</i> F.Muell. Openly-branched shrub 2 m. On sandy creek bank below scarp.													X	
<i>Acacia sutherlandii</i> (F.Muell.) F.Muell. Depauperate shrub to 1 m or small tree to 6 m, bark corky. Common on Carson Volcanics in open-woodland (C2) (C4).										X		X		
<i>Acacia translucens</i> A.Cunn. in Hook. Low shrub to 2 m, much branched; bark fissured, fibrous. Common on sandstone (A2) (A3) (B2) (C2) (C3). In sand, in woodland and on siltstone scarp (A4); in tall shrubland (B4).		X	X	X		X		X		X	X			

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Acacia tumida</i> F.Muell. ex Benth. Tree to 9 m with fissured bark and well developed canopy. On sandy river levee (A1); on sandy creek bank (A4); on sandstone (B2); in alluvium beside creek (B3); in rocky sandstone, in woodland (B4).	X			X		X	X	X							
<i>Acacia</i> sp. ASG 13841, 14046 Spreading shrub 4 m. In rocky sandstone with tall open shrubland (C1). Shrub 3 m. In rocky creek bed in low woodland (C4).									X			X			
<i>Acacia</i> sp. (Brunioideae) ASG 13656 Slender shrub 70 cm. On sandstone cliff edge in low woodland.					X										
<i>Albizia lebbek</i> (Willd.) Benth. Tree 20 m; bark rough, dark grey; fls cream. In loam/sandstone in vine forest.									X						
MORACEAE															
<i>Ficus coronulata</i> F.Muell. Tree 7 m; bark smooth. In sandy-loam on creek bank (B1) (C4). Tree to 3 m; leaves pendulous. On edge of Carson River (C2)					X					X		X			
<i>Ficus leucotricha</i> Miq. Tree to 8 m; fruit yellow-green, silky hairy. Sandstone cliff edge (B3) (C3); in sandstone rocks beside creek (C2).							X			X	X				
<i>Ficus leucotricha</i> Miq. var. <i>megacarpa</i> F.Muell. Tree to 4 m; fruit yellow, turning red. Growing out of fissures in sandstone (B3); on sandstone cliff (C1).							X		X						
<i>Ficus leucotricha</i> Miq. var. <i>sessilis</i> Corner Tree 5 m with latex. On sandstone ridge in low woodland.								X							
<i>Ficus opposita</i> Miq. var. <i>indecora</i> (A.Cunn.) Corner Several-stemmed shrub 4 m; bark fissured, grey. In dry sandy creek bed (A1); in rocky sandstone gully, in low closed-forest (B1); in sand, in woodland at foot of scarp (C4).	X				X							X			
<i>Ficus opposita</i> Miq. var. <i>micracantha</i> (Miq.) Corner Low rough-lvd shrub. In sandstone gorge (B3) (C5).							X							X	
<i>Ficus platypoda</i> A.Cunn. Spreading shrub or small tree to 5 m; fruit pale yellow. Common on sandstone ledges near creek (A2) (C1) (C3); on sandstone scarp in low open-forest (C4).		X							X		X	X			
<i>Ficus platypoda</i> A.Cunn. var. <i>minor</i> Benth. Spreading tree with aerial roots. On sandstone scree in low open-forest (B1); among sandstone rocks by river (B4).					X			X							
<i>Ficus racemosa</i> L. Tree 20 m with stout trunk; cauliflorous. In loam/sandstone in vine forest (C1); in sand over sandstone on banks of Woorakin Creek (C2); on river banks (C4).									X	X		X			

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Ficus subpuberula</i> Corner Much-branched shrub; fruit pale yellow. In sandstone in tall shrubland.								X							
<i>Ficus virens</i> Ait. var. <i>sublanceolata</i> Miq. Tree growing out of cracks in sandstone, sterile at time of collection (A2) (B3) (C3). Erect tree to 11 m; fruit white/cream turning maroon. On sandstone cliff (B1). Tree 18 m; bark smooth, creamy-grey. On creek bank in vine forest (C1); shrub among sandstone rocks by water fall(C1). Common in sandstone gorge (C2).		X			X		X		X	X	X				
<i>Ficus</i> sp. ASG 13650 Tree 5 m; fr. yellow. At edge of sand- stone cliff.					X										
MYRISTICACEAE															
<i>Myristica</i> ? <i>insipida</i> R.Br. ASG 13672 Tree 10 m; bark dark grey. In rocky sandstone gully, in low closed-forest.					X										
MYRSINACEAE															
† <i>Rapanea</i> ? <i>porosa</i> (F.Muell.) Mez. ASG 14128 Several-stemmed shrub 3 m. On sandstone slope of gully, in low closed-forest.														X	
MYRTACEAE															
<i>Calytrix achaeta</i> F.Muell. Dense shrub to 2 m; fls cream-white. Common on sandstone (A2) (A4) (B2) (C3); on sandstone plateau in low wood- land (C4).		X		X		X					X	X			
<i>Calytrix brachychaeta</i> F.Muell. Dense shrub to 4 m; fls cream-white. In rocky sandstone river bed (A1) (C1); on sandstone near creek (B3) (C2) (C3); among sandstone rocks in tall shrubland (B4).	X						X	X	X	X	X				
<i>Calytrix conferta</i> A.Cunn. Dense shrub to 4 m; fls pink. Common on sandstone (A3); on sandstone plateau in low woodland (A4).			X	X											
<i>Calytrix microphylla</i> A.Cunn. Sprawling to erect shrub to 4 m; fls pink. Common on sandstone (A1) (A2) (B2) (C3).	X	X				X					X				
<i>Eucalyptus</i> aff. <i>alba</i> Reinw. ex Blume. ASG 13722 Tree to 5 m; stems glaucous. Edge of sandstone plateau					X										
<i>Eucalyptus apodophylla</i> Blakely et Jacobs Tree to 20 m; smooth white bark. In damp sandy-clay as emergent above low open-woodland (A1); in closed grassland and along edge of creek (A3); on sandy creek bank (A4) (C4).		X	X	X									X		
<i>Eucalyptus bleeseri</i> Blakely Tree to 16 m; bark grey/orange brown, flaky. On sandstone (A2) (B2) (B4) (C3). Tree 12 m; lvs ± shining; bark ± smooth with red flakes. On sandstone plateau in low woodland (A4). On sandstone near dried creek (C3).		X		X		X		X			X				

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Eucalyptus brachyandra</i> F.Muell. Tree 5 m; ± straggling; bark fibrous, grey; in old fruit. On sandstone cliff.									X					
<i>Eucalyptus camaldulensis</i> Dehn. Erect tree to 20 m; smooth white bark. By billabong (A1); on banks of Carson River (B1); common along creek bed (B2) (B3); on river bank by pool (B4).	X				X	X	X	X						
<i>Eucalyptus clavigera</i> A.Cunn. ex Schau. Tree to 6 m; bark fibrous. On sandstone.							X							
<i>Eucalyptus confertiflora</i> F.Muell. Tree to 10 m; lower bark rough and flaking, greyish/black; upper bark smooth, light grey peeling to expose cream bark underneath. On sandstone (A2); on siltstone scarp, in tall open-shrubland (A4); on dry scarp in woodland (B1); on siltstone hill (B2); on sandstone plateau in low woodland (C4).		X		X	X	X						X		
<i>Eucalyptus ferruginea</i> Schau. Tree to 4 m; young lvs rusty brown tomentose; bark rough, fibrous; in heavy fruit. Common on sandstone.		X												
<i>Eucalyptus foelscheana</i> F.Muell. Tree to 10 m; lvs ± shining; bark flaky, grey/orange. In basaltic loam in woodland (B1) (C4).					X			X						
<i>Eucalyptus grandifolia</i> R.Br. ex Benth. Tree to 6 m; bark white. On sandstone.			X											
<i>Eucalyptus herbertiana</i> Maiden Tree to 6 m with several trunks; bark white, ± powdery. On sandstone ridge in tall shrubland.								X						
<i>Eucalyptus ? herbertiana</i> Maiden KFK 4463 Tree to 10 m; bark grey, smooth. Near dried creek in sandstone.											X			
<i>Eucalyptus ? houseana</i> W.V.Fitzg. ex Maiden ASG 13921 Spreading tree 15 m; stout trunk; bark smooth, cream. At edge of seepage at top of scarp.													X	
<i>Eucalyptus jensenii</i> Maiden Tree to 4 m; bark rough, fibrous; fruit small. Common on sandstone.			X											
<i>Eucalyptus latifolia</i> F.Muell. Erect tree to 12 m, lower bark rough, upper smooth. Among sandstone rocks in low woodland (A1); on flat near creek (A3) (C2). Tree to 7 m. On siltstone scarp in tall open-shrubland (A4); in sand in woodland (A4).	X		X	X						X				
<i>Eucalyptus</i> aff. <i>leucophloia</i> Brooker Tree to 7 m; fruits small; bark white. Common on sandstone plateau (B1) (C1) (C2) (C4).					X				X	X		X		
<i>Eucalyptus ? microtheca</i> F.Muell. KFK 4058 Tree to 6 m; bark rough; fruits small. Common on sandstone.			X											
<i>Eucalyptus miniata</i> A.Cunn. ex Schau. Tree to 20m; fls orange. Common on sandstone (A1) (A2) (A3) (B1) (B3) (B4) (C1); in rocky gully, in low woodland (C4 obs.)	X	X	X		X		X	X	X			X		

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Eucalyptus oligantha</i> Schau. Tree to 10 m; bark grey, fissured. In sand in woodland (A4); and as shrub to 1.5 m in closed-grassland.				X											
<i>Eucalyptus papuana</i> F.Muell. Tree to 8 m; bark white, grey when newly exposed. In open-grassland.			X												
<i>Eucalyptus perplexa</i> Maiden & Blakely Ironbarked tree to 8 m. On sandstone plateau in low woodland.				X											
<i>Eucalyptus polycarpa</i> F.Muell. Tree to 14 m; bark fibrous. In low open-woodland (A1); in sand over sandstone (B2).	X					X									
<i>Eucalyptus ptychocarpa</i> F.Muell. Tree to 14 m; canopy well developed; bark fibrous. In sand in woodland along creek (A1 obs.); in sand, in woodland along creek (A4); on sandstone—not common (B2) (C2) (C3); in seepage on steep slope of gorge (C1); in rocky sandstone gully in low woodland (C4 obs.) (C5 obs.)	X			X		X			X	X	X	X	X		
<i>Eucalyptus tectifera</i> F.Muell. Tree to 5 m; bark fibrous. Common on sandstone (B2). Tree to 12 m. In basaltic loam in woodland (B1) (C4 obs.)					X	X							X		
<i>Eucalyptus tetradonta</i> F.Muell. Tree to 18 m; bark stringy, grey; fls cream. In sand in low open-woodland (A1); on sandstone (A2) (B2) (C3); in sand in woodland (A4) (B4) (C1 obs.)	X	X		X		X		X	X		X				
<i>Eucalyptus zygophylla</i> Blakely Tree to 4 m; bark rough, fibrous. On sandstone scree slope.			X												
<i>Eucalyptus</i> sp. ASG 13308, 13313, 13547, 13869, 13893, KFK 3079, 4073, s.n. C2.... Bloodwood; tree to 8 m; bark ± smooth with red flakes. In sand over sandstone, in low open-woodland (A1); on sandstone scree above gorge (A2) (A3); on sandstone plateau, in low woodland (A4). Tree to 15 m. On sandstone plateau, in low woodland (C4).	X	X	X	X						X			X		
<i>Eucalyptus</i> sp. ASG 14071, KFK 4486 Bloodwood; tree to 6 m; bark rough. At edge of sandstone cliff above waterfall (C1); on sandstone (C3).									X		X				
<i>Eucalyptus</i> sp. ASG 13753 Bloodwood; tree 7 m; bark rough, flaked. In sandstone, in low open-woodland.								X							
<i>Eucalyptus</i> sp. ASG 13653, KFK 4466 Bloodwood; spreading tree 12 m; bark rough. On sandstone plateau, in low woodland (B1); on sandstone near creek (C3).					X						X				
<i>Eucalyptus</i> sp. KFK 4172 Tree to 18 m; bark fibrous. Common at base of sandstone cliff.								X							

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
<i>Eugenia bleeseri</i> O.Schwarz Shrub to 5 m. In sand in low woodland (A4). Tree 8 m; bark finely tessellated, pale grey. In sand over sandstone near river (B4). Shrub/tree to 10 m. In sand, in low open-forest above seepage on plateau (C4).				X				X				X		
<i>Eugenia eucalyptoides</i> F.Muell. Diffuse shrub to small tree; fls white. Growing with <i>Melaleuca argentea</i> and <i>M. leucadendron</i> along creeks (B3) (C3). Shrub to 4 m with several stems; fls cream; fruit pink. In rocky river bed (B4).							X	X			X			
<i>Eugenia</i> sp. ASG 13476, 13488 Shrub 4 m; petioles red. In rocky river bed.	X													
<i>Eugenia</i> sp. ASG 13663 Shrub or tree 3-6 m; lvs dark green, shining. In rocky sandstone gully in low closed-forest.					X									
<i>Eugenia</i> sp. ASG 13846 Shrub 4 m; bark dark grey, finely fissured; lvs shining. In rocky sandstone gully, in low closed-forest.												X		
<i>Fenzlia phebalioides</i> W.V.Fitzg. Spindly shrub 2-3 m; bark fissured; mature fruits maroon. On sandstone cliff (A2) (B1) (C3); in sandstone gully, in low closed-forest (C4) (C5).		X			X						X	X	X	
† <i>Homalocalyx ericaeus</i> F.Muell. Low, spindly shrub to 1 m. In low woodland (B1); common on sandstone (B3) (C3).					X		X				X			
<i>Melaleuca argentea</i> W.V.Fitzg. Tree/shrub to 6 m. On sandy/rocky river banks (A1) (B4). Trees to 25 m; fls cream, sweet-scented. Common along creek and river banks with <i>M. leucadendron</i> (B2). Low trees to 4 m. Common on edge of creek and pools (B3) (C3).	X					X	X	X			X			
<i>Melaleuca leucadendron</i> (L.) L. Trees up to 30 m. Common along creeks and rivers (A1) (B3) (C3); Carson River (B1) (B4) (C1); in tall closed-forest along creek (C5).	X				X		X	X	X		X		X	
<i>Melaleuca minutifolia</i> F.Muell. Small trees 4-8 m with white paper bark. Common on sandstone.			X											
<i>Melaleuca ? nervosa</i> (Lindl.) Cheel Slender tree to 5 m. In sand in low open-forest.				X										
<i>Melaleuca viridiflora</i> Soland. ex Gaertn. Tree to 15 m. In gorge (A2) (A3) (C5); common in sand near creek (B2) (C3). Emergent in closed-grassland (dry in winter) and along creek (A4); along creek below escarpment (B1); on sandy platform on sandstone scarp, in low woodland (C4); in black mud, around swamp in low open-woodland (Galaxy Swamp).		X	X	X	X	X					X	X	X	X

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
† <i>Metrosideros eucalyptoides</i> (F.Muell.) F.Muell. Tree 25 m; bark ± rough, grey. In sandy-loam in fringing tall closed-forest by creek.														X
† <i>Syzygium suborbiculare</i> (Benth.) Hartley & Perry Tree to 15 m; lvs bright shining green; fls white. In rocky sandstone gully in low closed-forest (B1) (C4).					X								X	
<i>Tristania ? suaveolens</i> Sm. ASG 13627 Spreading tree to 10 m; bark grey, fibrous. Along creek banks (B1); in crevices on sandstone cliff above river (B4) (C1). Spreading tree to 18 m; bark grey, ± fibrous. On sandy creek banks, in woodland (C4).					X			X	X				X	
<i>Verticordia cunninghamii</i> Schau. Tree to 7 m. In sand over sandstone in tall open-shrubland near river (A1); in sand in low open-forest (A4) (B1); in tall shrubland (B4); on sandstone plateau in low woodland (C4 obs.). Spindly shrub to 2 m; fls white. In sandstone gorge, not common (A2); on sandstone near dried creek (A3) (C3).	X	X	X	X	X			X			X	X		
<i>Xanthostemon paradoxus</i> F.Muell. Tree to 6 m. In rocky sandstone river bed (A1); on sandstone plateau in low woodland and in gully (B1); common on summit of siltstone hill (B2) and along edge of sandstone cliff (B3) (C1); in low open-woodland (B4).	X				X	X	X	X	X					
NYMPHAEACEAE														
<i>Nymphaea gigantea</i> Hook. Aquatic perennial herb; lvs floating, reddish below; fls blue with yellow anthers, sweetly scented; fruit submerged. In creek and river pools. (A3) (A4) (B1) (B2) (B3) (C2) (C3).			X	X	X	X	X			X	X			
OLEACEAE														
<i>Jasminum didymum</i> G.Forst. Straggling shrub/climber. On sandstone scarp in low closed-forest.													X	
ONAGRACEAE														
<i>Ludwigia parviflora</i> Roxb. Ephemeral herb; fls yellow. In wet sandy creek bed (A1) (B1).	X				X									
<i>Ludwigia suffruticosa</i> (L.) Walt. Perennial herb to 3 m; fls yellow. In sandy creek bed (A1); on edge of sandstone creek bed (B3) (C2).	X						X			X				
OPILIACEAE														
<i>Cansjera leptostachya</i> Benth. Shrub 30 cm; several stems; lvs bright green. In sand in low open-forest.				X										

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
PAPILIONACEAE															
<i>Abrus precatorius</i> L. Ephemeral climber; in heavy fruit at time of visit. On sandstone rock ledge (B3); on sandstone scree in low woodland (C1).							X		X						
<i>Atylosia cinerea</i> F.Muell. ex Benth. Straggly shrub on sandstone (B3) (C3); in low woodland (C4).							X				X	X			
<i>Bossiaea bossiaeoidea</i> (A.Cunn. ex Benth.) A.B.Court Sprawling leafless shrub to 1 m; stems flat; fls yellow. In sand in low woodland/open-woodland (A1) (A4); forming thickets on sandstone (A2) (A3) (B2) (C3); on sandstone plateau in low woodland (C4).	X	X	X	X		X					X	X			
<i>Burtonia subulata</i> (Benth.) Benth. Diffuse shrub 70 cm-1 m; fls yellow. In sand in low open-woodland (A1) (A4) (B4); common on sandstone (A2) (C3); on sandstone plateau in low woodland (C4).	X	X		X				X			X	X			
<i>Crotalaria alata</i> Hamilt. Ephemeral herb; fls yellow. In white sand near edge of <i>Eucalyptus</i> woodland (B2); on edge of swamp (Galaxy Swamp).						X									X
<i>Crotalaria calycina</i> Schranck. Ephemeral herb.									X						
<i>Crotalaria crassipes</i> Hook. Sparsley branched ephemeral herb; fls yellow. In creek bed among scree.										X					
<i>Crotalaria crispata</i> A.Cunn. ex Benth. Perennial herb. In sandy creek bed in tall open-shrubland (A1) (A4).	X			X											
<i>Crotalaria retusa</i> L. Herb 1 m; fls yellow. In sand, in low open-woodland (A1); by creek (B1).	X				X										
<i>Crotalaria trifoliatrum</i> Willd. Erect ephemeral herb. On rocky basaltic creek bank in low open-woodland.					X										
<i>Crotalaria</i> sp. ASG 13583 Ephemeral herb 2.5 m. In sand over sandstone on creek bank.	X														
<i>Desmodium muelleri</i> Benth. Prostrate herb. In sand by creek (A1); in sand, in low woodland near swamp (Galaxy Swamp).	X														X
<i>Desmodium trichostachyum</i> Benth. Prostrate herb. In sand near creek (B1) (B2); in seepage at top of scarp, in grassland with low open-woodland (C4).					X	X						X			
<i>Dicerma biarticulatum</i> (L.) DC. Perennial legume to 1.5 m. In sand over sandstone, in tall open-shrubland near river (A1). Diffuse herb. On damp sand near creek (A2). In seepage on sandstone scarp; in low open-woodland (C4).	X	X										X			
<i>Erythrina vespertilio</i> Benth. Erect tree 12 m; deciduous; bark corky, pale; fls bright red. In black loam, in low woodland in gorge (C1); in basaltic loam in open-woodland (C4).									X			X			



Plate 1.—Aerial view of Worriga Gorge, looking south (C1). The plateau on the right has been burnt recently. Palmoondoora Creek flows along the bottom of the gorge.



Plate 2.—Ferns by Elasmias Creek in Worriga Gorge (C1), chiefly *Stenochlaena*, *Lygodium* and *Cyclosorus*.



Plate 3.—Solea Falls, Drysdale River (B4). (Photo by M. K. Morcombe)



Plate 4.—Tall closed-forest along Forest Creek (C5).



Plate 5.—Sugar Glider (*Petaurus breviceps*). (Photo by M. K. Morcombe)



Plate 6.—Western Chestnut Native-Mouse (*Pseudomys nanus*).

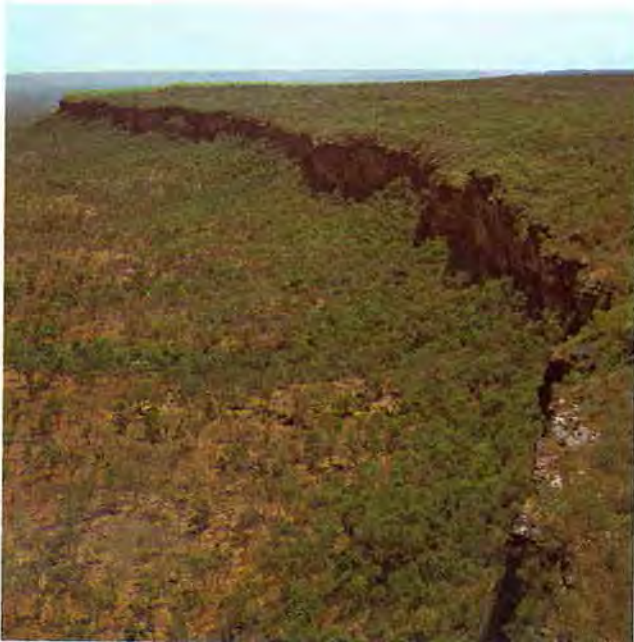


Plate 7.—Aerial view looking north along the Carson Escarpment near (Bl.)

(Photo by M. K. Morcombe)

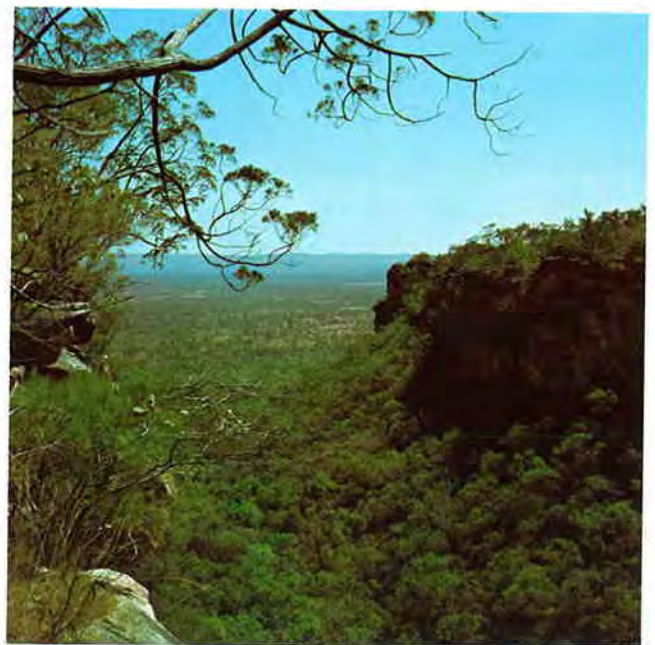


Plate 8.—Glider Gorge, Carson Escarpment (Bl). Low closed-forest in gorge, Carson River plains beyond.



Plate 9.—Tree Snake (*Dendrelaphis punctulatus*).



Plate 10.—*Dysphania fenestrata* (Swainson), male, wingspan 8.5 cm (C5). Adults fly during the day in rain forest; their coloration is probably aposematic.



Plate 11.—Aerial view of Petrogale Gorge, looking south-east, showing Johnson Creek and the plunge pool at the base of Cracticus Falls (B3).
(Photo by M. K. Morcombe)



Plate 12.—Aerial view of the Drysdale River. (Photo by M. K. Morcombe)



Plate 13.—*Gossypium populifolium* (Benth.) F. Muell ex Tod. At Emu Creek (A4).



Plate 14.—*Nematocentris* species 1, 66 mm SL (A1).



Plate 15.—Carson River near C4, with narrow stand of fringing forest.
(Photo by M. K. Morecombe)



Plate 16.—Morgan Falls looking east from above the first waterfall (C1).

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
? <i>Galactia</i> sp. ASG s.n. Sprawling perennial herb with buried legumes. In sand in low open-woodland near creek.				X										
<i>Glycine tomentosa</i> Benth. Prostrate among sandstone on scree slope.			X											
<i>Jacksonia argentea</i> C.A.Gardn. Shrub to 2.5 m; fls yellow. In sand over sandstone in low open-woodland (A1); in tall shrubland (B4); in lateritic loam on plateau, in low shrubland (C1); on sandstone (C2) (C3); in sandstone gully, in low open-forest (C5).	X							X	X	X	X			X
<i>Jacksonia thesioides</i> A.Cunn. ex Benth. Small, slender shrub to 2 m; fls yellow. In sand over sandstone on bank near river (A1); common along creeks (B2); in sand in fringing woodland by creek (B4); common on sandstone (C3); in sandstone gully in low open-forest (C5).	X					X		X			X			X
<i>Mirbelia viminalis</i> (A.Cunn.) C.A.Gardn. Much branched shrub to 1 m; fls deep yellow. Common on sandstone (A2) (A4); on sandstone plateau, in low woodland (C4).		X		X									X	
? <i>Piliostigma malabaricum</i> (Roxb.) Benth. ASG 13929 Several-stemmed shrub 2 m; deciduous; bark ± fibrous. In sand in woodland at foot of scarp.													X	
† <i>Plagiocarpus axillaris</i> Benth. Compact shrub to 0.5 m. In low woodland (B1); on sandstone (C3). Shrub 1m. Among sandstone rocks in low open-woodland (B4); in sandstone gully, in low open-forest (C4) (C5).					X			X			X	X	X	
<i>Soralea pustulata</i> F.Muell. Erect herb (? ephemeral) to 2 m. On scree at foot of escarpment, in low woodland (B1) (C4).					X								X	
<i>Rhynchosia</i> aff. <i>australis</i> Benth. ASG 14096 Perennial herb to 1 m, semi-scandent; viscid-aromatic; fls yellow. In black loam at foot of sandstone cliff.									X					
<i>Sesbania bispinosa</i> (Jacq.) Faur. et Rendle Shrub 2 m; in fr. Among basalt rocks of river bed.					X									
<i>Sesbania formosa</i> F.Muell. Tree 4 m; bark corky. On sandy creek bank (B1). Tree to 20 m. In loam/sandstone by creek in vine forest (C1). Tree 12 m; bark corky; fls white, sweetly scented. On loamy river bank (C4).					X				X				X	
<i>Tephrosia coriacea</i> Benth. Single-stemmed perennial herb. In sand in tall open-shrubland.	X													
<i>Tephrosia rosea</i> (F.Muell.) Benth. Sparsely branched shrub. On sandstone.							X							
<i>Tephrosia</i> sp. ASG 13273 Slender shrub 70 cm. In sand in open-forest (A4); in laterite/sandstone in low open-forest (C1).				X					X					

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Tephrosia</i> sp. ASG 13309 Shrub 1 m. On rocky sandstone plateau in woodland.				X											
<i>Tephrosia</i> sp. ASG 13498 Perennial herb 1.5 m. In sandy creek bed.	X														
<i>Tephrosia</i> sp. ASG 14050 Sterile shrub 60 cm. In laterite/sand- stone in low open-forest.									X						
<i>Tephrosia</i> sp. KFK 3091 Small bush; sterile. On sandstone.		X													
? <i>Tephrosia</i> sp. KFK 4291 Low shrub, sterile. On sandstone.						X									
<i>Zornia chaetophora</i> F.Muell. Herb with perennial stock; fls yellow. Regenerating in burnt woodland.					X										
PASSIFLORACEAE															
<i>Adenia heterophylla</i> (B1.) Koord. ssp. <i>aus- tralis</i> (DC.) de Wilde White flowered creeper common at base of sandstone cliff by river (B3); on sand- stone scarp in low open-forest (C4).					X		X						X		
<i>Passiflora foetida</i> L. Slender climber with tendrils; lvs soft and hairy; fls white; fruit orange. In creek bed (B2) (C2); on <i>Melaleuca leuca- dendron</i> (B3); in gorge by creek (C1); on river banks (C4).						X	X		X	X			X		
PITTOSPORACEAE															
<i>Citriobatus spinescens</i> (F.Muell.) Druce Tree 6 m; several stems; bark smooth, grey. In loam/sandstone in vine forest.									X						
PLUMBAGINACEAE															
<i>Plumbago</i> ? <i>zeylanica</i> L. Dead plants obs. in gorge near creek.									X						
POLYGALACEAE															
<i>Polygala</i> sp. ASG 13234 Ephemeral herb. In closed-grassland.				X											
<i>Polygala</i> sp. ASG 13594 Reddish ephemeral herb. In rocky bas- altic loam by creek.					X										
POLYGONACEAE															
<i>Polygonum attenuatum</i> R.Br. Low herb; fls white. On alluvium by creek.							X								
PORTULACEAE															
<i>Calandrinia quadrivalvis</i> F.Muell. Ephemeral herb; fls bright pink. In dry sand near river (A1); in sandy-clay in grassy creek bed (A4); in sand in grassy creek bed (B2); in sand, in low woodland near swamp (Galaxy Swamp).	X			X		X								X	

SPECIES	SITE													
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS
PROTEACEAE														
<i>Banksia dentata</i> L.f. Tree to 5 m; in young fruit. In low open woodland on swamp flat (A1); in swampy area (A4) (B4) (Galaxy Swamp). Tree to 10 m. In low open-forest at edge of seepage at top of scarp (C4).	X			X				X				X		X
<i>Grevillea agrifolia</i> A.Cunn. ex R.Br. Shrub to 4 m; fls cream, sweetly scented. Near river (A1) (C1 obs.); on sandstone (A2) (A4) (B3) (C2); in sand over sandstone in tall shrubland (B4).	X	X		X			X	X	X	X				
<i>Grevillea cunninghamii</i> R.Br. Shrub to 3 m; fls red. Among sandstone rocks in low open-woodland (B4); in sandstone gully, in low woodland (C5). Shrub to 1.5 m; fls red. On sandstone (C3).								X			X		X	
<i>Grevillea erythroclada</i> W.V.Fitzg. Erect, little-branched shrub/tree to 8 m; fls cream. In sand in open woodland/low open-forest.				X										
<i>Grevillea heliosperma</i> R.Br. Erect shrub to 3 m or tree to 6 m; rough dark grey bark. In sand, in low open-woodland (A1); common on sandstone plateau (A2); in open-forest (A4).	X	X		X										
<i>Grevillea mimosoides</i> R.Br. Tree to 10 m. In basaltic loam in woodland (B1). Shrub to 3 m; bark corky; fls cream. Common on Carson Volcanics (C2) and sandstone (C2).					X					X				
<i>Grevillea pteridifolia</i> Knight Tree to 10 m; fls orange. Near creek (A1) (C3); in sand in open-forest, and as emergent in closed-grassland (A4); on alluvial sand on fringe of cadjeput closed-forest (B2); on sandstone (B3); on sandstone in gully (B4) (C4 obs.).	X			X		X	X	X			X	X		
<i>Grevillea refracta</i> R.Br. Shrub to 4 m; fls orange or red with yellow limb. Common on sandstone (A1) (A2) (B3) (C3).	X	X					X				X			
<i>Grevillea viscidula</i> C.A.Gardn. Tree to 4 m; fls greenish yellow; fruit viscid. Emergent in closed-grassland (A3); on sandstone (B3).			X				X							
<i>Hakea arborescens</i> R.Br. Erect shrub to 3 m. On sandstone (A3) (C2); in sand in low open-forest (A4). Small tree to 6 m; in fruit. On basaltic scree, in low open-woodland (C4).			X	X						X		X		
<i>Persoonia falcata</i> R.Br. Tree to 4 m; fls yellow. Common on siltstone (A2) (B2) (B3); in sand in open-woodland (A4); in sand over sandstone in tall shrubland (B4); on sandstone plateau and scarp, in low woodland (C4 obs.).		X		X		X	X	X				X		
<i>Stenocarpus cunninghamii</i> R.Br. Shrub to 6 m; fls cream. In sandstone gully on escarpment, in low open-forest (B1) (C4); on siltstone (B2); sandstone (B3) (C3); in sandstone rocks above river (B4) (C1).					X	X	X	X	X		X	X		

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
RHAMNACEAE															
<i>Alphitonia excelsa</i> (Fenzl) Benth. Low shrub in gorge (A2). In rocky sandstone gully, in low closed-forest (B1) (C4); on sandstone scree in low woodland (C1). Tree to 12 m in sandstone gorge, fruit black (C2) (C5).		X			X				X	X		X	X		
<i>Zizyphus</i> sp. ASG 13935 Shrub 2-5 m. On sandstone scarp in low open-forest.												X			
RHIZOPHORACEAE															
<i>Carallia brachiata</i> (Lour.) Merrill Tree to 20 m; bark irregularly tessellated, grey. In loam/sandstone by creek, in vine forest (C1). Tree 5 m; lvs shining; fls pale green. In sandstone gully, in low closed-forest (C4). Tree 20 m. By creek in fringing tall closed-forest (C5).									X			X	X		
RUBIACEAE															
<i>Borreria ? australiana</i> Specht Prostrate herb. On damp sand near creek.		X													
<i>Canthium</i> sp. ASG 13302, 13768, KFK 3043 Shrub 3 m; rough grey bark; lvs ± yellow-green. On sandstone plateau in low woodland (A4) (B4).				X				X							
<i>Dentella repens</i> J.R. & G. Forst. Prostrate ephemeral herb; fls white. In sand over basalt rocks in river bed.					X										
<i>Gardenia megasperma</i> F.Muell. Tree 5 m; bark smooth. On sandstone scarp in low closed-forest.												X			
<i>Gardenia pantonii</i> F.Muell. Tree to 3 m. On sandstone cliff-top above river (B4); common on sandstone (C2) (C3).								X		X	X				
<i>Gardenia</i> sp. ASG 13196 Several-stemmed shrub 1 m. In sand in woodland.				X											
<i>Gardenia</i> sp. ASG 13268 Shrub 2 m; bark brown-grey. In sand in open-forest.				X											
<i>Gardenia</i> sp. ASG 13572 Tree 4 m; in fruit. Among sandstone rocks in low woodland.	X														
<i>Gardenia</i> sp. KFK 4287, ASG 14122 Shrub to 2 m. Common on sandstone (B2); On sandstone slope of gully, in low closed-forest (C5).						X							X		
<i>Gardenia</i> sp. KFK 3098, ASG 13290 Tree to 3 m; smooth-barked. Common along edge of sandstone cliff (A2); on siltstone scarp in tall open-shrubland (A4).		X		X											
<i>Gardenia</i> sp. KFK 4290 Tree to 3 m. On sandstone.						X									
<i>Gardenia</i> sp. KFK 4075 Shrub to 4 m; stems and trunk orange. On sandstone.			X												

SPECIES	SITE														GS
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5		
<i>Ixora ? tomentosa</i> Roxb. ASG 13289, 14048 Several-stemmed shrub to 70 cm. On silt-stone scarp in tall open-shrubland (A4). Tree 4 m; bark ± stringy, grey. On lateritic knoll in low woodland (C1).				X					X						
† <i>Morinda ? acutifolia</i> F.Muell. ASG 14136 Small, slender shrub, with latex. In sand near creek, in closed-forest.														X	
<i>Nauclea coadnata</i> J.E. Sm. Tree to 9 m; dark grey, roughish. Common along bed and banks of tributary of Carson River (B1) and Drysdale River (B2). Tree to 18 m. In loam/sandstone near creek, in vine forest (C1). Tree to 20 m; bark tessellated. On sandy creek bank in woodland (C4).					X	X			X			X			
<i>Oldenlandia galioides</i> (F.Muell.) F.Muell. Small, spreading ephemeral herb; fls white. In damp sand by river (A1); beside creek (A4) (B2); on wet sandstone cliff or scarp, in low woodland (C4).	X			X		X						X			
<i>Randia cochinchinensis</i> (Lour.) Merrill Spreading tree; bark smooth, grey. In rocky sandstone gully in low closed-forest (B1) (C4). Shrub 3 m. On ledge at base of sandstone cliff (B3); on sandstone near creek (C3). Tree 10 m; fruit orange-red. In loam/sandstone in vine forest (C1). Shrub 2 m. On sandstone slope of gully, in low closed-forest (C5).					X		X		X		X	X	X		
<i>Timonius timon</i> (Spreng.) Merrill Tree 6 m. In loam/sandstone, in vine forest (C1). Shrub to 2 m; fls white. In sand beside creek (C2). ± Pyramidal tree 10 m; bark brown, fissured; lvs ± shining; fls creamy-white. On loamy river bank (C4).									X	X		X			
RUTACEAE															
<i>Boronia lanuginosa</i> Endl. Shrub to 1.5 m; a few late fls (cream). Among sandstone rocks in low open-woodland (A1); in sand over sandstone (A2); in tall shrubland (B4); on sandstone scree slope (C3); in sandstone gully, at edge of low closed-forest (C4) (C5). Fls pale pink, centre darker (C5).	X	X						X			X	X	X		
<i>Glycosmis pentaphylla</i> (Retz.) DC. Shrub on sandstone (C3). Tree 5 m; bark slightly rough, grey. In rocky sandstone gully, in low closed-forest (C4).											X	X			
† <i>Glycosmis trifoliata</i> (Blume) Spreng. Shrub to 2 m. On sandstone (C3). Shrub 3 m. On sandstone slope of gully, in low closed-forest (C5).											X		X		
<i>Micromelum minutum</i> (Forst. f.) W. & A. Several-stemmed shrub 3 m. On sandstone scree, in low woodland.									X						
SANTALACEAE															
<i>Exocarpos latifolius</i> R.Br. Shrub to 2 m. Common on sandstone cliff.		X													

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Santalum lanceolatum</i> R.Br. Tree to 3 m. In sand in low open-forest (A4); on sandstone plateau in low woodland (B1); beside creek (B3) (C2); in tall shrubland (B4); on sandstone (C3); in low woodland (C4).				X	X		X	X		X	X	X			
SAPINDACEAE															
<i>Atalaya hemiglauca</i> F.Muell. ex Benth. Shrub 4 m. In rocky sandstone soil near creek.									X						
<i>Atalaya variifolia</i> (F.Muell.) F.Muell. ex Benth. Shrub 3 m with several stems. On sandstone scree in low open-forest (B1). Tree 10 m; crown small; bark tessellated. grey; in bud. In sand, in woodland at foot of scarp (C4).					X							X			
<i>Distichostemon hispidulus</i> (Endl.) Baill. Spreading shrub to 2 m; ♂ fls green turning brown then red, ♀ fls with red styles; fruit developing. In sandy creek bed (A1); on rocky plateau in woodland (A4); on sandstone (A2) (B2) (C3); at side of creek (B3).	X	X		X		X	X				X				
<i>Dodonaea</i> sp. KFK 4112 Low, much-branched shrub; lvs pinnate. On sandstone.			X												
SAPOTACEAE															
<i>Planchonella arnhemica</i> (F.Muell.) Van Royen Tree to 9 m with corky fissured bark and dense canopy; fruit green. In sand, in low open-woodland (A1); on sandstone hill (A2) (B2) (C3); among sandstone rocks in low open-woodland (B4); in sand, in woodland (B4); on sandstone scree in low woodland (C1).	X	X				X		X	X		X				
† <i>Planchonella pohlmanniana</i> (F.Muell.) Pierre ex Dubard var. <i>vestita</i> V.Royen Tree to 8 m; leaves green/grey, felty; canopy well developed. Common on sandstone (B3) (C5).								X					X		
<i>Pouteria sericea</i> (Ait.) Baehri Dense shrub to 5 m. In rocky river bed (A1); in sandstone gully, in low closed-forest (B1 obs.); on sandstone near creek (B3). Tree 15 m. In loam/sandstone in vine forest, being strangled by <i>Ficus ? virens</i> (C1). Shrub to 2 m; fls cream. Common on sandstone (C3). Tree to 6 m. In sandstone gully in low closed-forest (C5).	X				X		X		X		X		X		
SCROPHULARIACEAE															
<i>Buchnera linearis</i> R.Br. Erect ephemeral herb; fls white suffused pink or pale lilac. In damp soil near remnant pool (A3) (B2); in closed-grassland (A4).			X	X		X									

SPECIES	SITE														GS
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5		
<i>Buchnera ramosissima</i> R.Br. Ephemeral herb; fls white or pink. On sandstone (A2) (B2) (C2); on sandstone plateau in low woodland (A4) (C4).		X		X		X				X		X			
<i>Buchnera urticifolia</i> R.Br. Erect herb; fls white, tinged pink. On edge of swamp (Galaxy Swamp); in sand near river (B4); in rocky creek bed (C1).								X	X					X	
<i>Buchnera</i> sp. ASG 13724 Ephemeral herb 2 m; fls white. On rocky scree in low woodland.					X										
<i>Hemiarrrhena plantaginea</i> Benth. Ephemeral rosetted herb; fls blue, sometimes white. Very common in wet areas beside creeks and pools (A2) (A4) (B1) (B2) (B4) (C1 obs.).		X		X	X	X		X	X						
<i>Limnophila chinensis</i> (Osbeck) Merr. Semi-aquatic herb; fls lilac. Forming dense mats in pool (A1) (A4) (B2) (B4).	X			X		X		X							
<i>Limnophila fragrans</i> (Forst.f.) Seem. Small semi-aquatic herb; fls pale pink. In sand by creek (B1) (C4); on mud bank beside creek (C3) (C5).					X						X	X	X		
<i>Limnophila indica</i> (L.) Druce Aquatic. On edge of mud bank.										X					
<i>Limnophila</i> sp. ASG 13551, 13737, 14161 Aquatic herb; fls mauve. In billabong (A1); in black drying mud of swamp (Galaxy Swamp).	X													X	
<i>Lindernia subulata</i> R.Br. var. <i>glanduligera</i> Specht. Ephemeral herb, fls purple. In seepage at top of scarp, in grassland among low open-woodland.												X			
<i>Microcarpaea minima</i> (Koen.) Merr. (Previously recorded for W.A. as <i>M. muscosa</i> R.Br.) Small matted herb forming sward on mud, beside creek (A4) (B3) (C1).				X			X		X						
<i>Mimulus linearis</i> (R.Br.) Wettst. Ephemeral herb; fls mauve, throat yellow with orange spots (B4); in sandy clay in low woodland near swamp (Galaxy Swamp)								X						X	
<i>Mimulus</i> sp. ASG 13789 Ephemeral herb, fls yellow. In sandy hollow near river.								X							
<i>Stemodia coerulea</i> Benth. Aromatic ephemeral herb; fls blue/mauve. Common on sandstone (A2) (A3) (B3); in sand, in dry grassy creek bed (A4) (B1); in rock crevices by river (B4), in seepage at base of wet sandstone cliff on scarp, in low woodland (C4).		X	X	X	X		X	X				X			
<i>Stemodia viscosa</i> Roxb. Perennial viscid herb; fls blue. On edge of Carson Volcanics.										X					
SOLANACEAE															
<i>Nicotiana benthamiana</i> Domin. Aromatic herb to 30 cm; fls white. On ledge at base of sandstone cliff.							X								

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Solanum dioicum</i> W.V. Fitzg. Slender shrub 80 cm. In sand, in low open-woodland (A1); on sandstone scarp, in low woodland (C4).	X												X		
<i>Solanum</i> sp. ASG 14068 Spreading shrub to 70 cm; fls pale purple. Among sandstone rocks near creek.									X						
STACKHOUSIACEAE															
<i>Stackhousia viminea</i> Sm. Slender ephemeral herb; fls yellow. In closed grassland (A4); in rocky basaltic loam by creek (B1); in sand in woodland (B4); on sandstone scarp, in seepage area among grass in low open-woodland (C4).				X	X			X					X		
STERCULIACEAE															
<i>Brachychiton diversifolium</i> R.Br. Tree to 12 m; bark grey, lightly tessellated; fls yellow-green with red streaks. In sand, in low woodland (A1) (A4) (C4).	X			X						X			X		
<i>Brachychiton paradoxum</i> Schott Deciduous tree to 3 m, no flowers but mature fruits; on scree slope on edge of open-woodland (A3) (B3).			X				X								
<i>Brachychiton</i> sp. ASG 13251 Deciduous shrub with several stems to 70 cm; fls orange-red. In sand, in low open-forest.				X											
<i>Brachychiton</i> sp. ASG 13728, 13772, 13933 Tree 6 m; deciduous; fls pale red, green at base. On sandstone scree in low open-forest (B1) (C4); among sandstone rocks in low woodland (B4).					X			X					X		
<i>Sterculia viridiflora</i> W.V. Fitzg. Deciduous tree to 8 m, flowers small and pink; common on sandstone areas (B3) (C2) (C3).							X			X	X				
<i>Sterculia viscidula</i> W.V. Fitzg. Tree 5 m; fls red. In sand, in low open-woodland (A1) (C1 obs.) (C4 obs.).	X	X	X						X	X			X		
<i>Waltheria indica</i> L. Diffuse shrub to 2 m; fls yellow. In sand near dry creek bed, in open-woodland (A1); common near creek (A3); on dry flat (A3); in open-woodland (A4) (B2).	X		X	X		X									
STYLIDIACEAE															
<i>Stylidium</i> aff. <i>ceratophorum</i> O.Schwarz KFK 4030, 4012, ASG 13914 Fls pink with white throat, red outside. In wet soil of closed-grassland (A3); in seepage at top of scarp, in closed-grassland (C4).			X										X		
<i>Stylidium claytonioides</i> W.V. Fitzg. Corolla bright pink with yellow throat, brownish outside, column claw dark brown. In seepage area, in closed-grassland among low open-woodland, at top of scarp.													X		

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Stylidium fissilobum</i> F.Muell. Fls white. In wet soil of closed-grassland (A3); in sand in low woodland near creek (B4).			X					X							
<i>Stylidium</i> aff. <i>floribundum</i> R.Br. KFK 4037 Basally rosetted herb; scape with silky glandless hairs; fls pale pink, throat deep pink. In wet soil of closed-grassland.			X												
<i>Stylidium multiscapum</i> O.Schwarz Ephemeral herb; fls deep pink inside, pale outside. In white sand along grassy banks of Nymphaea Creek (A3); in sandy-clay along grassy creek bed (A4) (B4); closed-grassland (Galaxy Swamp).			X	X					X					X	
<i>Stylidium muscicola</i> F.Muell. Delicate ephemeral herb, fls pink, cream outside. Seepage areas on sandstone cliff ledges (A2); on wet, shaded sandstone ledges in gully, in low closed-forest (B1) (C4); on wet sandstone ledges of cliff (C1).		X			X				X			X			
<i>Stylidium pachyrrhizum</i> F. Muell. Ephemeral herb; fls magenta, white outside. On damp area of closed-grassland near Lorikeet Creek.		X													
<i>Stylidium</i> aff. <i>pachyrrhizum</i> F.Muell. ASG 13817 Fls pale pink with red throat markings. In sand by creek.								X							
<i>Stylidium</i> aff. <i>rotundifolia</i> R.Br. ASG s.n. In damp sand near river.								X							
<i>Stylidium schizanthum</i> F.Muell. Ephemeral herb; fls white. In clay, in low woodland near swamp (Galaxy Swamp); in damp soil of closed-grassland (A3).			X											X	
<i>Stylidium</i> sp. KFK 4224, 4008, ASG 13484, s.n. Ephemeral herb; fls white or pale pink. In damp sand by river (A1) (A3) (B2) (B4 s.n.).	X		X			X		X							
<i>Stylidium</i> sp. ASG 14087 Fls deep pink. On wet ledges of sandstone cliff.									X						
TILIACEAE															
<i>Grewia polygama</i> Roxb. Spindly shrub. On sandstone ledge (A2); in sand, in low open-forest (A4); in basaltic loam in woodland (B1).		X		X	X										
<i>Triumfetta denticulata</i> Benth. Spindly, much branched shrub. In sand, in tall open-shrubland near dry creek (A1); common on sandstone (B3).	X							X							
<i>Triumfetta plumigera</i> F.Muell. Erect shrub to 2 m; in fruit. On sandstone plateau among hummock grass (A2); in low open-forest (C4).		X										X			
<i>Triumfetta</i> sp. KFK 4274, 4215, 4508, ASG 13501 Sparsely-branched shrub; fruit fallen. In sand in low woodland (A1); on sand over sandstone (B2) (C3).	X					X					X				

SPECIES	SITE														
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	GS	
<i>Triumfetta</i> sp. ASG 13492, KFK 4269 Slender, short-lived shrub to 80 cm. In sand over sandstone, in low open-woodland.	X														
ULMACEAE															
<i>Celtis philippensis</i> Blanco Tree to 8 m; bark smooth, dark grey. In rocky sandstone gully in low closed-forest (B1). In loam/sandstone by creek in vine forest (C1). On sandstone scarp in low closed-forest (C4). Scrambling shrub to 2 m. On Carson Volcanics (C2).					X				X	X			X		
<i>Trema aspera</i> (Brongn.) Bl. Shrub 1 m; lvs bright green. In rocky basaltic loam by creek in low woodland (B1). Shrub in sandstone gorge (B3) (C2).					X		X			X					
VERBENACEAE															
<i>Clerodendrum tomentosum</i> R.Br. Diffuse, much branched shrub to 2 m; fls white. On edge of creek (B3) (C2); on sandstone cliff-top above river (B4); in rocky sandstone gully, in low closed-forest (C4).							X	X		X			X		
<i>Vitex glabrata</i> R.Br. Straggling shrub 4 m. In rocky sandstone gully, in low closed-forest (B1). Tree to 10 m; deciduous, fls only. Sandstone gorge (B3). Tree 10 m; bark grey, lightly fissured. In rocky sandstone gully, in low closed-forest (C4); Tree 6 m; bark ± fibrous, grey; fls pale blue. In sandstone gully on scarp, in low woodland (C4). Tree 8 m. On sandstone slope of gully, in low closed-forest (C5).					X		X						X	X	
VISCACEAE															
† <i>Viscum flexicaule</i> Barlow Pendulous hemi-parasite; fls. minute; fr. globular, opaque, whitish. On <i>Terminalia canescens</i> .														X	

PART VI

THE MAMMALS OF THE DRYSDALE RIVER NATIONAL PARK NORTH KIMBERLEY, WESTERN AUSTRALIA

By N. L. MCKENZIE,¹ A. CHAPMAN,² W. K. YOUNGSON¹ and A. A. BURBIDGE¹

INTRODUCTION

When the Western Australian Sub-Committee of the Australian Academy of Science Committee on National Parks recommended that the Drysdale River National Park be created (Anon. 1962) they could only say that "the area can be confidently expected to be rich in such little known and interesting forms of the tropical north as the Rock Wallabies (*Petrogale brachyotis* and *Peradorcas concinna*), the Arnhem Land Possum (*Trichosurus arnhemensis*) and the Flying Possum or Sugar Glider (*Petaurus breviceps*)".

In September 1974, when the Drysdale River National Park was gazetted, nothing specific was known of its mammal fauna although further survey work in western and eastern parts of the Kimberley had substantially improved knowledge of Kimberley mammals generally. Work by the Western Australian Museum in the Lake Argyle area and the Department of Fisheries and Wildlife on the islands along the north-west Kimberley coast is, as yet, unpublished. Material collected by W. H. Butler in the general area prior to 1966 is listed by Bannister (1969) and McKenzie, Chapman and Youngson (1975) present an account of mammals collected on the Prince Regent River Reserve in 1974. In addition, records from the mammal collection of the Western Australian Museum have been drawn upon in the Discussion section.

This paper is based on information collected during an eighteen day biological survey in August 1975. Mammals were systematically collected from twelve sites within the Drysdale River National Park (D.R.N.P.) using trapping and spotlighting techniques similar to those described in McKenzie *et al.* (1975).

Six days were spent at each site. The sites visited are fully described in Kabay, George and Kenneally (this publication) and a map showing their distribution is included in Kabay (this publication).

The technique for bat collection after dark was improved by using a gas lantern to create an area of illumination on top of a cliff at the A2 site, in a woodland clearing at A3 and along the edge of the Drysdale River at B2. Bats became visible as they flew through the lighted area and could be held in a spotlight beam until shot.

All specimens have been lodged in the Western Australian Museum. Registration numbers: M14001 to 14346.

In the annotated species list below, data are presented in the following order:

1. Numbers of male and female specimens collected and collection sites.

2. Descriptions of habitats in which animals were collected. These have been indexed to the Environment section (Kabay *et al.*, this publication) from which more detailed habitat information can be derived.
3. Breeding information.
4. Method of capture.
5. Notes on taxonomy, behaviour, ecology and distribution.

LIST OF SPECIES

MARSUPIALIA

FAMILY MACROPODIDAE

Macropus robustus Gould. **Euro**

2 (1♂, 1♀) from C1, C4. Pick-up skeletal material from A2, C1, C2. Seen at A1, C2.

All types of rugged sandstone country. Habitats (indexed from Kabay *et al.*, this publication) A2(a), C1(a), C2(a), C2(g), C4(c).

One skeleton came from flood debris in a fringing formation of Cadjeput (*M. leucadendron*) and *Pandanus* along the Carson River in C2(e).

The female from C4 had a pouch young.

Shot during the day, pick-up material.

Macropus agilis (Gould). **Sandy Wallaby.**

3 (2♂, 1♀) from B1, C2, C4.

In low open-woodland of *Eucalyptus* and sorghum with some *Pandanus* along a creek in B1(d).

In fringing formation of Cadjeput (*M. leucadendron*) and *Pandanus* along the Carson River in C2(e)/C2(f).

In low woodland over tall cane grassland on volcanic soils in C4(g).

Shot.

At B1 several were seen along the creek and one was observed drinking. Dingo scats, collected at A2 and C2, contained *M. agilis* hair material.

Petrogale brachyotis Gould. **Short-eared Rock-Wallaby.**

4 (1♂, 3♀) from B4, C1. Seen at C2, C3, B3.

In rugged King Leopold and Warton sandstone boulder country supporting low woodlands to tall open-shrublands including *Eucalyptus* spp., *Owenia*, *Ficus*, *Acacia* spp., *Brachychiton*, *Terminalia* and/or *Grevillea* spp. over *Plectrachne*—B4(a), C1(a), C2(c), C2(g), C3(e).

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The two females from B4 each had one male pouch young.

Shot both during the day and at night.

FAMILY PETAURIDAE

Petaurus breviceps Waterhouse. **Sugar Glider** (Colour Plate)

3 (2♂, 1♀) from B1.

In woodland to low woodland of *Eucalyptus* spp. some *Acacia* and *Owenia* over ephemeral grasses on Warton sandstone scree of the Carson Escarpment—B1(b).

Shot and caught by hand at night.

One was eating a Peaceful Dove (*Geopelia striata placida* Gould) when discovered. All were about five metres above the ground, two in *Eucalyptus* trees and one in a tree which was not identified. A third female was collected in an *Owenia vernicosa* tree at the same site but escaped.

FAMILY DASYURIDAE

Planigale maculata (Gould).

1♂ from C3.

Tall open-shrubland of *Acacia* sp. over tussock grassland with occasional sandstone outcrops on a deep sandy alluvial deposit beside Planigale Creek—C3(d).

Trapped.

The specimen was examined by M. Archer and is included in his revision of *Planigale* (Archer 1976).

RODENTIA

FAMILY MURIDAE

Rattus tunneyi (Thomas). **Tunney's Rat.**

32 (21♂, 11♀) from A2, A3, A4, B1, B2, C1, C2, C3, C4.

Mostly along or adjacent to drainage lines in deep soils supporting closed-grasslands or tussock grasslands of various species of cane grass and often including ferns, sedges and ephemerals. These are normally associated with fringing forests to fringing low open-woodlands which, on creeks and rivers, include species such as *Melaleuca argentea*, *M. leucadendron*, *Pandanus* spp. and *Eucalyptus* spp. On smaller watercourses, grasslands and low open-woodlands of *Eucalyptus* spp. and *Pandanus* often also include *Acacia* spp. and *Grevillea*. This situation was found along watercourses on all geological formations except the Elgee siltstones—i.e. A2(e), A2(f), A2(g), A3(f), A4(a), A4(b), A4(c), B1(d), B2(c), C1(b), C2(b), C3(b), C4(d).

One female was pregnant with 5 foetuses. Others had slightly enlarged uteri and, in three specimens, developed mammae.

Work by C.S.I.R.O. Wildlife Division in Western Arnhem Land (Anon. 1974, p.10) indicates that *Rattus tunneyi* breeds in the dry season. “. . . *Rattus tunneyi* are markedly seasonal breeders. The peak of breeding activity is in the middle part of the dry season”.

Trapped.

Hydromys chrysogaster (Geoffroy). **Water Rat.**

2 (2♂) from B4, C1.

Both came from fringing plant formations along watercourses in sandstone country where tussocks of cane grasses are associated with Cadjeputs (*M. argentea*, *M. leucadendron*) and *Pandanus aquaticus*. Found on sandy soil—B4(c); sand and sandstone boulders—C1(d)/C1(e).

Trapped. Pick-up specimen.

Zyzomys argurus (Thomas). **Common Rock-Rat.**

86 (46♂, 36♀, 4 unsexed due to damage) from A2, A4, B1, B3, B4, C1, C2, C3, C4.

Recorded in all types of rugged sandstone and siltstone country and in all the associated plant formations; from closed vine thickets under cliffs to low open-woodlands over spinifex to fringing formations along watercourses—A2(c), A2(d), A2(e), A4(e), B1(b), B3(d), B3(e), B3(g), B4(a), B4(d), C1(a), C1(c), C2(a), C3(c), C4(a).

Occasionally also recorded in fringing formations on deep soils where these are immediately adjacent to rugged sandstone country—A2(e)/A2(f), C2(a) to C2(b). Four were recorded in low open-woodlands over patchy spinifex and cane grass where outcrops of sandstone boulders are a conspicuous feature of the environment—A2(b), C4(f).

Ten were pregnant (5 with 3, and 5 with 2 foetuses). A further twenty females had enlarged uteri and developed mammae.

Work by the C.S.I.R.O. Wildlife Division in Western Arnhem Land indicates that *Zyzomys* spp. give birth in all months of the year (Anon. 1974).

Trapped.

Pseudomys nanus (Gould). **Western Chestnut Native-Mouse.** (Colour Plate)

43 (24♂, 19♀) from A1, A2, A3, A4, B1, B2, C1, C3, C4.

The majority (25 specimens) came from grasslands and closed-grasslands of cane grasses such as *Sorghum*, of sedges and ephemerals, and sometimes of *Plectrachne*, in and adjacent to watercourses. Upper storeys were often present as low open-forests and open-woodlands variably composed of *Eucalyptus* spp., *Melaleuca viridiflora*, *Pandanus*, *Grevillea* and *Acacia*, or as an open-forest of *Melaleuca leucadendron*, *Eucalyptus ptychocarpa*, *Pandanus* and *Grevillea*—A2(d), A2(f), A3(f), A4(c), B1(d), B2(c), C1(b), C1(a)/C1(b), C3(b). Soils are deep alluvials, sometimes with scattered sandstone or basalt rocks, Cenozoic sandy soils, or dampish heavy soils derived from mudstones.

Also common (10) on the scree sides of the mudstone hills in a hummock and cane grassland with some *Eucalyptus* spp., *Callitris intratropica* and low shrubs, and on heavy soils at the foot of these hills in a tall open-woodland of *Eucalyptus* spp. with patches of dense low *Melaleuca minutifolia* over cane grassland—A3(c), A3(d).

Six specimens came from both sloping and flat country supporting formations ranging from low open-forests to low open-woodlands of *Eucalyptus* spp., *Callitris intratropica* and/or *Acacia* spp. over open cane grass (0.5 m) with occasional spinifex patches. These were found on Cenozoic sandy soils with occasional scattered sandstone rocks—A1(d), A4(a), A4(b). Two further specimens came from a similar structural formation of *Eucalyptus* spp., *Terminalia* and *Pandanus* over closed grassland (0.5 m) on loamy volcanic soil—C4(f).

There was some evidence of reproductive activity as five had some uterine enlargement; one of these had seven uterine implantation scars and developed mammae.

Trapped.

Pseudomys nanus is probably synonymous with *P. gracilicaudatus* (Ride 1970, p.155) and the above habitats are similar to habitats described by Parker (1973) for *P. gracilicaudatus* in the Northern Territory.

Pseudomys delicatulus (Gould). **Little Native-Mouse.**
24 (15♂, 9♀) from A1, A2, B1, B2.

Seventeen specimens were collected in both flat and gently sloping country supporting low open-woodlands of *Eucalyptus* spp. and such species as *Callitris intratropica*, *Petalostigma pubescens*, *Terminalia* sp., *Brachychiton* sp., *Erythrophleum chlorostachys* and *Buchanania obovata* over areas of cane grass (*Sorghum*) and patches of *Plectrarchne* or *Triodia* hummock grassland. Soils are sandy or loamy with occasional scattered sandstone or volcanic rocks and outcrops—A1(d), A2(b), B1(c), B2(d).

Seven were captured on adjacent deep sandy alluvial soils supporting closed to open-grasslands of cane grasses and in adjacent watercourse fringing formations of trees such as *Melaleuca*, *Eucalyptus* spp. and *Pandanus* over cane grasses—A1(a), B1(d), B2(b)/B2(c), B2(e).

Two were pregnant (one with 4 and one with 2 foetuses). Five others had enlarged uteri.

Calaby and Keith (1974, p.194) commented on this species from the Cobourg Peninsula, Northern Territory: "Animals collected in July and August 1965 were actively breeding and the majority of females were pregnant. The litter size was usually three or four". "Three females dissected in February were not pregnant". Taylor and Horner (1970, p.11) also commented on a sample collected in July and August from the Cobourg Peninsula "We were sampling a population in full reproductive vigour in the dry winter months of July and August". There is also information from Eastern Arnhem Land where Johnson (1964) recorded young of *P. delicatulus* (as *Leggadina delicatula*) collected in July and August, 1948.

Trapped, one shot. Additional material found in feral cat stomachs.

More commonly recorded than in the Prince Regent River Reserve, possibly because suitable grassland habitats were much more widespread in the Drysdale River National Park.

Pseudomys sp.

9 (4♂, 5♀) from A2, A3.

Five came from an area of *Melaleuca minutifolia*, *M. viridiflora*, *Cochlospermum fraseri* over an open-grassland of cane grass, with some spinifex hummock grassland, on heavy soils below mudstone hills—A3(d).

The others came from plateaux supporting low open-woodlands to open-woodlands of *Eucalyptus* spp. and at A2, *Erythrophleum chlorostachys* and *Acacia translucens*, over open-hummock grasslands of spinifex and areas of low open-grasslands of cane grass. Soils are sandy and formed a matrix around sandstone and mudstone boulders and outcrops—A2(b), A3(c).

Two had slightly developed mammae.

Trapped.

This species is probably referable to the *Pseudomys* sp. recorded on the Prince Regent River Reserve (McKenzie *et al.* 1975). The above habitats include vegetational situations referable to "valley woodlands" in which *Pseudomys* sp. was recorded on the Prince Regent River Reserve.

CHIROPTERA

FAMILY PTEROPODIDAE

Pteropus scapulatus Peters. **Red Flying Fox.**
2♂ from A2.

Flying above the edge of an Upper Pentecost sandstone cliff (Boiga Falls) at the head of a valley—A2(a)/A2(c). Below the cliff is a closed-forest of *Eucalyptus* spp., *Melaleuca leucadendron*, *Pandanus* and *Ficus*—A2(e)/A2(f). On the plateau above the cliff is a low open-woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys* and *Acacia translucens* over *Triodia* hummock grassland—A2(b).

Shot after dark.

Many flying foxes were seen and heard each night at A2 from 2000 hrs onwards. Those recognised in spotlights were all *P. scapulatus*.

Pteropus alecto Temminck. **Black Flying Fox.**
9 (7♂, 2♀) from B2, B4, C2, C4.

Six were shot as they flew along the formations of Cadjeputs and *Pandanus* fringing the Drysdale River—B2(a), B4(c).

Two were taken from a group feeding in a large fruiting *Ficus* tree in a sandstone gully—C2(a).

One was collected from its roost in a *Eucalyptus* tree in a low woodland below the Carson Escarpment—C4(f).

One was pregnant with one foetus.

Shot both after dark (B2, B4, C2) and during daytime (C4).

A colony of at least 30 000 individuals was found on the Drysdale River ca 8 km south of B2. They were roosting in an open-forest of *Melaleuca argentea* and *Pandanus* which fringed the river and covered several small islands. The colony extended for about 2 km along the river. Many were recorded flying along the Drysdale River near A1, B2 and B4 after dark. They were probably from this colony.

FAMILY EMBALLONURIDAE

Taphozous flaviventris Peters. **Yellow-bellied Sheath-tailed Bat.**

5 (2♂, 3♀) from A2, B2, C3.

Shot above the edge of an Upper Pentecost sandstone cliff (Boiga Falls) at the head of a valley—A2(a)/A2(c). Below the cliff is a closed-forest of *Eucalyptus* spp., *Melaleuca leucadendron*, *Pandanus* and *Ficus*—A2(e)/A2(f). On the plateau above the cliff is a low open-woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys* and *Acacia translucens* over *Triodia* hummock grassland—A2(b).

Also collected in the valley amongst an open-woodland of *Eucalyptus* spp. and *Pandanus* over a dense stand of cane grass—A2(g).

One came from a fringing formation of *Melaleuca argentea*, *M. leucadendron* and *Pandanus* on deep sand along the Drysdale River—B2(a).

Another was shot above a pool in rugged Warton sandstone country. A fringing formation of Cadjeputs and species such as *Barringtonia acutangula*, *Eugenia eucalyptoides* and *Acacia* spp. grows along the creek bed—C3(a).

All females showed some uterine distension and one had developed mammae.

Shot at dusk and night (1800–2000 hrs).

Taphozous georgianus (Thomas). **Common Sheath-tailed Bat.**

1♀ from C4.

In a Warton sandstone gully in a low forest of *Eugenia*, *Gardenia*, *Ficus* and other trees and shrubs—C4(d).

Collected after being flushed from its roost during the day.

FAMILY MOLOSSIDAE

Tadarida lorae (Thomas). **Little Northern Scurrying Bat.**

1♀ from A2.

Flying above the edge of an Upper Pentecost sandstone cliff (Boiga Falls) at the head of a valley—A2(a)/A2(c).

Below the cliff is a closed-forest of *Eucalyptus* spp., *Melaleuca leucadendron*, *Pandanus* and *Ficus*—A2(e)/A2(f). On the plateau above the cliff is a low open-woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys* and *Acacia translucens* over *Triodia* hummock grassland—A2(b).

Shot at dusk.

Johnson (1959) has pointed out that all the small Australian molossid bats of the group including *T. lorae* and *T. norfolkensis* may eventually be shown to represent a single species but the material now available is divisible into distinct northern and southern types. Felten (1964) re-examined Indo-Australian *Tadarida* and distinguished three sub-species: *T.l. lorae*, *T.l. ridei* and *T.l. cobourgiana*. No Western Australian specimens were examined and this population requires further study to see if it is different from the Northern Territory sub-species: *T.l. cobourgiana*.

Tadarida jobensis (Miller). **Northern Mastiff Bat.**

5 (1♂, 4♀) from A2. 5 (1♂, 4♀) from outside the reserve near Old Doongan Homestead.

Flying above the edge of an Upper Pentecost sandstone cliff (Boiga Falls) at the head of a valley—A2(a)/A2(c). Below the cliff is a closed-forest of *Eucalyptus* spp., *Melaleuca leucadendron*, *Pandanus* and *Ficus*—A2(e)/A2(f). On the plateau above the cliff is a low open-woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys* and *Acacia translucens* over *Triodia* hummock grassland—A2(b).

Six had enlarged uteri and three of these had developed mammae.

Shot after dark (1900–2230 hrs).

At A2 this was the most common bat observed after dark.

FAMILY VESPERTILIONIDAE

Miniopterus schreibersii (Kuhl). **Bent-wing Bat.**

9 (4♂, 4♀, 1 damaged) from C2, 1♂ from the Old Doongan Homestead outside the Park.

Eucalyptus low open-woodland with *Ficus*, *Pandanus* and *Acacia* and spinifex along a shallow sandstone gully—C2(a)/C2(c).

Shot at dusk (9) and struck from the air with a sandal at night (1).

Eptesicus pumilus caurinus Thomas. **Little Bat.**

13 (8♂, 4♀, 1 damaged) from B1, B4, C2, C3.

Taken from caves in sandstone on the Carson Escarpment and from a Fairy Martin nest under an overhang in rugged Warton sandstone country supporting a low open-woodland of *Eucalyptus* spp., *Acacia* spp. and *Ficus* over *Plectrachne* hummock grassland—B4(a).

Also from *Eucalyptus* low open-woodland with *Ficus*, *Acacia* and spinifex along a shallow sandstone gully—

C2(a)/C2(c)—and around a pool in a sandstone watercourse which supports a fringing formation of Cadjeputs and other tree and shrub species—C3(a).

All showed some uterine distension and one was pregnant with two fetuses; another had developed mammae.

Six were shot at dusk, five were taken while roosting in caves, one was taken while roosting in a Fairy Martin nest along with three *Myotis adversus*, and one was dropped by a Little Falcon (*Falco longipennis*).

Eptesicus douglasi Kitchener.

5(1♂, 4♀) from C3.

Specimens were taken at the same site as the *E.p. caurinus* from C3(a). The *Eptesicus douglasi*, however, were only shot very close to a rock face on one side of the pool. Many were seen in this situation but it was difficult to collect them.

There was some evidence of reproductive activity as all females had enlarged uteri and three had developed mammae.

Shot at late dusk.

The species is described in Kitchener (1976).

Nycticeius greyi (Gould). **Little Broad-nosed Bat.**

5 (2♂, 3♀) from B2, C2.

From a fringing formation of *Melaleuca argentea*, *M. leucadendron* and *Pandanus* on deep sand along the Drysdale River—B2(a).

Eucalyptus low open-woodland with *Ficus*, *Pandanus*, *Acacia* and spinifex along a shallow gully—C2(a)/C2(c).

Shot at dusk.

The taxonomy of *Nycticeius* is uncertain. Parker (1973) lists this form in the Northern Territory under *N. balstoni* (Thomas) and comments that northern populations are generally referred to as *N. b. balstoni*. Frith (1973) observed that the number of Australian species is debatable and McKean (1972) stated that "Australian *Nycticeius*, with the exception of *N. ruyppellii*, can be distinguished from each other only by slight size differences in various skull and external measurements or by slight differences in the appearance of the baculum. Some forms appear to merge with each other while others are sympatric".

Myotis adversus (Horsfield). **Large-footed Myotis.**

17 (2♂, 15♀) from B4.

Taken from three Fairy Martin nests found under an overhang in rugged Warton sandstone country supporting a low open-woodland of *Eucalyptus* spp., *Acacia* spp. and *Ficus* over *Plectrachne* hummock grassland—B4(a).

All the female specimens collected had a distended right uterine horn.

Caught by hand.

One nest contained 11♀ and 1♂, the second nest 2♀ and 1♂ and the third contained only 2♀. A single male *Eptesicus pumilis caurinus* was also in the second nest.

Although the species is known in all Australian mainland states, McKean and Hall (1965) and Parker (1973) list only three specimens from W.A. These specimens are from the "Swan River" and were collected prior to 1841. Two other localities have been recorded recently in W.A. and both are in the Kimberley. W. H. Butler collected from a small colony near Mt Caroline in 1968 and McKenzie *et al.* (1975) collected one female on the Prince Regent River Reserve.

Chalinolobus nigrogriseus rogersi Thomas. **Hoary Bat.**

29 (24♂, 5♀) from A2, A4, B2, B3, B4, C2, C3, C4.

Mostly over or adjacent to pools and watercourses in various types of fringing situations. At B2(a) they were collected beside a fringing forest of *Melaleuca leucadendron*, *M. argentea* and *Pandanus* on deep sand with areas of cane grasses and bare sandbars. At B3(d)/B3(e), B4(c), C2(a)/C2(c) and C3(a) they were collected over rugged sandstone country where such plants as *Pandanus*, *Ficus*, *Eucalyptus*, Cadjeputs and *Barringtonia* fringe the watercourses and bare rock sheets are common. At A2(g) and A4(c) they were collected in woodland to low open-forest of *Eucalyptus* spp. and *Pandanus* over dense cane grass along a creek.

At A2 they were also shot above the edge of an Upper Pentecost sandstone cliff (Boiga Falls) at the head of a valley—A2(a)/A2(c). Below the cliff is a closed-forest of *Eucalyptus* spp., *Melaleuca leucadendron*, *Pandanus* and *Ficus*—A2(e)/A2(f). On the plateau above the cliff is a low open-woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys* and *Acacia translucens* over *Triodia* hummock grassland—A2(b).

At C4 they were collected in a low woodland of *Eucalyptus* spp., *Erythrophleum chlorostachys*, *Grevillea* spp., *Buchanania* sp. and *Pandanus* over ephemeral *Sorghum* on sandy soils—C4(f).

All females showed slight uterine distension; one had developed mammae.

Shot at dusk and after dark (1750–2000 hrs). By far the most common bat recorded. One of the first bats seen flying in the evening, appearing in almost full daylight soon after sunset.

Separated from *C. n. nigrogriseus* by Van Deusen and Koopman (1971) who include a map of collection localities up to 1969. They list a specimen from the Drysdale River. It was collected by G. F. Hill in 1910 and lodged in the Western Australian Museum.

Nyctophilus arnhemensis (Johnson). **Arnhem Land Long-eared Bat.**

2♂ from B2.

In a fringing formation of *Melaleuca argentea*, *M. leucadendron* and *Pandanus* on sandbanks along the Drysdale River—B2(a).

Shot both at dusk and at night.

New record for Western Australia. Previously known only from the Northern Territory (Johnson 1959). At B2 many were seen flying low over sandbanks on the edge of the Drysdale River and around a *M. argentea* tree. Forearm measurements are 38.8 mm and 36.8 mm.

Nyctophilus bifax Thomas. **North Queensland Long-eared Bat.**

1 ♂ from A1.

On a sandbank in a fringing formation of *Melaleuca argentea*, *M. leucadendron* and *Pandanus* along the Drysdale River—A1(a).

Pick-up carcass.

Cranial and external measurements correspond with those listed for both *Nyctophilus bifax* Thomas and *N. daedalus* Thomas in Thomas (1915). The determination was based on the bifurcate baculum. Forearm is 41.8 mm. This is a new record for Western Australia; the species is also known from northern Queensland and, as *N. bifax daedalus* (Johnson 1964), from northern Northern Territory.

Nyctophilus walkeri (Thomas).

2 ♂ from B3.

Collected over a large rocky pool in a watercourse fringed by *Melaleuca leucadendron*, *M. argentea* and *Eugenia*. The Pentecost sandstone scree slopes and rock ledges around the pool support *Pandanus*, *Acacia* and *Ficus* over spinifex—B3(d)/B3(e).

Shot at late dusk. Flying low (<1 m) above the water.

The skull and mandible from one of the specimens were compared to the holotype (B.M. 92.4.4.1) by J. E. Hill of the British Museum of Natural History who confirmed it as *Nyctophilus walkeri*, a species not previously recorded in Western Australia. Forearm measurements are 33.4 mm and 32.7 mm. Although Tate (1941, p. 594) referred the holotype to *N. microtis*, a New Guinea species, he also commented that "the tiny species *walkeri* appears to be a wholly distinct species". Its taxonomic status requires investigation.

MONOTREMATA

FAMILY TACHYGLOSSIDAE

Tachyglossus aculeatus (Shaw). **Echidna.**

Pick-up material from B1, C3. Scats from C2, C4.

All from rugged sandstone country—B1(a), C2(g), C3(c), C4(a).

CARNIVORA

FAMILY CANIDAE

Canis familiaris dingo Meyer. **Dingo**

No specimens retained.

One dingo was shot in a riverine grassland of cane grass in a fringing formation of *Melaleuca argentea* and *Pandanus*—C1(b). A den, inhabited by an adult female and several young, was found in an open woodland of *Eucalyptus* spp. over cane grass on rocky ground—C3(c). Scats were collected at A2(c) and C2(a).

Remains of *Tachyglossus aculeatus* were collected near the den at C3. Stomach contents from the dingo shot at C1 contained hair. Scats from A2 and C2 all contained both macropod bone material and hair. The hair was examined microscopically and was structurally consistent with Dingo and *Macropus agilis* hairs.

FAMILY FELIDAE

Felis catus (Linnaeus). **Feral Cat.**

No specimens retained. 1 ♂ from B2, another seen at B1. A third was shot outside the reserve near the Old Doongan Homestead.

The B2 specimen was between the fringing formation along the Drysdale River and an area of tall open tussock grassland on sandy alluvial soils—B2(e).

Shot during daytime and at night (2300 hrs).

The stomach contents of the B2 cat included one *Pseudomys delicatulus*, a *Diporiphora* (Agamidae), and amphibian material. The cat collected near the Homestead had remains of four *Pseudomys nanus* and four species of lizard in its gut.

ARTIODACTYLA

FAMILY BOVIDAE

Bos taurus (Linnaeus). **Feral Cattle.**

No specimens. Seen at A1, A3, A4, B1, B2, C1, C2, C4, Scats and recently used pads were recorded at A2, B4, C3.

Single animals and groups of up to eight cattle were encountered in or near fringing formations of Cadjeputs and *Pandanus* along large watercourses and in woodland formations on sandy soils. Effects of cattle on the vegetation of the reserve are discussed in Kabay *et al.* (this publication).

DISCUSSION

Twenty eight species of native mammal and two species of introduced mammal were recorded on the Drysdale River National Park during the survey. With the exception of three bat species new to Western Australia, all are known from elsewhere in the north-west Kimberley.

Collections made at localities such as Inglis Gap (17° 10' S, 125° 10' E) and Kalumburu (14° 20' S, 126° 40' E) by W. H. Butler (Bannister 1969), and in the Prince Regent River Reserve (McKenzie *et al.* 1975), suggest that other Kimberley species may be present within the Park (Table 1). These localities are climatically and geologically related to the D.R.N.P. Climatic data in Anon (1975) indicates that Inglis Gap is the more similar area, having an annual average

TABLE 1

SPECIES COLLECTED AT INGLIS GAP, KALUMBURU AND ON THE PRINCE REGENT RIVER RESERVE BUT NOT COLLECTED ON THE DRYSDALE RIVER NATIONAL PARK

Species	Inglis Gap	Kalumburu	Prince Regent
<i>Macropus antilopinus</i>	X		X
<i>Onychogalea unguifera</i>		X	
<i>Peradorcas concinna</i>		X	X
<i>Trichosurus arnhemensis</i>		X	
<i>Wyulda squamicaudata</i>		X	X
<i>Petropseudes dahli</i>		X	X
<i>Isodon macrourus</i>	X*	X	X
<i>Isodon auratus</i>		X	X
<i>Dasyurus hallucatus</i>	X	X	X
<i>Phascogale tapoatafa</i>		X	
<i>Antechinus cf. bilarni</i>		X	X
<i>Sminthopsis</i> sp.		X	
<i>Mesembriomys macrurus</i>			X
<i>Mesembriomys gouldii</i>		X	
<i>Conilurus penicillatus</i>			X
<i>Zyzomys woodwardi</i>		X	X
<i>Melomys</i> sp.		X	X
<i>Macroderma gigas</i>		X†	
<i>Chalinolobus gouldii</i>	X		X
<i>Macroglossus lagochilus</i>			X

* J. Nelson, pers. comm.

† Douglas (1962)

rainfall of ca 800 mm and an inland location. The D.R.N.P. (900–1 050 mm) receives a lower rainfall than the Prince Regent River Reserve and is substantially less humid than coastal areas such as Kalumburu. An examination of Northern Territory mammal distributions listed in Parker (1973) suggests that species such as *Peradorcas concinna*, *Petropseudes dahli*, *Zyzomys woodwardi* and *Macroglossus lagochilus* are less frequent or absent in inland areas which have an average annual rainfall as low as that of the Drysdale River National Park.

While the Park is geologically similar to the localities mentioned above (Miles, Kenneally and George 1975; Williams and Sofoulis 1971; Derrick and Playford 1973; Gellatly and Sofoulis 1969; Speck 1960), it is geomorphologically much less rugged and has a higher proportion of grassland and savannah woodland. It is worth noting that the greatest mammal diversity on the Prince Regent River Reserve (McKenzie *et al.* 1975) was recorded in the extremely rugged sandstone country. In fact, all or nearly all the Prince Regent specimens of *Peradorcas concinna*, *Petrogale brachyotis*, *Dasyurus hallucatus*, *Antechinus cf. bilarni*, *Zyzomys woodwardi* and *Wyulda squamicaudata* were collected in this sort of country. The large numbers and widespread occurrence of the three *Pseudomys* species on the D.R.N.P. is probably associated with the extent of the grassland and savannah woodland as these were the main habitats in which these rodents were collected. On the other hand the diversity of Microchiroptera recorded on the Drysdale River National Park (11 species) is probably the result of improved spotlighting equipment which allowed more efficient after-dark collecting than was possible during the Prince Regent survey.

This collection provides further evidence of the strong affinities between Kimberley and Arnhem Land faunas because two of the bats—*Nyctophilus arnhemensis* and *N. walkeri*—collected on the D.R.N.P. were previously

known only from Arnhem Land. In addition this survey suggests that mammal species occurring in the two areas occupy similar habitats and have similar reproductive patterns.

In almost every case habitats described for species in this collection were referable to habitats described for the same species in the northern Northern Territory by Johnson (1964), Parker (1973) and Calaby and Keith (1974). Only the habitats described for *Planigale maculata* and *Tadarida loriae* were different; habitat data for these species are known from only a few localities in Northern Territory and only from single specimens on the Drysdale River National Park.

Females with pouch young or with foetuses were recorded in only five of the twenty-six species collected. A further seven species had enlarged uteri and/or swollen teats. No attempt was made to assess the reproductive condition of males. These data are comparable to information from the Northern Territory where births in the dry season (April to September) have been recorded by Johnson (1964), Taylor and Horner (1970) and Calaby and Keith (1974) for a variety of mammal species.

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PART VII

BIRDS OF THE DRYSDALE RIVER NATIONAL PARK NORTH KIMBERLEY, WESTERN AUSTRALIA

By R. E. JOHNSTONE¹, JOHN DELL², L. A. SMITH¹ and P. J. FULLER³

INTRODUCTION

This paper is based on data obtained during a biological survey of the Drysdale River National Park in August 1975. Sites visited are described in Kabay, George and Kenneally (this publication); a map showing their position and reference codes (A1 to A4, B1 to B4 and C1 to C5) appears in Fig. 1 in Kabay (this publication). Johnstone was responsible for gathering information from sites A4, B4 and C4; Dell from sites A2, B2 and C2; Smith from sites A3, B3, C3 and C5; and Fuller from sites A1, B1 and C1. Additional data were obtained by Johnstone and Smith during brief visits on 7 August to a gorge in the north-west of the Park in 14° 34' S, 127° 02' E (reference code G), to the upper King George River in 14° 37' S, 127° 14' E (reference code UKG), and to the upper Berkeley River in 15° 06' S, 127° 18' E (reference code UB). The last two localities are respectively 1 and 10 km outside the eastern boundary of the Park and are therefore enclosed in square brackets in the following list, as is Old Doongan Homestead (reference code OD) which is 6 km outside the south-western boundary of the Park, and Galaxy Swamp (reference Code S) in 14° 37' S, 126° 55' E which was visited by Smith on 21 August 1975.

In the list of species we present the following data:

- (1) The sites from which each species was recorded.
- (2) The number of specimens collected (these are lodged in the Western Australian Museum under registered numbers A 14038-14131); unless otherwise stated specimens are study skins.
- (3) Relative abundance.
- (4) Habitat preferences.
- (5) Evidence of breeding in the Park.
- (6) Taxonomic notes.

LIST OF SPECIES

FAMILY CASUARIIDAE

Dromaius novaehollandiae (Latham). **Emu.**

Recorded at A1, A3, A4 and B4.

Moderately common by Kimberley standards; largest party 6. Usually near watercourses.

FAMILY PODICIPITIDAE

Podiceps novaehollandiae novaehollandiae Stephens.
Little Grebe.

Recorded at B1 and C1.

Single birds on small pools.

FAMILY PHALACROCORACIDAE.

Phalacrocorax sulcirostris (Brandt). **Little Black Cormorant.**

Recorded at A1, B2, B4 and C4.

Mainly larger pools along the Drysdale, but one seen once on an alga-choked pool on Woorakin Creek.

Phalacrocorax carbo novaehollandiae Stephens. **Black Cormorant.**

Recorded at B4.

Moderately common about the confluence of Johnson Creek and the Drysdale, where it outnumbered *P. sulcirostris*.

Fast-flowing rocky pools.

Phalacrocorax melanoleucos (Vieillot). **Little Pied Cormorant.**

Recorded at A1, A4, B1, B2, B3, B4, C1, C2 and [UKG].

Widespread but scarce; usually single, but once two together. Pools on small creeks as well as major watercourses.

Anhinga novaehollandiae (Gould). **Australian Darter.**

Recorded at A1, A4, B1, B3, B4 and C4.

Scarce; single birds except for one pair. Usually on large open pools on major watercourses; also one on a long but shallow lily pond at the foot of the Ashton Range.

FAMILY ARDEIDAE

Ardea pacifica Latham. **White-necked Heron.**

Recorded at A1, B1, B2, B4, C1, C3, C4 and [S].

Widespread but scarce; usually single, occasionally two together. Small drying pools on creeks and the Drysdale flood-plain, as well as large river-pools.

Ardea novaehollandiae Latham. **White-faced Heron.**

Recorded at A1, B1, B3, B4, C1, C3, C4, [S] and [OD].

Widespread but scarce; usually single, occasionally two together. Large pools along major watercourses and occasionally small lagoons on the Drysdale flood-plain.

Egretta alba modesta (Gray). **Great Egret.**

Recorded at A1, A4, B1, B2, B3, B4, C4 and [S].

Widespread but scarce; single birds. Pools on large and small watercourses and on the Drysdale flood-plain.

Nycticorax caledonicus hilli Mathews. **Nankeen Night-heron.**

Recorded at A1, B1, B2, B3, B4, C1, C3, C4 and [UB]. One specimen (male).

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Scarce to moderately common. Usually found in daytime perched in dense waterside vegetation (cadjeputs, pandanus, and occasionally figtrees); observed feeding at dawn at sandy and rocky margins of river pools.

Ixobrychus flavicollis Latham. **Black Bittern.**

Recorded at B2, B3, B4, C2 and C3. One specimen (male).

Scarce; single birds, including juveniles. Usually perched in daytime in pandanus lining pools on large and small watercourses.

FAMILY CICONIIDAE

Xenorhynchus asiaticus (Latham). **Black-necked Stork.**

Recorded at A1, B1, B2, B4, C1 and C4.

Scarce; single birds. Larger pools on major watercourses (Drysdale and Carson Rivers and Palmoondoora Creek).

FAMILY THRESKIORNITHIDAE

Threskiornis moluccus moluccus (Cuvier). **White Ibis.**

Recorded at B2 and [S].

Scarce; two on a drying billabong and one on a drying swamp, both localities on the Drysdale flood-plain.

Threskiornis spinicollis (Jameson). **Straw-necked Ibis.**

Recorded at A1, B1 and B4.

Scarce; single birds. Pools on the Carson and Drysdale.

Platalea regia Gould. **Royal Spoonbill.**

Recorded at B1.

One bird with a White-necked Heron on a large pool on the Carson.

FAMILY ANATIDAE

Anseranas semipalmata (Latham). **Pied Goose.**

Recorded at A1 and B4.

One bird at each site. Pools on the Drysdale River and lower Johnson Creek.

Anas superciliosa Gmelin. **Black Duck.**

Recorded at A3 and [S].

Two birds on a small pool on a creek, and twelve at the swamp.

FAMILY ACCIPITRIDAE

Elanus notatus Gould. **Black-shouldered Kite.**

Recorded at A1, A3, C3, and [OD].

Scarce; single birds. Open woodland.

Lophoictinia isura (Gould). **Square-tailed Kite.**

Recorded at A4. One specimen (wing and tail only).

One bird in stunted *Melaleuca* on a swampy watercourse.

Hamirostra melanosternon (Gould). **Black-breasted Buzzard.**

Recorded at A4, B1, B2, B3, C1, C2, G and [UKG].

Scarce or uncommon; in ones or twos. Open country, especially at grass fires or in recently burnt areas.

Milvus migrans affinis Gould. **Black Kite.**

Recorded at C3.

One appeared briefly at a camp late one afternoon.

Haliastur sphenurus (Vieillot). **Whistling Kite.**

Recorded at A1, B1, B2, B3, B4, C1, C2, C3 and C4.

Locally common; usually in ones and twos, but up to four birds congregating at fires. Only a single bird was seen during the first week, but in the second and third weeks one or two birds attached themselves to each camp site, and they appeared soon after the outbreak of fires. At B4 one flew from a nest in a huge cadjeput.

Accipiter fasciatus subsp. **Australian Goshawk.**

Recorded at A2, A4, B1, B4, C1, C2 and C4. Three specimens: two females of the northern race *A. f. didimus* (Mathews) and one female in spirits of the southern *A. f. fasciatus* (Vigors & Horsfield).

Scarce or uncommon; single birds. Mainly along watercourses. At this time of the year the resident population is evidently augmented by southern visitors.

Accipiter cirrocephalus cirrocephalus (Vieillot). **Collared Sparrowhawk.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C2, C3 and C4.

Moderately common; in ones and twos. Mainly in forests and scrubs fringing watercourses. On 20 August two birds were building a nest in a *Eucalyptus miniata* ca 100 m from Woorakin Creek.

Aquila audax (Latham). **Wedge-tailed Eagle.**

Recorded at A2, B1, C1, C3 and C4.

Scarce; ones and twos. Mainly over cliffs.

FAMILY FALCONIDAE

Falco peregrinus macropus Swainson. **Peregrine Falcon.**

Recorded at B1, B3, B4, C1, and C4.

Scarce; ones and twos. Mainly about high cliffs.

Falco longipennis longipennis Swainson. **Little Falcon.**

Recorded at A3, A4, B1, B4 and [OD].

Scarce; usually single birds. At B4 one bird hunting bats dropped an *Eptesicus pumilus* when fired at.

Falco hypoleucos Gould. **Grey Falcon.**

Recorded at A2, B1, and C4.

Scarce; single birds seen on three occasions.

Falco berigora Vigors & Horsfield. **Brown Falcon.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, G and [UKG].

Locally common; ordinarily in ones and twos, but up to six birds appearing within minutes of the outbreak

of fires. The commonest diurnal raptor in the Park. As elsewhere in the Kimberley very dark birds were observed, but one bird was noted as very pale.

Falco cenchroides cenchroides Vigors & Horsfield. **Nankeen Kestrel.**

Recorded at A2, B3, C1, C2 and C4.

Scarce; single birds seen on six occasions; perhaps only a passage migrant in the Park.

FAMILY PHASIANIDAE

Coturnix ypsilophora australis (Latham). **Brown Quail.**

Recorded at A2, C1 (?sp.) and C4.

Locally common; coveys of up to 16 birds.

Long grass, especially along creeks.

FAMILY TURNICIDAE

Turnix maculosa (Temminck). **Red-backed Quail.**

Recorded at B2.

A bird observed by Dell at 1 m almost certainly belonged to this species. It was in closed grassland up to 1 m high on damp silty soil at edge of creek; at ground level the grass was dense and couch-like.

Turnix sp.

Recorded at B3 and [UKG].

A small greyish quail flushed from grass among scattered sandstone boulders at B3; and two small pale quail, possibly *T. pyrrhotorax* or *T. velox*, flushed from river bank.

FAMILY GRUIDAE

Grus rubicundus (Perry). **Brolga.**

Recorded at A1, A3, A4, B2, B4, C1, C2, C3, C4, [S], [UKG] and [OD].

Scarce to moderately common; usually in pairs or small parties (up to 9 birds), rarely singly. Watercourses and swamps.

FAMILY OTIDAE

Otis australis Gray. **Australian Bustard.**

Recorded at A2, B1, C1, and C2.

Common at C1, especially after all the grass was burnt, mostly in twos but one party of 5; elsewhere scarce.

FAMILY CHARADRIIDAE

Charadrius melanops Vieillot. **Black-fronted Dotterel.**

Recorded at A1, B1, B2, B4, C4 and [S].

Moderately common. Pools on the Carson and Drysdale and at drying swamps and lagoons on the Drysdale flood-plain. Not observed on minor watercourses.

FAMILY SCOLOPACIDAE

Tringa hypoleucos Linnaeus. **Common Sandpiper.**

Recorded at B1 (? sp.) and B4. One specimen (female).

Uncommon. Rocky pools and rapids on the Carson and Drysdale.

FAMILY BURHINIDAE

Burhinus grallarius (Latham). **Southern Stone-Curlew.**

Recorded at A1, B2, B4, C1 and C4.

Uncommon.

FAMILY COLUMBIDAE

Geopelia humeralis (Temminck). **Bar-shouldered Dove.**

Recorded at A1, B1, B2, B3, B4, C1, C2, C3, C4, and C5.

Locally common on the Carson and Drysdale; scarce to moderately common on other watercourses and along cliffs. Dense waterside vegetation (*Eugenia*, *Acacia*, *Pandanus*, etc.), vine scrub and *Ficus* thickets.

Geopelia striata placida Gould. **Peaceful Dove.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, [S], [UKG], [UB], and [OD].

Common or very common about major watercourses, in ones, twos or small parties; scarce to moderately common elsewhere. Mainly grassy riverine flats, but also attracted to burnt country; occasionally feeding in sandstone/spinifex and open woodland up to 2 km from water.

Geopelia cuneata (Latham). **Diamond Dove.**

Recorded at A3, A4, C2, [S] and [UKG].

Scarce; in ones, twos and threes. As often in dry situations (plateaux and sandstone) as near water.

Chalcophaps indica longirostris Gould. **Green-winged Pigeon.**

Recorded at C4. Two specimens (females).

Two birds, possibly transient, were living in a patch of vine scrub on Carlia Creek, from which they visited a nearby sandstone hill to feed on minnarichi seeds (*Acacia* sp.).

Petrophassa albipennis Gould. **White-quilled Rock Pigeon.**

Recorded at B1, B3, B4, C1, C2, C3, C4 and C5. Six specimens (4 males, 1 female, 1 unsexed).

Common; mainly in ones and twos, occasional small parties (up to five birds). Rugged sandstone. Nest and two eggs collected at C2 on 20 August.

Phaps chalcoptera (Latham). **Common Bronzewing.**

Recorded at C3.

Two birds regularly drinking at small pool.

Ocyphaps lophotes (Temminck). **Crested Pigeon.**

Recorded at A1.

Two birds, possibly transient, seen on one occasion.

FAMILY PSITTACIDAE

Trichoglossus haematodus rubritorquis Vigors & Horsfield. **Red-collared Lorikeet.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, [UKG], [UB] and [OD].

Uncommon (usually in pairs) to very common (in flocks of up to 60). Flowering trees, especially eucalypts

(*E. tetradonta*, *E. miniata* and *E. houseana*), but also *Melaleuca leucadendron*, *Bombax ceiba*, *Erythrina vespertilio* and *Verticordia cunninghamii*. Two pairs occupying hollows in eucalypts.

Trichoglossus versicolor Lear. **Varied Lorikeet.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G, [UKG] and [OD].

Moderately common to very common; occasionally in pairs but usually in flocks (up to 100 birds); generally about four times as numerous as *T. haematodus*. Mainly flowering eucalypts (*E. tetradonta*, *E. miniata* and *E. houseana*), also *Melaleuca leucadendron*.

Calyptorhynchus magnificus (Shaw). **Red-tailed Black Cockatoo.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, [UKG], [UB] and [OD].

Locally common: usually in pairs or small parties, also several flocks of 40–150. Usually feeding in eucalypts, including *E. miniata* and *E. ptychocarpa*, well back from water, but often in big cadjeputs along larger watercourses (possibly when coming in to drink).

Cacatua galerita (Latham). **Sulphur-crested Cockatoo.**

Recorded at B1, B2, B3, B4, C1, C2, C4 and C5.

Scarce or uncommon; in ones and twos. In forests (especially cadjeputs) fringing the major watercourses.

Cacatua tenuirostris sanguinea Gould. **Little Corella.**

Recorded at A1, B1, B4, C1 and C4.

Locally common (e.g. about the Carson and its tributary, Palmoondoor Creek) but generally scarce; mainly in ones and twos, also in small flocks (up to 12). In or near river-fringing forests.

Aprosmictus erythropterus (Gmelin). **Red-winged Parrot.**

Recorded at A1, A2, A3, A4, B1, B2, B4, C1, C2, C3, C4, G and [OD].

Locally common (e.g. on the Drysdale at A1) but generally scarce; mainly in ones and twos, occasionally in small parties (up to 7); a flock of 25 at A1. In a wide variety of habitats including tall open forest, open woodland with flowering *Grevillea*, vine scrub and *Ficus* and other waterside thickets.

Platycercus venustus (Kuhl). **Northern Rosella.**

Recorded at A1, A2, A4, B1, B2, C1 and C2.

Scarce; usually in pairs, one party of 5. Mainly in woodland (including *Callitris intratropica*, whose seeds they eat) on plateaux; also trees along minor watercourses.

FAMILY CUCULIDAE

Cuculus pallidus (Latham). **Pallid Cuckoo.**

Recorded at A1, A2, A3, A4, B1, B2, C3 and [OD].

Scarce; single birds; only one record after 15 August.

Though many birds were calling, most of them were presumably passage migrants. Mainly in open woodland and open forest, occasionally on minor watercourses.

Cacomantis variolosus dumetorum (Gould). **Brush Cuckoo.**

Recorded at A4 (? sp.) and B4. One specimen (male).

The two birds at B4 were in a dense thicket (*Barringtonia*, *Acacia* and creepers) along a flood channel of the Drysdale.

Chrysococcyx basalis (Horsfield). **Horsfield Bronze Cuckoo.**

Recorded at B3.

One calling early one morning.

Centropus phasianinus macrourus Gould. **Pheasant Coucal.**

Recorded at A1, A3, A4, B3, B4, C1, C2, C3, C4, C5 and [OD]. One specimen (male).

Uncommon (as the birds were mostly silent, they could have been more plentiful than our records indicate). Usually in long grass and pandanus along watercourses; rarely in sandstone/spinifex.

FAMILY STRIGIDAE

Ninox connivens connivens (Latham). **Winking Owl.**

Recorded at A3, B2 and B4.

Locally common (e.g. at B2) but generally scarce. At B2 roosting by day in cadjeputs along the Drysdale, and at dusk feeding on insects above a river-pool; much calling at night and some calling by day.

Ninox novaeseelandiae boobook (Latham). **Boobook Owl.**

Recorded at A1, A2, A3, A4, B4, C1, C3 and C4.

Uncommon. Open woodland on plateaux and back from major watercourses. Calling at night.

FAMILY PODARGIDAE

Podargus strigoides phalaenoides Gould. **Tawny Frogmouth.**

Recorded at A1, A2, A3, A4, B1, B3, B4, C1, C2 and G. Two specimens (males).

Uncommon. By day usually roosting in dense vegetation, especially cadjeputs along watercourses.

FAMILY AEGOTHELIDAE

Aegotheles cristatus leucogaster Gould. **Owlet Nightjar.**

Recorded at A2, A3 and B3.

Scarce; in ones and twos. Mainly in open woodland on plateaux. Calling at night.

FAMILY CAPRIMULGIDAE

Eurostopodus guttatus (Vigors & Horsfield). **Spotted Nightjar.**

Recorded at C2 and C3.

Single records of single birds at each site, one of them calling at night.

FAMILY ALCEDINIDAE

Alcedo azurea ruficollaris (Bankier). **Azure Kingfisher.**

Recorded at A4, B2, B3, B4, C3 and C4. Two specimens (1 male, 1 unsexed).

Scarce; usually single birds, a pair seen once. Mainly on the smaller watercourses at pools with overhanging pandanus and cadjeputs.

Dacelo leachii leachii Vigors & Horsfield. **Blue-winged Kookaburra.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4 and [OD].

Moderately common. In many habitats ranging from forests along watercourses to open woodlands of plateaux.

Halcyon pyrrhopygia Gould. **Red-backed Kingfisher.**

Recorded at A1, A3, A4, B1, B3 and C4.

Scarce; single birds. Open woodland. Old nesting tunnels found in termitaria.

Halcyon sancta sancta Vigors & Horsfield. **Sacred Kingfisher.**

Recorded at A4, B2, B4, C4, and C5.

Scarce; single birds. In cadjeputs and other trees along watercourses.

FAMILY MEROPIDAE

Merops ornatus Latham. **Australian Bee-eater.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G, [UKG], [UB] and [OD].

Common; mainly in pairs and small parties (up to 6); a flock of 50 flying south on 17 August were probably passage migrants. In most habitats from vicinity of river pools to open woodlands of plateaux.

FAMILY ALAUDIDAE

Mirafra javanica Horsfield. **Singing Bushlark.**

Recorded at A3, B1 (? sp.), B2 and [OD]. One specimen (female).

Scarce. Grassland.

FAMILY HIRUNDINIDAE

Hirundo nigricans nigricans Vieillot. **Tree Martin.**

Recorded at A1, B1 and B2.

Scarce; usually in small parties (up to 5). Not recorded after 13 August. Presumably only a winter visitor to the Park.

Hirundo ariel (Gould). **Fairy Martin.**

Recorded at B1, B4 and C4. One specimen (a mummified nestling).

Common at B4 in flocks of up to 80; only a few birds seen at C4 and none elsewhere. Cliffs about the Drysdale River falls at B4 and along the Carson Escarpment. Many old nests found in cliffs at B1 and B4.

FAMILY CAMPEPHAGIDAE

Coracina novaehollandiae novaehollandiae (Gmelin). **Black-faced Cuckoo-shrike.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G and [UKG].

Common at C1, C2, C3 and C4, often in small parties (up to 8); elsewhere scarce to moderately common, usually in ones and twos. In all wooded habitats, including vine scrub at C4 where they were feeding on the whitish fruits of a *Ficus virens* var. *sublanceolata*. The birds were most plentiful and most often appeared in flocks during the last week of our survey; most of the birds were probably passage migrants on their way south.

Coracina papuensis hypoleuca (Gould). **White-breasted Cuckoo-shrike.**

Recorded at A1, A2, A4, B1, B2, B4, C1, C2, C3, C4, C5, [UKG] and [OD]. Two specimens (females).

Common at B2 in pairs and small parties (up to 8); elsewhere scarce to moderately common, in ones and twos. Mainly in river-fringing forests (especially of cadjeputs); occasionally in vine scrub and at flowering trees (*Eucalyptus* and *Brachychiton*) in woodland.

Lalage sueurii tricolor (Swainson). **White-winged Triller.**

Recorded at A3, A4, B1, B4, C2, C4, [S] and [UKG]. One specimen (female).

Common at A4, where it was attracted to flowering eucalypts (*E. tetradonta*, *E. miniata* and *E. houseana*) along a small creek and to flowering *Grevillea pteridifolia*; scarce to moderately common elsewhere; mainly in ones and twos, occasionally in small parties (including a flock of 6 immatures). Open woodland, especially with flowering trees and shrubs (including *Erythrina vespertilio* and *Cochlospermum fraseri*).

FAMILY MUSCICAPIDAE

Poecilodryas superciliosa cerviniventris (Gould). **Buff-sided Robin.**

Recorded at C5. Two specimens (males).

At least four birds lived in the thicket of *Xanthostemon* and *Alphitonia* at the head of Dysphania Gorge.

Microeca leucophaea leucophaea (Latham). **Brown Flycatcher.**

Recorded at A2, A3, A4, B2, C3, C4, [S] and [OD].

Common at A3 in far south-east of Park; scarce or uncommon elsewhere. Mainly open eucalypt woodland; also in small groves of *Melaleuca* and of flowering *Grevillea pteridifolia*.

Petroica cucullata (Latham). **Hooded Robin.**

Recorded at A3 and [OD].

A single male seen at A3 (in far south-east of Park) on two occasions (5 and 9 August) in a *Cochlospermum fraseri*.

FAMILY PACHYCEPHALIDAE

Pachycephala rufiventris rufiventris (Latham). **Rufous Whistler.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G, [UKG], [UB] and [OD]. One specimen (unsexed).

Uncommon to moderately common; usually single birds. All kinds of wooded country, but generally preferring the river-fringing forests to the more open and lower woodlands of plateaux.

Colluricincla harmonica harmonica (Latham). **Brown Shrike-thrush.**

Recorded at A4 and [UKG].

Single birds on one occasion at each site.

Colluricincla woodwardi Hartert. **Brown-breasted Shrike-thrush.**

Recorded at B1, B3, B4, C1, C2, C3, C4 and [S]. Five specimens (4 males, 1 female).

Locally common but generally uncommon; usually single birds. Sandstone cliffs and boulders.

FAMILY RHIPIDURIDAE

Rhipidura leucophrys leucophrys (Latham). **Willie Wag-tail.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, [S], [UKG], [UB] and [OD].

Locally common but generally scarce to moderately common. Mainly on watercourses.

Rhipidura rufiventris isura Gould. **Northern Fantail.**

Recorded at A2, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5 and G.

Locally common. All kinds of dense vegetation, e.g. forests (mainly of cadjeputs) fringing larger watercourses, vine scrubs in gullies and gorges, and thickets of *Ficus*, *Livistona* and *Gardenia* along cliffs or among sandstone boulders. At A2 a nest and two eggs found on 6 August, and a nest and sitting bird on 7 August. An unoccupied nest found on 19 August at C3 probably belonged to this species.

FAMILY MONARCHIDAE

Myiagra rubecula concinna Gould. **Leaden Flycatcher.**

Recorded at A2, A4, B1, B3, B4, C1, C2, C4 and C5.

Moderately common at C4; scarce or uncommon elsewhere. Figtree thickets and vine scrubs along cliffs and in gorges; also forests (*Melaleuca*, *Terminalia*, *Ficus* etc.) fringing major watercourses.

Myiagra inquieta nana (Gould). **Restless Flycatcher.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, [S], [UKG] and [OD].

Moderately common at B4; scarce or uncommon elsewhere. Mainly in denser vegetation (especially cadjeputs and pandanus) fringing watercourses and swamps; occasionally in vine scrubs and mixed woodlands (e.g. *Eucalyptus*, *Banksia* and *Melaleuca*).

Myiagra alecto rufolateralis (Gray). **Shining Flycatcher.**

Recorded at B4 and C2. One specimen.

A female was collected in dense pandanus around a large pool on Johnson Creek, and a bird in female plumage was seen by K. F. Kenneally on the Carson.

FAMILY GRALLINIDAE

Grallina cyanoleuca (Latham). **Magpie-lark.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C1, C2, C4, [S] and [OD].

Common in well-watered areas, mainly in ones and twos, also occasional flocks (up to 14); scarce or absent in dry south-east sector of Park. On watercourses and lagoons. Status in Park uncertain; no old nests were seen, and the larger flocks probably consisted of winter visitors.

FAMILY TIMALIIDAE

Pomatostomus temporalis rubeculus (Gould). **Red-breasted Babbler.**

Recorded at A1, A2, A3, A4, B1, B2, C1, C2, C3, C4 and [OD].

Locally common but generally scarce. Open woodland. At C4 copulation observed on 16 August, and on 18 August another pair seen entering a new nest. Old nests found at A1 and [OD].

FAMILY ACANTHIZIDAE

Gerygone olivacea rogersi Mathews. **White-throated Warbler.**

Recorded at A3, A4, B2, B4, C4 and C5. Three specimens (2 males, 1 female).

Scarce or uncommon. Mainly in wattle (*Acacia*) thickets; also in *Melaleuca*, *Eucalyptus* and *Callitris*.

We follow Hall (1974, p. 169) in recognising *rogersi* of the Kimberley and Northern Territory as distinct from the north Queensland subspecies, *G. o. flavigasta*.

Gerygone chloronotus chloronotus Gould. **Green-backed Warbler.**

Recorded at B1, B4, C1, C2, C3, C4 and C5. Seven specimens (3 males, 2 females, 1 unsexed, 1 in spirits). Locally common but generally scarce. Mainly vine scrub at foot of cliffs; also *Ficus* and other thickets in gullies and along watercourses.

Smicrornis brevirostris (Gould). **Weebill.**

Recorded at A1, A2, A3, A4, B1, B3, B4, C1, C2, C3, C4, C5, G, [UKG], [UB] and [OD]. One specimen (in spirits).

Common on plateaux; moderately common in gorges and about major watercourses. Mainly open woodland (especially with flowering eucalypts). At A2 on 3 August a pair feeding three flying young.

FAMILY MALURIDAE

Malurus dulcis rogersi Mathews. **Lavender-flanked Wren.**

Recorded at A1, B1, B3, B4, C1, C2, C3, G and [UB]. One specimen (female).

Scarce to moderately common. Rugged sandstone and rocky watercourses.

Malurus melanocephalus (Latham). **Red-backed Wren.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C4, [UKG], [UB], and [OD]. One specimen (male).

Locally common. Mainly in long grass and pandanus near water; also in more open grass and shrubbery of woodlands.

FAMILY SYLVIIDAE

Acrocephalus stentoreus australis Gould. **Australian Reed-warbler.**

Recorded at B4. One specimen (male with small testes). The only bird recorded was making strange chuckling notes in dense pandanus fringing Johnson Creek. We agree with Mees (1964, p. 91) that Reed-warblers from the three sectors of their Western Australian range are inseparable. Bill length, measured to base of skull, in the Western Australian Museum's three Kimberley specimens ranges from 22 to 24 mm (mean 23.0); in 9 specimens from the Pilbara, 21–23 (22.0); and in 5 specimens from the South-west, 22–24 (22.6).

Cincloramphus mathewsi Iredale. **Rufous Songlark.**

Recorded at A4, B1, B2, and [UKG]. Two specimens (1 male, 1 in spirits).

Scarce. Mainly long grass beside watercourses and at foot of cliffs; also in more open long grass of woodlands.

Cincloramphus cruralis (Vigors & Horsfield). **Brown Songlark.**

Recorded at A3.

At least two in closed grassland on small watercourse.

Cisticola exilis (Vigors & Horsfield). **Golden-headed Fantail-warbler.**

Recorded at A2, A3, A4, B1, B2, B4, C1, C2, C4, [S], [UKG] and [OD]. One specimen (in spirits).

Moderately common. Mainly denser grass (1–2 m high) and pandanus beside water; also in long grass on basalt flats and under open forest.

FAMILY NEOSITTIDAE

Neositta chrysoptera leucoptera (Gould). **White-winged Sittella.**

Recorded at A1, A2, A3, A4, B1, B2, B4, C3, C4 and [OD].

Moderately common on plateaux in south-east of Park; elsewhere scarce. Mainly open eucalypt woodland on plateaux; also trees (especially *Melaleuca*) along watercourses.

FAMILY CLIMACTERIDAE

Climacteris melanura melanura Gould. **Black-tailed Tree-creeper.**

Recorded at A1, A3, A4, C4 and [OD].

Moderately common in far south of Park (A3 and A4) and at [OD]; elsewhere scarce. Open woodland. At C4 one was flushed from hollow limb of a dead eucalypt on 19 August.

FAMILY DICAIEIDAE

Dicaeum hirundinaceum hirundinaceum (Shaw). **Mistle-toe-bird.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G and [UKG].

Moderately common to very common. All kinds of wooded country, but favouring the denser forests and scrubs of rivers, gorges and cliffs.

Pardalotus rubricatus Gould. **Red-browed Pardalote.**

Recorded at B2 (? sp.).

On 13 August Dell heard but did not see a bird calling in low open woodland on top of a siltstone hill. This species has been recorded about 100 km south of the Park, on the Gibb River-Wyndham road.

Pardalotus striatus uropygialis Gould. **Black-headed Pardalote.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G, [UKG] and [UB].

Common at A4; scarce to moderately common elsewhere. Open woodland and waterside forests (*Melaleuca* spp.). Many old nesting tunnels found at A1 and C4; also at latter a bird flushed from a fresh tunnel.

FAMILY MELIPHAGIDAE

Lichmera indistincta indistincta (Vigors & Horsfield). **Brown Honeyeater.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, [S], G, [UKG] and [UB].

Scarce to very common. All wooded habitats, but favouring river-fringing forests (especially of cadjeputs) and flowering trees and shrubs (e.g. *Eucalyptus houseana*, *E. tetradonta*, *E. miniata*, *Brachychiton* sp., *Verticordia cunninghamii* and *Grevillea pteridifolia*). At B2 on 9 August a pair feeding two nestlings, which were almost ready to leave the nest on 15 August.

Meliphaga albilineata (White). **White-lined Honeyeater.**

Recorded at B4, C3, C4 and C5. Three specimens (2 females, 1 unsexed).

Moderately common. In thickets of *Xanthostemon* and *Ficus* in gorges and gullies.

Meliphaga virescens (Vieillot). **Singing Honeyeater.**

Recorded at A1, A2, A3, A4, B1, B4, C3, [UKG] and [OD]. One specimen (male).

Locally common in far south-east of Park (A3); elsewhere scarce. Mainly in thickets of *Melaleuca* and *Acacia* in otherwise open country.

Meliphaga fusca flavescens (Gould). **Yellow-tinted Honeyeater.**

Recorded at A1, A4, B2, B4, C4 and [UKG]. Five specimens (3 males, 2 females).

Locally common. River-fringing forest (especially of cadjeputs); also minor watercourses lined with flowering trees and shrubs (*Eucalyptus houseana*, *E. miniata*, *E. tetradonta*, *Melaleuca* spp. and *Grevillea pteridifolia*). On 13 August a pair at B2 feeding a young bird unable to fly properly.

Meliphaga plumula (Gould). **Yellow-fronted Honeyeater.**

Recorded at A2, A3 and [OD]. One specimen (unsexed).

Scarce to moderately common in south-east sector of Park. In trees and flowering *Grevillea pteridifolia* along minor watercourses.

Meliphaga unicolor unicolor (Gould). **White-gaped Honeyeater.**

Recorded at A2, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5, G, [UKG], [UB] and [OD].

Common on larger watercourses and in gorges; scarce to moderately common elsewhere. River-fringing forests (especially of cadjeputs, but also *Ficus*, *Terminalia*, *Barringtonia*, *Pandanus* and *Acacia*); also vine scrubs in gorges and gullies and at foot of cliffs; occasionally visiting flowering trees and shrubs in open country (*Erythrina vespertilio* and *Grevillea pteridifolia*).

Melithreptus albogularis Gould. **White-throated Honeyeater.**

Recorded at A1, A2, A4, B1, B3, B4, C1, C2, C3, C4, C5, S, [UKG], [UB] and [OD]. One specimen (female).

Scarce to very common, greatly preferring the valleys to the plateaux. Mainly river-fringing forests (especially *Melaleuca leucadendron* and *M. argentea*; also *Ficus*, *Terminalia* and *Eucalyptus*) and vine scrubs in gullies and gorges and at foot of cliffs; commonly attracted to flowering eucalypts and *Grevillea pteridifolia*; one seen in a grove of *Callitris intratropica*.

Melithreptus gularis laetior Gould. **Golden-backed Honeyeater.**

Recorded at A4, B2, B4, C2 and C4. One specimen (male).

Locally moderately common but generally scarce. In woodlands (especially with flowering eucalypts); also attracted to flowering cadjeputs along the Drysdale.

Entomyzon cyanotis albipennis (Gould). **Blue-faced Honeyeater.**

Recorded at A1, A4, B1, C2 and C4. Two specimens (1 male, 1 female).

Scarce to moderately common; often in small parties (up to 10). In various habitats, especially those with flowering trees and shrubs (*Erythrina*, *Eucalyptus*, *Grevillea* and *Brachychiton*).

Philemon citreogularis citreogularis (Gould). **Little Friarbird.**

Recorded at A1, A3, A4, B1, B2, B4, C1, C4, [S], G, [UKG] and [OD]. One specimen (male).

Scarce to common. In most wooded habitats, especially those associated with watercourses and alluvial soils; attracted to flowering trees and shrubs (*Melaleuca leucadendron*, *Eucalyptus miniata*, *E. tetradonta*, *Grevillea pteridifolia*, *Erythrina vespertilio* and *Brachychiton* sp.).

Philemon argenticeps argenticeps (Gould). **Silver-crowned Friarbird.**

Recorded at A1, A2, A4, B1, B3, B4, C1, C2, C3, C4, C5, G, [UKG] and [UB]. Two specimens (males).

Scarce to common; occasionally in small parties (up to 9). In most wooded habitats, favouring those associated with sandstone; attracted to fruiting trees (e.g. *Ficus virens* var. *sublanceolata*) and flowering trees and

shrubs (*Erythrina vespertilio*, *Bombax ceiba* and *Grevillea pteridifolia*). An old nest found in a Cabbage Gum at C4.

Ramsayornis fasciatus fasciatus (Gould). **White-breasted Honeyeater.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C2, C3, C4, G, [UKG] and [UB]. One specimen (male).

Scarce to common; often in small parties (up to 10). Mainly about watercourses at flowering trees and shrubs (*Melaleuca argentea*, *M. leucadendron*, *Eucalyptus houseana*, *E. tetradonta*, *E. miniata*, *Grevillea pteridifolia* and *Brachychiton* sp.).

Conopophila rufogularis (Gould). **Rufous-throated Honeyeater.**

Recorded at A1, A3, A4, B1, B2, C3, C4, C5 and [OD].

Scarce to common. Ordinarily in cadjeput forests along watercourses, but commonly attracted to nearby flowering trees and shrubs (*Eucalyptus miniata*, *E. tetradonta*, *E. houseana*, *Erythrina vespertilio* and *Grevillea pteridifolia*).

Cissomela pectoralis (Gould). **Banded Honeyeater.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C2, C3, C4, C5, G, [UKG] and [UB]. One specimen (female).

Scarce to very common; often in flocks (up to 10). Mainly at flowering trees and shrubs (*Melaleuca leucadendron*, *M. argentea*, *Eucalyptus houseana*, *E. tetradonta*, *E. miniata*, *Brachychiton* sp. and *Grevillea pteridifolia*). Many birds were in juvenile plumage.

Manorina flavigula (Gould). **Yellow-throated Miner.**

Recorded at A3, B2, B3, C1, C2, C3, C4, (S) and G. One specimen (in spirits).

Very common, in pairs and small parties (up to 5) at B3, mainly in cadjeputs along Johnson Creek; moderately common at C1 along Palmoondoora Creek; elsewhere scarce.

FAMILY ESTRILDIDAE

Neochmia phaeton phaeton (Hombron & Jacquinot). **Crimson Finch.**

Recorded at A1, A2, A4, B1, B2, B3, B4, C1, C2, C3, C4 and [UB].

Scarce to common; usually in small parties (up to 9), one flock of 20 birds. *Pandanus* and long grass on watercourses.

Poephila bichenovii annulosa (Gould). **Black-ringed Finch.**

Recorded at A1, A4, B1, B2, B3, B4, C1, C2, C3, C4, C5 and [OD].

Scarce at A4; elsewhere moderately common to very common, usually in small parties (up to 12).

Mainly in grassy areas close to water; at B2 feeding in grassy open woodland up to 1.5 km from water. At C3 a nest and three eggs found on 16 August, and three fledglings flushed from another nest on 20 August.

Poephila personata personata Gould. **Masked Finch.**

Recorded at A4.

A flock of 10 feeding in grassy open woodland on 8 August.

Poephila acuticauda (Gould). **Long-tailed Finch.**

Recorded at A1, A2, A3, A4, B1, B2, C4, [S], [UKG] and [OD]. Two specimens (males with bill yellow-orange).

Scarce to common; usually in small parties (up to 6), also flocks of 10–15. Mainly in grass along watercourses; seldom in dry woodlands.

Chloebia gouldiae (Gould). **Gouldian Finch.**

Recorded at B2 and [S].

Scarce. It was estimated that a bird collected but not retained was barely two weeks out of the nest; it was in low open woodland *ca* 2 km from water. All the other birds were close to water, including a flock of 10 at [S] (about half of them were red-headed).

Lonchura castaneothorax castaneothorax (Gould). **Chestnut-breasted Finch.**

Recorded at A3, B2 and C2. Three specimens (2 males, 1 female).

Small parties (up to 4 birds) in pandanus along watercourses; two at A3 with Long-tailed Finches on a grassy watercourse.

FAMILY ORIOLIDAE

Oriolus sagittatus (Latham). **Olive-backed Oriole.**

Recorded at A4, B2, B3, B4, C1, C2, C3, C4, C5 and [UKG]. Seven specimens (5 males, 1 female, 1 unsexed).

Locally common (up to 8 feeding in a single figtree), but generally scarce or uncommon. Mainly in cadjeputs and figtrees (it was especially fond of the small whitish fruits of *Ficus virens* var. *sublanceolata*).

FAMILY ARTAMIDAE

Artamus leucorhynchus (Linnaeus). **White-breasted Wood-swallow.**

Recorded at A4, B2, B4 and C2. One specimen (male).

Locally common but generally scarce. At large pools on the major watercourses and at nearby lagoons, usually resting in fringing cadjeputs.

Artamus personatus (Gould). **Masked Wood-swallow.**

Recorded at A2, A3, A4, C2 and [OD].

Locally common in small flocks (up to 20); occasional large flocks in transit (up to 200 birds), flying high.

Artamus cinereus melanops Gould. **Black-faced Wood-swallow.**

Recorded at A1, A2, A3, A4, B1, B4, C1, C2, C4, S, [UB] and [OD].

Locally common (e.g. on basalt flats near the Carson River) but generally scarce or uncommon; in pairs or small parties (up to 12). Open woodlands.

Artamus minor Vieillot. **Little Wood-swallow.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, G, [UKG] and [OD].

Scarce to very common (the most abundant aerial insectivore in the Park), often in small parties (up to 8).

Mainly in open woodland; occasionally attracted to flowers of *Eucalyptus miniata*. On 4 August a pair entering hollow limb of dead tree at A4.

FAMILY CRACTICIDAE

Cracticus torquatus argenteus Gould. **Silver-backed Butcherbird.**

Recorded at A2, A4, B2, B3, B4, C1, C2, C4, C5, [S], G and [UB]. Seven specimens (3 males, 4 females).

Scarce to common. Mainly river-fringing forests (especially of cadjeputs; also *Pandanus* and *Barringtonia*); also in vine scrubs. On 8 August a bird sitting on a nest at A2; also breeding at B3.

Cracticus nigrogularis (Gould). **Pied Butcherbird.**

Recorded at A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, G, [UB] and [OD].

Scarce to uncommon; generally outnumbered by Silver-backed Butcherbird except on plateaux. Open woodlands.

FAMILY PTILONORHYNCHIDAE

Chlamydera nuchalis nuchalis (Jardine & Selby). **Great Bowerbird.**

Recorded at A1, A2, B1, B2, B3, B4, C1, C2, C3, C4 and C5. One specimen (in spirits).

Locally common. Mainly in fruiting *Ficus* spp. (in sandstone, along watercourses and in vine scrubs). Birds active at bowers; copulation observed on 16 August at C4.

FAMILY CORVIDAE

Corvus orru ceciliae Mathews. **Australian Crow.**

Recorded at A1, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4 and [OD]. Two birds, not retained, weighed 595 and 610 g.

Locally common but generally scarce; one party of 15 near a fire. Open woodlands.

DISCUSSION

Most birds that could be expected in winter were in fact recorded during this survey of the Park. A summer survey would doubtless add breeding visitors like the Koel (*Eudynamys scolopacea*) and Dollar-bird (*Eurystomus orientalis*) and Palaearctic migrants such as the Chinese Snipe (*Gallinago megala*), Oriental Pratincole (*Glareola maldivarum*), Oriental Cuckoo (*Cuculus saturatus*), Fork-tailed Swift (*Apus pacificus*) and Yellow Wagtail (*Motacilla flava*).

The avifauna of the Drysdale River National Park, not unexpectedly, is generally intermediate between that of the subhumid north-west Kimberley (as exemplified by the Prince Regent River Reserve) and the semiarid east Kimberley (as exemplified by the vicinity of Lake Argyle). In addition to the many birds shared by all three regions, there are four species of north-west Kimberley birds that reach the Drysdale but not to Lake Argyle: the Red-backed Quail (*Turnix maculosa*), Green-winged Pigeon (*Chalcophaps indica*), Shining Flycatcher (*Myiagra alecto*) and Silver-backed Butcherbird (*Cracticus torquatus*). And there are eight species of Lake Argyle

birds that reach west to the Drysdale but not to the Prince Regent: the Crested Pigeon (*Ocyphaps lophotes*), Singing Bushlark (*Mirafra javanica*), Hooded Robin (*Petroica cucullata*), Brown Songlark (*Cincloramphus cruralis*), Red-browed Pardalote (*Pardalotus rubricatus*), Yellow-fronted Honeyeater (*Meliphaga plumula*), Masked Finch (*Poephila personata*) and Gouldian Finch (*Chloebia gouldiae*).

The families showing most differences between north-west, north and east Kimberley are the pigeons (Columbidae) and finches (Estrildidae). The members of

TABLE 1

PIGEONS AND FINCHES RECORDED ON THE PRINCE REGENT RIVER RESERVE AND ADJACENT ISLANDS, IN THE DRYSDALE RIVER NATIONAL PARK, AND AROUND LAKE ARGYLE

	Prince Regent River	Drysdale River	Lake Argyle
COLUMBIDAE			
<i>Ptilinopus regina ewingii</i>	X		
<i>Ducula spilorrhoa spilorrhoa</i>	X		
<i>Geopelia humeralis</i>	X	X	X
<i>Geopelia striata placida</i>	X	X	X
<i>Geopelia cuneata</i>	X	X	X
<i>Chalcophaps indica longirostris</i>	X	X	
<i>Petrophassa albipennis</i> (brown-backed form)	X	X	
<i>Petrophassa albipennis</i> (rufous-backed form)			X
<i>Phaps chalcoptera</i>	X	X	X
<i>Phaps histrionica</i>			X
<i>Geophaps smithii blaauwi</i>	X		
<i>Geophaps plumifera plumifera</i>			X
<i>Ocyphaps lophotes</i>		X	X
ESTRILDIDAE			
<i>Emblema pictum</i>			X
<i>Neochmia phaeton phaeton</i>	X	X	X
<i>Neochmia ruficauda clarescens</i>			X
<i>Poephila guttata castanotis</i>			X
<i>Poephila bichenovii annulosa</i>	X	X	X
<i>Poephila personata personata</i>		X	X
<i>Poephila acuticauda</i>	X	X	X
<i>Chloebia gouldiae</i>		X	X
<i>Lonchura castaneothorax castaneothorax</i>	X	X	X
<i>Lonchura pectoralis</i>			X

these families occurring on the Prince Regent River Reserve and adjacent islands, in the Drysdale River National Park, and around Lake Argyle, are listed in Table 1.

The considerably lower rainfall of the Drysdale River National Park compared to the Prince Regent River is reflected in the fact that 14 north-west Kimberley birds do not extend to the Drysdale. Eleven of these species are primarily inhabitants of closed-forests, and almost half of them are wholly or mainly frugivorous: the Rose-crowned Pigeon (*Ptilinopus regina*), Torres Strait Pigeon (*Ducula spilorrhoa*), Varied Triller (*Lalage leucomela*), Yellow Oriole (*Oriolus flavocinctus*) and Yellow Figbird (*Sphecotheres viridis*). The other closed-forest species are the Scrub Fowl (*Megapodius freycinet*), Rufous Owl (*Ninox rufa*), Rainbow Pitta (*Pitta iris*), Cicada-bird (*Coracina tenuirostris*), Little Shrike-thrush (*Colluricincla parvula*) and Spangled Drongo (*Dicrurus bracteatus*). Three non-forest species complete the list of Prince Regent birds that were not recorded in the Drysdale River National Park, namely the King Quail (*Coturnix chinensis*), Partridge Pigeon (*Geophaps smithii*) and Black Grass-wren (*Amytornis housei*).

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PART VIII
AMPHIBIANS AND REPTILES
OF THE DRYSDALE RIVER NATIONAL PARK
NORTH KIMBERLEY, WESTERN AUSTRALIA

by G. M. STORR¹ and L. A. SMITH¹

INTRODUCTION

This paper is based on collections and observations made during a biological survey of the Drysdale River National Park in August 1975. Thorough collections were made at 12 sites (A1 to A4, B1 to B4, and C1 to C4; see Kabay, this publication). A few specimens were obtained on brief visits to other localities, namely a gorge in the north-west of the Park in 14° 34' S, 127° 02' E (reference code G), to 10 km east of Old Doongan HS (reference code EOD), and to the upper Berkeley River in 15° 06' S, 127° 18' E (UB). The last-named locality is just outside the Park and is therefore enclosed in square brackets in the following list, as are Old Doongan Homestead (reference code OD) and a locality 5 km north-east of Old Doongan (NEOD). All specimens are lodged in the Western Australian Museum under registered numbers R50292-50988.

In the species accounts we seldom assess relative abundance, but some indication of it can be deduced from the number of specimens collected (given in brackets after each locality). Where no number follows a locality the record is based on observation only.

None of the 13 species of frogs was breeding; hence the lack of meaningful ecological data. Most of the 47 species of reptiles were inactive, but some idea of preferred habitat was obtained for the commoner species.

In order to illustrate the affinities of the present herpetofauna, the members of four families (Hylidae, Gekkonidae, Agamidae and Scincidae) are listed in Table 1 together with those of the Prince Regent River Reserve (north-west Kimberley) and the vicinity of Lake Argyle (east Kimberley). The Prince Regent River Reserve list includes *Diporiphora magna*, a specimen of which was collected at E6 but inadvertently omitted from our account (Storr and Smith 1975); in the same paper a specimen of *Menetia maini* Storr was misidentified as *M. greyii* Gray, and *Omolepida maxima* Storr was listed as *Omolepida* sp.

LIST OF SPECIES

AMPHIBIA

FAMILY LEPTODACTYLIDAE Ground Frogs

Crinia signifera Girard².

Recorded at A1 (2), A3 (5), A4 (13), B2 (2), B4 (1), C1 (1), C2 (1), C3 (14) and C4 (24).

Some of the frogs at A4 were calling at night ("creek creek"); they were located in small depressions in wet sand at edge of water in a nearly-dry creek (R.E. Johnstone pers. comm.).

Limnodynastes convexiusculus (Macleay).

Recorded at B2 (1).

This is the easternmost of our Kimberley specimens; the others are from Kalumburu, Mitchell Plateau and Lake Gilbert (Beverley Springs Station).

?*Limnodynastes* sp.

Recorded at C4 (1).

This undescribed species was previously known from the Ord River and Northern Territory (M. J. Tyler pers. comm.).

Uperoleia sp.

Recorded at C3 (4).

FAMILY HYLIDAE Tree Frogs

Litoria bicolor (Gray).

Recorded at B1 (2) and C4 (1).

Litoria caerulea (White).

Recorded at B1 (1).

Litoria coplandi (Tyler).

Recorded at A1 (8), A2 (3), B1 (4), B2 (6), B3 (5), B4 (23), C1 (18), C2 (5), C3 (10) and C4 (14).

"*Litoria latopalmata* Günther".

Recorded at A4 (1), B2 (4), B3, C3 (3) and C4 (5). They were calling on Johnston Creek (B3).

Litoria meiriana (Tyler).

Recorded at B1 (1), B4 (1), C3 (25) and C4 (15).

Litoria nasuta (Gray).

Recorded at A3 (2), A4 (1) and C4 (1).

Litoria peronii (Tschudi).

Recorded at A3 (2), A4 (3), B1 (2), B3 (5) and B4 (2).

Litoria rubella (Gray).

Recorded at A1 (1) and C1 (1).

Litoria wotjulumensis (Copland).

Recorded at A1 (2), A2 (1), A3 (3), A4 (40), B1 (6), B2 (4), B3 (1), B4 (1), C1 (10), C2 (2), C3 (5) and C4 (19).

This abundant species was found at all sites.

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REPTILIA

FAMILY CHELUIDAE **Side-necked Turtles**

Chelodina rugosa Ogilby.

Recorded at A1 (1), B1 (1) and C1.

Uncommon. Pools on major watercourses (Drysdale and Carson Rivers and Palmoondoora Creek).

Emydura australis (Gray).

Recorded at A1 (4), B1 (4), B2, B3, C1 and C4.

Common in pools on several watercourses (Drysdale and Carson Rivers and Palmoondoora, Johnson and Woorakin Creeks).

FAMILY GEKKONIDAE **Geckos**

Diplodactylus ciliaris Boulenger. (Fig. 2).

Recorded at A1 (11), A2 (2), A3 (2), B4 (5), C1 (6) and C4 (1).

Found at night in shrubs and trees, on boulders and on the dry sandy bed of the Drysdale.

Diplodactylus stenodactylus Boulenger.

Recorded at [OD (2)].

These specimens were taken from the stomach of a feral cat.

Diplodactylus sp. affin. *michaelseni*

Recorded at C2 (1).

In spinifex/sandstone.

Gehyra australis Gray. (Fig. 4).

Recorded at A2 (6), A3 (1), A4 (1), B1 (2), B3 (5), B4 (20), C1 (4), C2 (1), C3 (4) and C4 (4).

Usually found at night on vertical surfaces (sandstone or tree trunks); also collected in a Fairy Martin's nest and a termitarium.

Gehyra sp.

Recorded at A1 (3), A2 (1), B2 (1), B4 (3) and C1 (5).

This small species was collected on flat sandstone rocks and in open eucalypt woodland with spinifex.

Heteronotia binoei (Gray).

Recorded at A2 (2), A4 (1), C1 (1) and C4 (26).

All specimens but one were found in or near termitaria in open woodland.

Heteronotia spelea (Kluge).

Recorded at B4 (1) and C3.

Found at night in sandstone.

Nephrurus asper Günther.

Recorded at A2 (1) and C3.

In sandstone/spinifex.

Oedura marmorata Gray. (Fig. 1).

Recorded at A1 (1), B4 (2), C2 (1), C3 (2) and C4 (1).

Active at night in sandstone/spinifex; one found at mid-day under a slab of sandstone.

Rhynchoedura sp.

Recorded at [OD (1)].

This specimen was taken from the stomach of a feral cat. Our only other specimens of this undescribed species were collected in north-west Kimberley.

FAMILY PYGOPODIDAE **Legless Lizards**

Lialis burtonis Gray.

Recorded at B2 (1) and B3 (1).

One specimen was found on sand in a creek-bed; the other in a small crevice in sandstone.

FAMILY AGAMIDAE **Dragon Lizards**

Amphibolurus minor Sternfeld.

Recorded at A4 (1).

On a grassy sandstone ridge.

Diporiphora bennettii bennettii (Gray).

Recorded at A2 (6), C1 (2), C3 (1) and [OD (1)].

Mainly in open grassy eucalypt woodland on plateaux.

Diporiphora bilineata margaretae Storr.

Recorded at A4 (11), B1 (2), B2 (2), B4 (1) and C4 (1).

Mainly in open grassy eucalypt woodland, but also in sandstone/spinifex.

Diporiphora magna Storr. (Fig. 3).

Recorded at A3 (1), A4 (3), B1 (1), B2 (2) and C4 (1).

On sandy soils with grasses, especially beside watercourses; also in eucalypt woodland.

Physignathus gilberti gilberti (Gray).

Recorded at A1 (17), B1 (4), B2 (3), B3 (2), B4 (5), C1 (2), C2 (2), C3 (1) and C4 (2).

Mainly in debris, vegetation and rocks margining watercourses; also in sandstone/spinifex. One female was gravid.

FAMILY SCINCIDAE **Skinks**

Carlia amax Storr.

Recorded at B1 (2).

Carlia foliorum (DeVis).

Recorded at A3 (1), A4 (1) and B1 (1).

In leaf litter beneath trees in woodland.

Carlia johnstonei johnstonei Storr.

Recorded at B4 (1), C2 (2), C3 (1) and C4 (3).

In leaf litter in sandstone.

Carlia triacantha (Mitchell).

Recorded at A2 (3) and A3 (1).

In sandstone/spinifex.

Cryptoblepharus megastictus Storr.

Recorded at B1 (2), B3 (2) and C2 (1).

Feeding in daytime on vertical sandstone surfaces.

Cryptoblepharus plagiocephalus (Cocteau).

Recorded at A4 (1) and C4 (2).

On trunks of trees.

Ctenotus decaneurus decaneurus Storr.

Recorded at B2 (1).

In spinifex on sandstone.

Ctenotus inornatus (Gray).

Recorded at A1 (8), A2 (6), A4 (4), B1 (2), B2 (4), B3 (4), B4 (3), C2 (3), C3 (3), C4 (9), G (1), [UB (1)] and EOD (1).

This abundant skink was found in a wide variety of habitats.

Ctenotus robustus Storr.

Recorded at A4 (1) and B1 (3).

In spinifex.

These specimens have 30–34 midbody scale rows, in keeping with their geographic intermediacy between north-west Kimberley (32–36 rows) and the Ord River (28–30 rows).

Morethia taeniopleura ruficauda (Lucas & Frost).

Recorded at A2 (1), B4 (1), C3 (1), C4 (1) and C5.

In sandstone/spinifex.

Notoscincus ornatus wotjulum (Glauert).

Recorded at B1 (1), B2 (1) and B4 (1).

In sandstone/spinifex and on the bank of a creek.

Sphenomorphus isolepis isolepis (Boulenger).

Recorded at B3 (1).

Active in daytime in leaf litter on sandstone.

Tiliqua scincoides (Shaw.)

Recorded at EOD (1).

FAMILY VARANIDAE **Goannas**

Varanus acanthurus Boulenger.

Recorded at A4 (1).

In sandstone.

Varanus glauerti Mertens.

Recorded at B3 (1), B4 (2), C2 (1), C3 (1) and C4 (1).

Among sandstone boulders; one seen sheltering in a narrow crevice.

Varanus glebopalma Mitchell.

Recorded at C1 (2), C2 (3) and C3 (1).

In sandstone.

Varanus gouldii gouldii (Gray).

Recorded at A4, B2 (1), C2 (1) and C4.

Mainly about watercourses.

Varanus mertensi Glauert.

Recorded at A1 (1), B4 (1), C2 (1), C3 (1) and C4 (1).

In pandanus and on rocks in pools and streams.

Varanus mitchelli Mertens.

Recorded at A4 (1) and C2 (1).

On watercourses.

Varanus sp.

Recorded at A3 (1) and A4 (2).

Two specimens were found in trees: one under the bark of a large dead *Callitris intratropica*, the other in a hollow of a dead paperbark.

This undescribed species appears to be related to *V. caudolineatus* and *V. gilleni*.

FAMILY BOIDAE **Pythons**

Liasis mackloti Duméril & Bibron.

Recorded at A4 (1), C2 (1) and [NEOD (1)].

One was found in a hollow 3 m up in a dead eucalypt, another in sandstone.

We follow McDowell (1975) in merging *L. fuscus* in *L. mackloti*.

Liasis sp.

Recorded at B4 (1).

In a crevice in sandstone rocks.

This python is generally similar in scutellation to *L. childreni* Gray, but it lacks the bold pattern of that species, its upper surface being an almost uniform purplish brown. We have similar specimens from near Wyndham (east Kimberley).

FAMILY COLUBRIDAE **Rear-fanged and Fangless Snakes**

Boiga fusca (Gray).

Recorded at A2 (3), B1, B2 (1), C2 (1), C3 and C4 (1).

Mainly about sandstone cliffs.

Dendrelaphis punctulatus (Gray). (Plate 9).

Recorded at A2 (3), B1 (1), B3, C1 (1), C4 (3) and G (1).

Mainly in pandanus along watercourses; also in fig-trees and liane scrub growing on or at foot of cliffs.

FAMILY ELAPIDAE **Front-fanged Snakes**

Demansia nuchalis (Günther).

Recorded at B3 (1).

On a sandstone scree slope with grasses.

Demansia sp.

Recorded at B2 (1).

On a river bank.

Furina christieana (Fry).

Recorded at A3 (1).

This specimen was found in evening 2 m up the trunk of a dead tree.

Pseudechis australis (Gray).

Recorded at A1 (1), A2 (1), B3, B4 and C2 (1).

Mainly about sandstone cliffs and screes.

FAMILY CROCODYLIDAE Crocodiles

Crocodylus johnstoni Krefft.

Recorded at A1 (1), A4, B1, B2, B3, B4, C1, C2, C3 and C4.

Mainly on large pools of major watercourses, but also along small creeks.



Figure 1—A gecko, *Oedura marmorata*.

DISCUSSION

Considering that so many frogs and reptiles were still hibernating, the remarkably high total of 60 species was recorded. The lists of Hylidae, Cheluidae, Varanidae and Crocodylidae probably contain all or nearly all the species occurring in the Park. The lists of Gekkonidae, Scincidae and Agamidae must be fairly complete, but all snake families are very much under-represented in this collection.

Geographically and climatically intermediate between subhumid north-west Kimberley and semiarid east Kimberley, the Drysdale River National Park is to some extent intermediate in its herpetofauna, but there are interesting differences in detail between families. Table 1 shows that the rich Drysdale hylid frog fauna is identical with that of the Prince Regent, whereas at Lake Argyle in east Kimberley there are somewhat fewer species and these include the dry-country *Litoria gilleni*. In the presence of *Diplodactylus* and *Rhynchoedura* and the absence of *Pseudothecadactylus*, the gekko fauna of the Drysdale is more like that of Lake Argyle than the Prince Regent. While the Drysdale list of Agamidae lacks most of the north-west Kimberley endemics (*Diporiphora a. albilabris*, *D. superba*, *Amphibolurus microlepidotus* etc.), it also lacks such east Kimberley arid elements as *Amphibolurus inermis*, *A. isolepis* and *Tympanocryptis tetraporophora*. The Drysdale skinks have more in common with those of the Prince Regent than Lake Argyle; the *Carlia* spp. are the same, and there is a complete absence of arid elements like *Ctenotus pantherinus calx*, *Lerista bipes*, *Omolepida branchialis*, *Sphenomorphus richardsonii* and *Tiliqua multifasciata*.

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Figure 2—A gecko, *Diplodactylus ciliaris*.



Figure 3—A gecko, *Gehyra australis*.



Figure 4—An agamid lizard, *Diporiphora magna*.

TABLE 1

SPECIES OF HYLID FROGS, GECKOS, AGAMID LIZARDS AND SKINKS IN THE PRINCE REGENT RIVER NATURE RESERVE (NORTH-WEST KIMBERLEY), DRYSDALE RIVER NATIONAL PARK (NORTH KIMBERLEY) AND THE VICINITY OF LAKE ARGYLE (EAST KIMBERLEY).

	Prince Regent River	Drysdale River	Lake Argyle
HYLIDAE			
<i>Litoria bicolor</i>	X	X	
<i>Litoria caerulea</i>	X	X	X
<i>Litoria coplandi</i>	X	X	X
<i>Litoria (?)gilleni</i>			X
<i>Litoria (?)latopalmata</i>	X	X	X
<i>Litoria meiriana</i>	X	X	
<i>Litoria nasuta</i>	X	X	X
<i>Litoria peronii</i>	X	X	X
<i>Litoria rubella</i>	X	X	X
<i>Litoria wotjulumensis</i>	X	X	
GEKKONIDAE			
<i>Crenadactylus ocellatus</i>			X
<i>Diplodactylus ciliaris</i>		X	
<i>Diplodactylus stenodactylus</i>		X	X
<i>Diplodactylus</i> sp. affin. <i>michaelseni</i>		X	X
<i>Gehyra australis</i>		X	X
<i>Gehyra</i> sp. (large)	X		
<i>Gehyra</i> spp. (small)	X	X	X
<i>Heteronotia binoei</i>	X	X	X
<i>Heteronotia spelea</i>	X	X	X
<i>Nephrurus asper</i>	X	X	X
<i>Oedura lesueurii rhombifera</i>	X		
<i>Oedura marmorata</i>	X	X	
<i>Pseudothecadactylus lindneri</i>			
<i>cavaticus</i>	X		
<i>Rhynchoedura ornata</i>			X
<i>Rhynchoedura</i> sp.		X	
AGAMIDAE			
<i>Amphibolurus inermis</i>			X
<i>Amphibolurus isolepis isolepis</i>			X
<i>Amphibolurus microlepidotus</i>	X		

TABLE 1—continued

	Prince Regent River	Drysdale River	Lake Argyle
AGAMIDAE—continued			
<i>Amphibolurus minor</i>		X	
<i>Chelosania brunnea</i>	X		
<i>Chlamydosaurus kingii</i>	X		X
<i>Diporiphora albilabris albilabris</i>	X		
<i>Diporiphora bennettii bennettii</i>	X	X	X
<i>Diporiphora bilineata margaretae</i>	X	X	
<i>Diporiphora magna</i>	X	X	X
<i>Diporiphora superba</i>	X		
<i>Physignathus gilberti gilberti</i>	X	X	X
<i>Tympanocryptis tetraporophora</i>			X
SCINCIDAE			
<i>Carlia amax</i>	X	X	X
<i>Carlia foliorum</i>	X	X	X
<i>Carlia johnstonei johnstonei</i>	X	X	
<i>Carlia rufilatus</i>			X
<i>Carlia triacantha</i>	X	X	X
<i>Cryptoblepharus megastictus</i>		X	
<i>Cryptoblepharus plagiocephalus</i>	X	X	X
<i>Ctenotus decaneurus decaneurus</i>		X	X
<i>Ctenotus inornatus</i>	X	X	X
<i>Ctenotus mastigura burbidgei</i>	X		
<i>Ctenotus militaris</i>			X
<i>Ctenotus pantherinus calx</i>			X
<i>Ctenotus robustus</i>	X	X	X
<i>Ctenotus tantillus</i>			X
<i>Lerista bipes</i>			X
<i>Lerista borealis</i>			X
<i>Lerista walkeri</i>	X		
<i>Menetia greyii</i>			X
<i>Menetia maini</i>	X		
<i>Morethia taeniopleura ruficauda</i>	X	X	X
<i>Notoscincus ornatus wotjulum</i>	X	X	X
<i>Omolepida branchialis</i>			X
<i>Omolepida maxima</i>	X		
<i>Proablepharus tenuis</i>	X		X
<i>Sphenomorphus isolepis isolepis</i>	X	X	X
<i>Sphenomorphus richardsonii</i>			X
<i>Sphenomorphus</i> sp.	X		
<i>Tiliqua multifasciata</i>			X
<i>Tiliqua scincoides</i>	X	X	X

PART IX
THE FRESHWATER FISH FAUNA
OF THE DRYSDALE RIVER NATIONAL PARK
NORTH KIMBERLEY, WESTERN AUSTRALIA

by J. B. HUTCHINS¹

INTRODUCTION

The Drysdale River National Park is drained by four rivers: Berkeley, King George, Carson and Drysdale. All were sampled with emphasis being placed on the last two as their drainage systems cover most of the Park (see Fig. 1 in Kabay, this publication). This investigation was carried out during the dry season so water levels were low. However, all rivers were flowing, with the Drysdale having the greatest flow.

Collection stations were selected to cover a variety of habitats which may be broadly distinguished as follows:

1. Main river, including large pools in river bed.
2. Small tributaries running into river.
3. Billabongs.

Collections were made with derris powder (6-8% rotenone), 15 metre seine net, dip-net, tortoise trap and handline.

LIST OF COLLECTING STATIONS

All collections were made by the author unless otherwise stated.

A1-1. Drysdale River, at campsite, 3 August 1975. Collection made with 15 m seine net along river bank at depths to 2 m over rocky bottom; water fresh and murky.

A1-2. Drysdale River, at campsite, 3 August 1975. Collection made with handline in depths to 3 m at 7.00 p.m.

A1-3. Drysdale River, at rapids about 1.5 km upriver from campsite, 4 August 1975. Collection made in small, moderate flowing pool (approximately 5 x 5 m) with 0.5 kg derris powder; water fresh and clear. In addition, further specimens were collected as affected water flowed from pool down a series of rapids.

A1-4. Mogurnda Creek, about 0.5 km above junction with Drysdale River, 5 August 1975. Collection made in a small, slow flowing pool (approximately 2 x 3 m) with 0.25 kg derris powder at depths to 0.5 m; water fresh and clear. Further specimens were collected as affected water flowed downstream (about 100 m).

A1-5. Drysdale River, near junction with Mogurnda Creek, 5 August 1975. Collection made at rear of a side channel with 0.25 kg derris powder; water fresh but very murky, surface covered with leaves.

A1-6. Drysdale River, 0.5 km upriver from campsite 6 August 1975. Collection made at rear of a side channel with 0.5 kg derris powder at depths to 2 m, employing a stop-net across the channel; water fresh and murky.

A1-7. Billabong (approximately 10 x 50 m) near Mogurnda Creek, 6 August 1975. Collection made in northern half of billabong with 0.5 kg derris powder over muddy bottom in depths to 1.5 m; water fresh and murky.

A1-8. Drysdale River, at campsite, 6 August 1975. B. Hutchins and D. Kabay. Collection made with tortoise trap in 1 m at 8.00 p.m.

A1-9. Drysdale River, about 3 km down river from campsite, 7 August 1975. Collection made in medium, swift flowing pool (approximately 10 x 10 m) with 0.5 kg derris powder over rock bottom at depths to 1 m (subterranean source, flowing over rapids into river); water fresh and clear.

A1-10. Drysdale River, about 250 m upriver from campsite, 8th August 1975. Collection made with dip-net and torch over sandy bottom near river bank in depths to 1 m at 8.00 p.m.; water fresh and clear.

KG-1. King George River, on eastern border of Park (14° 37' S, 127° 13' E) 10 August 1975; B. Hutchins and A. Chapman. Collection made in large slow flowing pool (10 x 25 m) with 0.5 kg derris powder over rocky bottom at depths to 1 m; water fresh and clear.

BR-1. Berkeley River, on eastern border of Park (15° 11' S, 127° 13' E) 10 August 1975, B. Hutchins and A. Chapman. Collection made in portion of river (approximately 5 x 30 m) with 1 kg of derris powder over a weed bottom at depths to 1.5 m; water fresh and clear.

B1-1. Carson River, about 2 km below junction with Orchid Creek, 11 August 1975. Collection made in medium billabong (approximately 3 x 20 m) with 0.25 kg derris powder over mud and debris bottom at depths to 1.5 m; water stagnant and muddy.

B1-2. Carson River, about 1 km below junction with Orchid Creek, 11 August 1975. Collection made in medium, quiet pool (approximately 5 x 15 m) with 0.25 kg derris powder over sand and rock bottom at depths to 2 m; water fresh and clear.

B1-3. Carson River, about 0.5 km above junction with Orchid Creek, 12 August 1975. Collection made in large, quiet pool (approximately 20 x 30 m) with 1 kg derris powder over sand and rock bottom at depths to 1.5 m; water fresh and clear.

B1-4. Orchid Creek, about 100 m below Dulcis Falls, 13 August 1975. Collection made in small, quiet pool (approximately 3 x 5 m) with 0.25 kg derris powder over rocky bottom at depths to 1.5 m; water fresh and murky.

B1-5. Orchid Creek, about 150 m below campsite, 13 August 1975. Collection made in medium, slow flowing pool (approximately 10 x 15 m) with 0.75 kg derris powder over sand and rock bottom at depths to 2 m; water fresh and clear.

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B1-6. Carson River, about 200 m below junction with Orchid Creek, 14 August 1975. Collection made in large pool (approximately 15 x 100 m) with handline; water fresh and murky.

B1-7. Carson River, about 1 km above junction with Orchid Creek, 15 August 1975. Collection made from river bank with handline; water fresh and murky.

B1-8. Orchid Creek, about 1 km above campsite, 15 August 1975., B. Hutchins and B. Wilson. Collection made in small, quiet pool (approximately 3 x 5 m) with 0.25 kg derris powder over rocky bottom at depths to 1 m; water fresh and murky.

C1-1. Palmoondoora Creek, about 100 m below Morgan Falls, 17 August 1975. Collection made in medium, slow flowing pool (approximately 5 x 25 m) with 0.5 kg derris powder over rocky bottom at depths to 1 m; water fresh and slightly murky.

C1-2. Palmoondoora Creek, at base of Morgan Falls, 17 August 1975. Collection made in deep, quiet pool (approximately 20 x 20 m) with handline; water fresh and clear.

C1-3. Palmoondoora Creek, at top of Morgan Falls, 17 August 1975. Collection made in medium, quiet pool (approximately 10 x 20 m) with 1 kg derris powder over rock bottom at depths to 3 m; water fresh and murky.

C1-4. Palmoondoora Creek, about 1 km above campsite, 18 August 1975. Collection made in small, slow flowing pool (approximately 3 x 10 m) with 0.25 kg derris powder over rocky bottom at depths to 0.5 m; water fresh and clear.

C5-1. Drysdale River, near junction of Forest Creek, 19 August 1975. Collection made in side channel river (approximately 10 m wide) with 0.25 kg derris powder over sand and debris bottom at depths to 2 m, employing a stop-net; water fresh and clear.

C5-2. Drysdale River, about 100 m above junction with Forest Creek, 19 August 1975. Collection made with hand-line from river bank at depths to 2 m; water fresh and slightly murky.

C5-3. Forest Creek, about 300 m upstream from campsite, 20 August 1975. Collection made in portion of slow flowing creek (approximately 2 x 15 m) with 0.25 kg derris powder over rock bottom with weeds and debris at depths to 1 m; water fresh and clear.

C5-4. Drysdale River, at rapids about 4 km above junction with Forest Creek, 21 August 1975. Collection made in portion (approximately 10 x 10 m) of very large, slow flowing pool with 0.5 kg of derris powder over rock and sand bottom at depths to 2 m; water fresh and clear.

RESULTS

A total of 26 species was recorded for the Park. All these species can maintain their life cycles in pure fresh water. However, three species, *Arius australis*, *Glossogobius giurus* and *Toxotes chatareus* are also inhabitants of brackish water areas. Nine species are considered to be undescribed, of which three are known only from the Park.

An annotated list of species is presented below. All specimens are deposited at the Western Australian Museum (catalogue numbers follow the station code numbers) and measurements given are either standard length (SL) or total length (TL). Table 1 depicts the species collected at each station.

LIST OF SPECIES

FAMILY CLUPEIDAE Herrings

Nematalosa erebi (Günther).

Chatoessus erebi Günther, *Catalogue Fishes Brit. Mus.* 7: 407 (1868); type locality, eastern Australia.

A1-1 (P25402-005), 7 specimens, 104-123 mm SL.

A1-6 (P25407-001), 1 specimen, 138 mm SL.

B1-1 (P25412-005), 15 specimens, 39-96 mm SL.

B1-2 (P25413-004), 10 specimens, 23-32 mm SL.

C1-1 (P25420-008), 5 specimens, 55-106 mm SL.

C5-4 (P25427-005) 2 specimens, 95-123 mm SL.

Collected only from areas of still or slow flowing water on main watercourse. Specimens collected from the Drysdale were relatively more elongate than those from the Carson. Distributed throughout the freshwater rivers of New Guinea and Northern Australia.

FAMILY ARIIDAE Fork-tailed Catfishes

Arius australis Günther.

Arius australis Günther, *Proc. Linn. Soc. Lond.* 103 (1867); type locality, Hunter River, New South Wales.

B1-6 (P25417-002), 1 specimen, 227 mm SL.

B1-7 (P25418-002), 1 specimen, 183 mm SL.

Collected only from the Carson river where it is apparently common. Many additional specimens up to 350 mm TL were taken from B1-6 but were not kept. Distributed in brackish and freshwater rivers of northern New South Wales, Queensland, Northern Territory and northern Western Australia.

FAMILY PLOTOSIDAE Eel-tail Catfishes

Tandanus glencoensis (Rendahl).

Copidoglanis glencoensis Rendahl, *Medd. Zool. Mus. Krist.* 5: 170 (1922); type locality, Daly River and Glencoe, Northern Territory.

A1-4 (P25405-003), 12 specimens, 39-102 mm SL.

A1-6 (P25407-005), 1 specimen, 102 mm SL.

A1-7 (P25408-006), 3 specimens, 95-108 mm SL.

KG-1 (P25429-005), 10 specimens, 47-88 mm SL.

BR-1 (P25428-004), 4 specimens, 78-115 mm SL.

C1-1 (P25420-005), 3 specimens, 86-125 mm SL.

C5-3 (P25426-001), 8 specimens, 48-102 mm SL.

C5-4 (P25427-007), 1 specimen, 119 mm SL.

Apparently common in streams of the Park except those joining the Carson River where it is replaced by *Tandanus* species 1. It was only rarely collected in large watercourses. Distributed in freshwater streams from the Pilbara, Western Australia to the Northern Territory.

Tandanus ater (Perugia).

Lambertia atra Perugia, *Ann. Mus. Stor. nat. Genova ser. 2*, 14: 551 (1894); type locality, Inawi, Papua.

A1-3 (P25404-008), 1 specimen, 95 mm SL.

A1-5 (P25406-008), 1 specimen, 101 mm SL.

A1-9 (P25410-008), 4 specimens, 62-111 mm SL.

B1-3 (P25414-001), 1 specimen, 103 mm SL.

This species was rarely collected and appears to be present in much smaller numbers than *Tandanus* species 1 with which it was always associated. Prefers main watercourses in areas of swiftly flowing water. This constitutes a new record for Western Australia. It is also known from Queensland, Northern Territory and New Guinea.

Tandanus species 1.

- A1-3 (P25404-007), 11 specimens, 56-153 mm SL.
- A1-4 (P25405-004), 8 specimens, 65-81 mm SL.
- A1-5 (P25406-006), 1 specimen, 135 mm SL.
- A1-9 (P25410-007), 6 specimens, 85-140 mm SL.
- B1-2 (P25413-005), 2 specimens 92-98 mm SL.
- B1-3 (P25414-010), 7 specimens, 74-279 mm SL.
- B1-5 (P25416-001), 7 specimens, 69-77 mm SL.
- C1-1 (P25420-006), 5 specimens, 89-147 mm SL.

This species is apparently undescribed. It is closely related to *Tandanus ater* but particularly differs in the structure of the spines of the first dorsal and pelvic fins—soft and flexible in this species, strong and bony in *T. ater*. It appears to be widespread in the Drysdale and Carson Rivers as well as in their tributaries. Also known from the Isdell River, Western Australia, Katherine and Ferguson Rivers in the Northern Territory and Burdekin River in Queensland.

Tandanus species 2.

- C5-4 (P25427-008), 2 specimens, 81-95 mm SL.

This species is closely related to *T. glencoensis* but differs mainly in possessing noticeably smaller eyes. However, this may prove to be a variable character.

FAMILY BELONIDAE Longtoms or Needlefishes

Belone krefftii Günther.

Belone krefftii Günther, *Catalogue Fishes Brit. Mus.* 6: 250 (1866); type locality, Australia.

- B1-3 (P25414-004), 5 specimens, 61-329 mm SL.

Probably common in the larger pools of the Carson River. Found in freshwater rivers of northern Australia and New Guinea.

FAMILY MELANOTAENIIDAE Rainbowfishes

Nematocentris australis (Castelnau).

Neoatherina australis Castelnau, *Res. Fish, Austr. (Vict. Offic. Rec. Philad. Exhib):* 32 (1875); type locality, Western Australia

- KG-1 (P25429-001), 33 specimens, 26-62 mm SL.
- BR-1 (P25428-006), 4 specimens, 26-39 mm SL.

This species apparently replaces *Nematocentris* species 1 in the eastern streams of the Park. It is widely distributed throughout the Kimberley region.

Nematocentris species 1. Plate 14.

- A1-1 (P25402-006), 1 specimen, 53 mm SL.
- A1-3 (P25404-006), 4 specimens, 31-55 mm SL.
- A1-4 (P25405-001), 34 specimens, 18-57 mm SL.
- A1-5 (P25406-004), 5 specimens, 28-34 mm SL.
- A1-6 (P25407-007), 3 specimens, 28-34 mm SL.
- A1-7 (P25408-001), 14 specimens, 23-66 mm SL.
- A1-9 (P25410-005), 3 specimens, 29-61 mm SL.
- B1-1 (P25412-008), 8 specimens, 21-45 mm SL.
- B1-2 (P25413-003), 5 specimens, 21-42 mm SL.
- B1-3 (P25414-007), 3 specimens, 26-40 mm SL.
- B1-5 (P25416-004), 15 specimens, 21-37 mm SL.
- B1-8 (P25419-002) 29 specimens, 24-65 mm SL.
- C1-1 (P25420-010), 10 specimens, 49-67 mm SL.
- C1-3 (P25422-001), 28 specimens, 32-79 mm SL.
- C1-4 (P25423-001), 22 specimens, 22-45 mm SL.
- C5-1 (P25424-006), 5 specimens, 24-49 mm SL.
- C5-3 (P25426-003), 18 specimens, 19-56 mm SL.

An apparently undescribed species which differs from other members of the genus basically in colour pattern. It is known only from the Drysdale, Carson and King Edward river systems where it is abundant. It has a preference for small tributaries and bilabongs rather than large watercourses.

Nematocentris species 2. Fig. 1.

- A1-1 (P25402-007), 4 specimens, 54-60 mm SL.
- A1-3 (P25404-005), 19 specimens, 33-67 mm SL.
- A1-4 (P25405-002), 4 specimens, 30-42 mm SL.
- A1-5 (P25406-005), 3 specimens, 28-31 mm SL.
- A1-6 (P25407-008), 7 specimens, 30-54 mm SL.
- A1-7 (P25408-002), 7 specimens, 35-42 mm SL.
- A1-9 (P25410-006), 21 specimens, 34-71 mm SL.
- KG-1 (P25429-002), 47 specimens, 22-43 mm SL.
- BR-1 (P25428-001), 17 specimens, 19-46 mm SL.
- C1-1 (P25420-009), 33 specimens, 29-65 mm SL.
- C5-1 (P25424-007), 12 specimens, 30-58 mm SL.
- C5-3 (P25426-004), 7 specimens, 30-43 mm SL.
- C5-4 (P25427-006), 36 specimens, 33-67 mm SL.

This species is also apparently undescribed. It is characterised by its colour pattern and elongate body. It was collected from all areas of the Park with the exception of the Carson River near site B1. It has a preference for large watercourses. Known only from this area.



Figure 1—*Nematocentris* species 2, 67 mm SL (A1).

FAMILY ATHERINIDAE Hardyheads or Silversides

Craterocephalus majoriae Whitley. Fig. 2.

Craterocephalus majoriae Whitley, *Rec. Austr. Mus.* 22: 87 (1948); type locality, Eidsvold, Burnett River, Queensland.

- A1-5 (P25406-009), 2 specimens, 35-53 mm SL.
- A1-10 (P25411-001), 5 specimens, 50-52 mm SL.
- C5-1 (P25424-008), 5 specimens, 36-58 mm SL.

Collected only from side channels of the Drysdale River. It occurs from the Clarence River, New South Wales through Queensland and the Northern Territory and is now recorded for Western Australia.



Figure 2—*Craterocephalus majoriae*, 52 mm SL (A1).

FAMILY CENTROPOMIDAE Glassfishes

Ambassis agrammus Günther.

Ambassis agrammus Günther, *Ann. Mag. nat. Hist. ser. 3*, 20: 57 (1867); type locality, Cape York, Queensland.

A1-4 (P25405-005), 7 specimens, 20-31 mm SL.
A1-6 (P25407-009), 9 specimens, 20-39 mm SL.
A1-7 (P25408-003), 10 specimens, 17-37 mm SL.
KG-1 (P25429-003), 17 specimens, 26-35 mm SL.
BR-1 (P25428-002), 14 specimens, 21-33 mm SL.
C5-1 (P25424-009), 6 specimens, 25-36 mm SL.
C5-4 (P25427-011), 3 specimens, 33-35 mm SL.

Commonly found in areas of quiet water amongst water plants. Not collected from the Carson River basin. Distributed in freshwater streams of northern Australia and New Guinea.

Ambassis macleayi (Castelnau). Fig. 3

Pseudoambassis macleayi Castelnau, *Proc. Linn. Soc. N.S.W.* 3: 43 (1878); type locality, Norman River, Gulf of Carpentaria.

B1-1 (P25412-006), 29 specimens, 22-58 mm SL.
B1-3 (P25414-008), 6 specimens, 37-43 mm SL.

This species was collected only from the Carson River where it replaces *Ambassis agrammus*. Occurs in freshwater streams of Northern Australia and New Guinea. A new record for Western Australia.

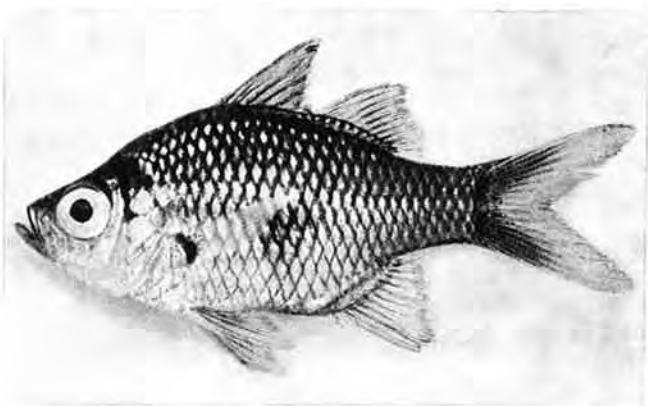


Figure 3—*Ambassis macleayi*, 58 mm SL (B1).

FAMILY TERAPONIDAE Grunters

Terapon unicolor (Günther).

Terapon unicolor Günther, *Catalogue Fishes Brit. Mus.* 1: 277 (1859); type locality, Mosquito Creek near Darling Downs, and Gwydir River, New South Wales.

A1-4 (P25405-006), 7 specimens, 48-96 mm SL.
A1-5 (P25406-001), 1 specimen, 45 mm SL.
A1-7 (P25408-005), 8 specimens, 51-110 mm SL.
A1-8 (P25409-003), 2 specimens, 92-94 mm SL.
KG-1 (P25429-004), 11 specimens, 39-117 mm SL.
B1-1 (P25412-001), 4 specimens, 61-88 mm SL.
B1-2 (P25413-002), 8 specimens, 43-66 mm SL.
B1-3 (P25414-002), 6 specimens, 49-95 mm SL.
B1-4 (P25415-001), 6 specimens, 46-89 mm SL.
B1-5 (P25416-002), 9 specimens, 36-79 mm SL.
B1-8 (P25419-001), 1 specimen, 46 mm SL.
C1-1 (P25420-001), 7 specimens, 75-121 mm SL.
C1-2 (P25421-003), 1 specimen, 127 mm SL.
C1-3 (P25422-002), 8 specimens, 44-113 mm SL.
C1-4 (P25423-002), 2 specimens, 44-55 mm SL.
C5-1 (P25424-003), 4 specimens, 39-65 mm SL.

This is probably the most common freshwater species of fish in northern Australia. It was collected or noticed at nearly every locality visited in the Park. It prefers tributaries and billabongs rather than main watercourses. This species may grow as large as 240 mm TL in areas where *Terapon jenkinsi* and *Terapon* species 1 are not present. Distributed from the Darling River, New South Wales to the Murchison River in Western Australia.

Terapon percoides (Günther).

Terapon percoides Günther, *Ann. Mag. nat. Hist. ser. 3* 14: 374 (1864); type locality, Fitzroy River, Queensland.

A1-1 (P25402-003), 2 specimens, 51-59 mm SL.
A1-3 (P25404-001), 6 specimens, 44-67 mm SL.
A1-5 (P25406-002), 2 specimens, 53-55 mm SL.
A1-6 (P25407-002), 13 specimens, 36-51 mm SL.
A1-8 (P25409-005), 2 specimens, 55-66 mm SL.
A1-9 (P25410-010), 6 specimens, 52-65 mm SL.
B1-1 (P25412-002), 6 specimens, 38-44 mm SL.
B1-3 (P25414-001), 11 specimens, 21-79 mm SL.
C1-1 (P25420-002), 9 specimens, 47-56 mm SL.
C5-1 (P25424-004), 4 specimens, 38-46 mm SL.
C5-4 (P25427-001), 10 specimens, 17-67 mm SL.

This species appears to prefer main watercourses as it was not collected from small tributaries in the Park. The number of body bars present on specimens collected from different localities was found to vary between 5 and 8. No specimens were found at sizes larger than 80 mm SL. Widely distributed in freshwater rivers of northern Australia.

Terapon jenkinsi (Whitley). Fig 4.

Mesopristes jenkinsi Whitley, *Aust. Zool.* 11: 26 (1945); type locality, Ivanhoe Station, Ord River, Western Australia.

A1-1 (P25402-001), 1 specimen, 104 mm SL.
A1-2 (P25403-001), 1 specimen, 224 mm SL.
A1-3 (P25404-001), 1 specimen, 111 mm SL.
A1-8 (P25409-002), 7 specimens, 67-103 mm SL.
A1-9 (P25410-002), 3 specimens, 49-62 mm SL.
BR-1 (P25428-003), 1 specimen, 230 mm SL.
B1-3 (P25414-003), 21 specimens, 37-104 mm SL.
B1-6 (P25417-001), 5 specimens, 250-290 mm SL.
B1-7 (P25418-001), 8 specimens, 120-240 mm SL.
C1-1 (P25420-003), 4 specimens, 72-141 mm SL.
C1-2 (P25421-002), 1 specimen, 134 mm SL.
C5-1 (P25424-001), 2 specimens, 205-260 mm SL.
C5-2 (P25425-001), 3 specimens, 114-211 mm SL.

Recorded as *Hephaestus fuliginosus* by Allen (1975:93) from the Prince Regent River. This species is abundant in the main water courses of the Park. The "blubber-lip" variety figured by Allen (1975:93, fig 6) was commonly collected. Widespread throughout the Kimberley region.



Figure 4—*Terapon jenkinsi*, 68 mm SL (A1).

Terapon species 1. Fig. 5.

- A1-2 (P25403-002), 1 specimen, 258 mm SL.
- A1-3 (P25404-003) 6 specimens, 40-179 mm SL.
- A1-6 (P25407-003), 1 specimen, 72 mm SL.
- A1-8 (P25409-001), 1 specimen, 270 mm SL.
- A1-9 (P25410-001), 4 specimens, 66-114 mm SL.
- C1-2 (P25421-001), 2 specimens, 198-318 mm SL.
- C5-1 (P25424-002), 1 specimen, 220 mm SL.
- C5-4 (P25427-002), 1 specimen, 109 mm SL.

An apparently undescribed species, closely related to *Terapon jenkinsi* from which it differs by possessing a relatively longer and shallower head. In addition, the lip fold on the ventral surface of the lower jaw is well separated medially rather than continuous, or nearly so, as in *T. jenkinsi*. One of the largest species of fish occurring in the Park, growing to over 320 mm SL. Known only from the Drysdale River and Palmoondoora Creek.



Figure 5—*Terapon* species 1, 72 mm SL (A1).

Terapon species 2. Fig. 6.

- A1-1 (P25402-002), 3 specimens, 82-94 mm SL.
- A1-3 (P25404-004), 45 specimens, 27-117 mm SL.
- A1-4 (P25405-010), 1 specimen, 65 mm SL.
- A1-5 (P25406-003), 1 specimen, 55 mm SL.
- A1-6 (P25407-004), 3 specimens, 50-67 mm SL.
- A1-8 (P25409-004), 1 specimen, 100 mm SL.
- A1-9 (P25410-003), 40 specimens, 33-118 mm SL.
- C1-1 (P25420-004), 10 specimens, 68-102 mm SL.
- C5-4 (P25427-004), 2 specimens, 97-114 mm SL.

This species was previously reported from the Kimberley region as theraponid species B by Allen (1975:94). It is common in the main watercourses of the Drysdale River and Palmoondoora Creek. It favours areas of moderate to swift flowing water. Known also from the upper Roe River and upper Prince Regent River.



Figure 6—*Terapon* species 2, 118 mm SL (A1).

Terapon species 3. Fig. 7.

- A1-3 (P25404-011), 1 specimen, 76 mm SL.
- C5-1 (P25424-005), 2 specimens, 143-151 mm SL.
- C5-4 (P25427-003), 3 specimens, 74-88 mm SL.

Previously collected by Rosen, Nelson and Butler (see Allen 1975:89) from the Northern Territory in 1969,

and is apparently undescribed. It was taken only from the Drysdale River and observed in abundance near site C5. It is now known to occur in the South Alligator, Katherine, East Mary, West Baines and Drysdale Rivers.



Figure 7—*Terapon* species 3, 143 mm SL (C5).

Terapon species 4. Fig. 8.

- A1-1 (P25402-004), 3 specimens, 75-84 mm SL.
- A1-3 (P25404-010), 7 specimens, 42-82 mm SL.
- A1-4 (P25405-007), 2 specimens, 85-95 mm SL.
- A1-9 (P25410-004), 30 specimens, 39-125 mm SL.

An apparently undescribed species, closely related to both *Terapon* species 2 and *Terapon* species 3. It may be distinguished from them by using the following key (for specimens over 65 mm SL):

1. (a) Ventral view of lower jaw triangular— 2
- (b) Ventral view of lower jaw semi-circular— *Terapon* species 3
2. (a) Outer series of teeth in one half of lower jaw numbering 17-33— *Terapon* species 4
- (b) Outer series of teeth in one half of lower jaw numbering 35-85— *Terapon* species 2

This species was collected only from the Drysdale River in the vicinity of site A1. It was always taken in association with *Terapon* species 2. Known only from this locality.



Figure 8—*Terapon* species 4, 125 mm SL (A1).

FAMILY APOGONIDAE Cardinalfishes

Glossamia aprion (Richardson).

Apogon aprion Richardson, *Ann. Mag. nat. Hist.* 9:16 (1842); type locality, King's River, near Victoria, Port Essington.

- B1-1 (P25412-009), 2 specimens, 39-47 mm SL.
- B1-3 (P25414-009), 3 specimens, 38-47 mm SL.

This species is distributed from coastal rivers of New South Wales to the Kimberley. Apparently not common in the Park as it was only collected from the Carson River.

FAMILY TOXOTIDAE Archerfishes

Toxotes chatareus (Hamilton-Buchanan). Fig. 9.

Coius chatareus Hamilton-Buchanan, Account of the Fishes found in the River Ganges and its branches: 101 and 370 (1822); type locality, Ganges River, India.

B1-1 (P25412-007), 8 specimens, 39-44 mm SL.

B1-6 (P25417-006), 4 specimens, 116-149 mm SL.

This species was collected only from the Carson River where it was commonly seen just below the surface of large pools. Found in brackish and freshwater rivers of northern Australia, Malaysia, Indonesia, New Guinea and South-east Asia.



Figure 9—*Toxotes chatareus*, 149 mm SL (B1).

FAMILY GOBIIDAE Gobies

Glossogobius giurus (Hamilton-Buchanan).

Gobius giurus Hamilton-Buchanan, Account of the Fishes found in the River Ganges and its branches: 51 and 366 (1822); type locality, Ganges River, India.

A1-3 (P25404-009), 6 specimens, 44-85 mm SL.

A1-4 (P25405-008), 7 specimens, 60-113 mm SL.

A1-6 (P25407-006), 7 specimens, 37-118 mm SL.

A1-9 (P25410-009), 5 specimens, 50-133 mm SL.

B1-1 (P25412-003), 10 specimens, 55-107 mm SL.

B1-2 (P25413-001), 11 specimens, 51-69 mm SL.

B1-3 (P25414-005), 8 specimens, 44-122 mm SL.

B1-5 (P25416-003), 3 specimens, 65-92 mm SL.

B1-8 (P25419-003), 4 specimens, 52-72 mm SL.

C1-1 (P25420-007), 9 specimens, 39-128 mm SL.

C5-1 (P25424-010), 5 specimens, 35-112 mm SL.

C5-4 (P25427-009), 9 specimens, 37-126 mm SL.

Common in the Drysdale and Carson Rivers where it prefers main watercourses. Widespread throughout northern Australia and the tropical Indo-West Pacific.

Mogurnda mogurnda (Richardson).

Eleotris mogurnda Richardson, Voy. Erebus and Terror: 4 (1844-48); type locality, Port Essington, Northern Territory.

A1-4 (P25405-009), 13 specimens, 25-57 mm SL.

A1-5 (P25406-007), 3 specimens, 30-43 mm SL.

A1-7 (P25408-004), 4 specimens, 25-56 mm SL.

KG-1 (P25429-006), 5 specimens, 33-41 mm SL.

BR-1 (P25428-005), 10 specimens, 23-60 mm SL.

C1-3 (P25422-003), 7 specimens, 40-73 mm SL.

C5-1 (P25424-011), 5 specimens, 24-40 mm SL.

C5-3 (P25426-002), 3 specimens, 25-38 mm SL.

Not collected from the Carson River area but abundant elsewhere. Prefers small tributaries and billabongs. Distributed in freshwater streams from northern Australia to New Guinea.

Bunaka herwerdenii (Weber). Fig. 10.

Eleotris herwerdenii Weber, *Notes Leyden Mus.* 32 (4): 238 (1910); type locality, Lorentz River, New Guinea.

B1-1 (P25412-004), 38 specimens, 21-103 mm SL.

B1-3 (P25414-006), 7 specimens, 39-87 mm SL.

Collected only from the Carson River where it prefers large pools of quiet water. Found in freshwater streams of northern Western Australia, Northern Territory and New Guinea.



Figure 10—*Bunaka herwerdenii*, 87 mm SL (B1).

Gobiid species. Fig. 11.

C5-4 (P25427-010), 2 specimens, 36-38 mm SL.

This species may represent an undescribed genus. It is similar to *Hyseleotris* and *Philypnodon* but the presence of vomerine teeth sets it apart. Collected only from one locality on the Drysdale River. It is known only from this record.

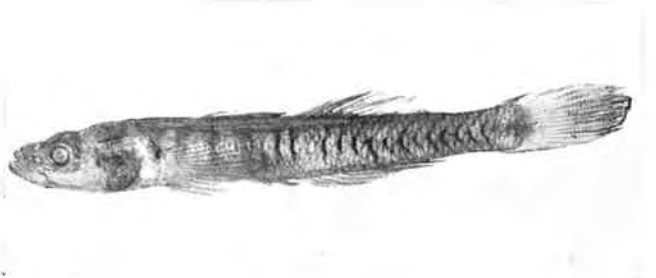


Figure 11—Gobiid species, 38 mm SL (C5).

DISCUSSION

In comparison with other major surveys of rivers of northern Western Australia, (McKay 1971; Allen 1975), the freshwater fish fauna of the Drysdale River National Park appears to be very rich. McKay's paper listed 17 species of freshwater fish from the Ord River and Allen collected 14 species from freshwater in the Prince Regent area. Work done in the Alligator Rivers area in the Northern Territory (Pollard 1974; Midgley 1973) has shown that the more northern rivers have greater numbers of freshwater fish species (Pollard—30 species, Midgley—33 species.) This is most likely due to a more favourable physical environment.

The species composition of the Drysdale River appears to be considerably different from that of the Carson River (see Table 1). Obvious discrepancies are the presence of *Arius australis*, *Belone krefftii*, *Glossamia aprion* and *Toxotes chatareus* in the Carson (B1) but not in the Drysdale (A1, C5); and *Tandanus glencoensis*, *Nematocentrus* species 2, and *Terapon* species 1, 2, 3, and 4 found in the Drysdale but not collected from the Carson. However, the fish fauna of Palmoondoora Creek (C1) which flows into the Carson River (via Morgan River, see Fig. 1 of Kabay; this publication) is very near that of the Drysdale River. This may be

explained by a comparison of the geological properties of sites A1, B1, and C1 (see Kabay, George and Kenneally; this publication). A1 and C1 were located on sandstone which holds water better than basaltic rock on which B1 was sited. Therefore, the Carson River at B1 is more likely to cease flowing and dry up before the others.

Noteworthy species replacement between the Drysdale and Carson rivers are *Ambassis agrammus* with *A. macleayi*, and *Mogurnda mogurnda* with *Bunaka herwerdenii*.

ACKNOWLEDGEMENTS

The author would like to thank the following specialists for help in determining the identities of species which proved difficult to identify: G. R. Allen, Western Australian Museum, Perth (Melanotoeniidae); M. N. Feinberg, American Museum of Natural History, New York (Plotosidae); D. Hoese, Australian Museum, Sydney (Gobiidae); W. Ivantsoff, Macquarie University, Sydney (Atherinidae); R. P. Varie, American Museum of Natural History, New York (Teraponidae). In most cases, the above workers are revising their respective

groups, and descriptions of several of the undescribed species listed in this report, particularly the teraponids and plotosids, are being prepared for publication.

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TABLE 1
SPECIES CONTENT FOR EACH COLLECTING STATION

	A1										BI										CI				C5			4													
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	1	2	3	4	1	2	3	1	2		3												
<i>Nematalosa erebi</i>	X					X																							X					X							
<i>Arius australis</i>				X		X	X																														X				
<i>Tandanus giencoensis</i>			X	X																																					
<i>Tandanus ater</i>			X	X																																					
<i>Tandanus species 1</i>			X	X																																					
<i>Tandanus species 2</i>			X	X																																					
<i>Belone krefftii</i>																																									
<i>Nematocentris australis</i>			X	X																																					
<i>Nematocentris species 1</i>			X	X																																					
<i>Nematocentris species 2</i>			X	X																																					
<i>Craterocephalus marjoriae</i>						X	X																																		
<i>Ambassis agrammis</i>						X	X																																		
<i>Ambassis macleayi</i>						X	X																																		
<i>Terapon unicolor</i>						X	X																																		
<i>Terapon percoides</i>						X	X																																		
<i>Terapon jenkinsi</i>						X	X																																		
<i>Terapon species 1</i>						X	X																																		
<i>Terapon species 2</i>						X	X																																		
<i>Terapon species 3</i>						X	X																																		
<i>Terapon species 4</i>						X	X																																		
<i>Glossamia aprion</i>						X	X																																		
<i>Toxotes chataneus</i>						X	X																																		
<i>Glossogobius giurus</i>						X	X																																		
<i>Mogurnda mogurnda</i>						X	X																																		
<i>Bunaka herwerdenii</i>						X	X																																		
<i>Gobiid species</i>						X	X																																		

PART X

REPORT ON THE MOLLUSC FAUNA OF THE DRYSDALE RIVER NATIONAL PARK NORTH KIMBERLEY, WESTERN AUSTRALIA

by H. E. MERRIFIELD¹, S. M. SLACK-SMITH¹, and B. R. WILSON¹

INTRODUCTION

A survey of the fauna and flora of the Drysdale River National Park in the North Kimberley conducted in August 1975 resulted in a collection of terrestrial and freshwater Mollusca totalling 34 species. The collection makes an interesting comparison with a similar collection made the previous year in the Prince Regent River Nature Reserve, in the North-West Kimberley. Many of the species are the same but there are significant differences in the fauna which reflect the different environmental conditions prevailing in these two large reserves.

Further study has improved the nomenclature of the molluscs listed in the report on the Prince Regent River Reserve Survey (Wilson & Smith 1975). The new collection from the Drysdale has helped to clarify some nomenclatural problems but has introduced an additional series of described and undescribed taxa. In the annotated systematic account which follows, the nomenclature has been researched as far as possible but in many cases confident determinations will require study of material from more localities and examination of types housed in eastern Australian and overseas museums. This account should be regarded as a provisional field report and not as a definitive taxonomic study.

All specimens are lodged in the collections of the Western Australian Museum.

COLLECTING STATIONS AND SPECIES FOUND

Two of the authors of this report (Slack-Smith and Wilson) participated in the field survey from 12th to 21st August 1975 specifically to collect molluscs. After leaving the Drysdale River National Park they visited several other Kimberley localities collecting molluscs but these specimens are not included in this report. Within the Park the authors collected extensively at many stations which covered as many habitat types as possible and which were grouped around the five sites—B1, B2, C1, C2 and C5. The last site actually lies just beyond the present northern boundary of the Park. The locations and descriptions of these stations are given in the following list, together with those of two supplementary stations on the Ashton and Drysdale Escarpments.

In addition, some molluscs were collected by other survey team members at sites not visited by the authors.

1. Ashton Range; gully in face of sandstone escarpment opening to the north-west; open eucalypt woodland with grass, a few fig trees and vines at head of gully; some fresh leaf litter under ledges and between boulders. 15° 11' S, 126° 48' E. B. R. Wilson and S. M. Slack-Smith.

Nesopupa sp. B, *Pupisoma circumlitum*, *Amimopina macleayi*, *Westracystis tentus*, *Pseudopeas interioris*, *Xanthomelon obliquirugosa*.

2. Deep gully at head of a tributary of the Drysdale River opening to the south, north of the Park; running stream cascading over sandstone boulders; fig trees and other large-leaved trees with vines; abundant leaf litter between boulders on sides of gully. 14° 35' S, 127° 02' E. B. R. Wilson and S. M. Slack-Smith.

Pupisoma circumlitum, *Amimopina macleayi*, *Westracystis tentus*, *Xanthomelon obliquirugosa*.

- A1. Drysdale River, A1 campsite. 15° 02' S, 126° 55' E. M. Upton; and rapids about 1 km south of A1 campsite, fast-flowing river, rocky bed. E. D. Kabay.

Notopala sp. B, *Notopala* sp. C.

- B1. Campsite on Orchid Creek at base of Carson Escarpment; open woodland with high grass. 14° 49' S, 126° 49' E. Grid ref. Sheet 4268, series R 611, 648:603. B. R. Wilson, A. A. Burbidge.

Xanthomelon obliquirugosa.

- B1-1a. Pool in Orchid Creek, with bed of dolerite and laterite rocks. Grid ref. as in B1-1. B. R. Wilson.

Amerianna sp.

- B1-1b. Small tributary of Orchid Creek, with sandy bed over clay. Grid ref. as in B1-1. B. R. Wilson, B. Hutchins.

Lymnaea sp., *Physastra* sp., *Ferrissia* sp., *Corbiculina* sp.

- B1-2. About 2 km west of B1-1; in low open eucalypt woodland, grass with sparse trees; deep fine brown soil and occasional ridges of basalt. Grid ref. Sheet 4268, series R611, 636:603. B. R. Wilson.

Gastrocopta sp. B form 2, *Pupoides anapacifica*, *Pseudopeas interioris*, *Amplirhagada* sp. form 1, *Xanthomelon obliquirugosa*.

- B1-3. At entrance to Glider Gorge; boulder ridge of Warton Sandstone between creek gullies; almost closed woodland of mixed eucalypts, with other large-leaved trees, *Pandanus* and high grass. Grid ref. Sheet 4268, series R611, 655:602. B. R. Wilson. (see Part III, fig. 10.)

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- Amplirhagada* sp. form 1, *Setobaudinia collingii*, *Xanthomelon obliquirugosa*, *Corbiculina* sp. (dead valve).
- B1-4.** Glider Gorge; scree slope on south side of gorge entrance; Warton Sandstone; some leaf litter under rocks. Grid ref. Sheet 4268, series R611, 657:599. B. R. Wilson. (see Part III, fig. 10.)
Amplirhagada sp. form 1, *Setobaudinia collingii*.
- B1-5.** Glider Gorge; about 0.5 km from entrance to gorge; steep scree slopes below Warton Sandstone ramparts; liane scrub with large-leaved trees; abundant leaf litter on slopes above creek. Grid ref. Sheet 4268, series R611, 662:600. B. R. Wilson. (see Part III, figs 10, 11, Col. Pl. 8.)
Gastrocopta sp. A, ?*Bensonella* sp., *Pupisoma circumlitum*, *Coneuplecta* sp., *Westracystis tentus*, *Pseudopeas interioris*, *Amplirhagada* sp. form 1, *Setobaudinia collingii*.
- B1-6.** Carson River at junction with Orchid Creek. Grid ref. Sheet 4268, series R611, 637:597. B. R. Wilson. (see Part III, fig. 12.)
Corbiculina sp.
- B1-7.** On Carson Escarpment about 0.5 km north of entrance to Glider Gorge; Warton Sandstone; foothill ridges and scree slopes below rampart. Grid ref. Sheet 4268, series R611, 658:617. B. R. Wilson. (See Part III, Col. Pl. 7.)
Amplirhagada sp. form 1.
- B1-8.** On Carson Escarpment about 1 km north of Glider Gorge; Warton Sandstone; at base of rampart, in crevice; liane scrub. Grid ref. Sheet 4268, series R611, 659:611. B. R. Wilson. (see Part III, Col. Pl. 7.)
Amplirhagada sp. form 1, *Setobaudinia collingii*.
- B2-1.** East of B2 campsite opposite junction of Drysdale River with Nymphaea Creek; at base of sandstone hills; open woodland of mixed eucalypts and low grass; almost no leaf litter. Grid ref. Sheet 4268, series R611, 766:605. S. M. Slack-Smith. (see Part III, fig. 13.)
Xanthomelon obliquirugosa.
- B2-2.** Ford across Drysdale River about 0.5 km north of junction with Nymphaea Creek; sandstone boulders and coarse sand with rapidly-flowing water. Grid ref. Sheet 4268, series R611, 780:615. S. M. Slack-Smith.
Notopala sp. A, *Velesunio wilsonii*, *Velesunio angasi*, *Corbiculina* sp.
- B2-3.** About 0.5 km north of Nymphaea Creek, about 1.5 km west of its junction with the Drysdale River; sandy soil with few small sandstone outcrops; open woodland of mixed species with grass and some fallen leaves; had been burned. Grid ref. Sheet 4268, series R611, 767:615. S. M. Slack-Smith. (see Part III, fig. 15.)
Pseudopeas interioris.
- B2-3a.** Creek near B2-3; running water, stony bottom with a little mud. Grid ref. as for B2-3. S. M. Slack-Smith.
Physastra sp.
- B3.** Johnson Creek, 1.6 km downstream from large pool. Grid ref. Sheet 4368, series R611, 940:655. W. K. Youngson.
Xanthomelon obliquirugosa.
- B3a.** Large pool in Johnson Creek. Grid ref. as in B3. W. K. Youngson.
Amerianna sp., *Velesunio angasi*.
- B4.** Drysdale River; narrow river bed with sandstone rocks covered with slimy black algal mat; fast-flowing water. 14° 40' S, 127° 00' E. (campsite). A. Chapman.
Notopala sp. B.
- C1-1.** Palmoondoor Creek above Morgan Falls; King Leopold Sandstone; eucalypt woodland with grass and *Triodia*. Grid ref. Sheet 4267, series R611, 488:371. B. R. Wilson, P. J. Fuller.
Xanthomelon obliquirugosa.
- C1-1a.** Pool in Palmoondoor Creek above Morgan Falls. Grid ref. as in C1-1. P. J. Fuller.
Amerianna sp., *Velesunio angasi*.
- C1-2.** Western side of Worriga Gorge on Palmoondoor Creek, about 0.5 km downstream from Morgan Falls; King Leopold Sandstone; liane thicket. Grid ref. Sheet 4267, series R611, 491:376. B. R. Wilson.
Nesopupa sp. A, *Nesopupa* sp. B, ?*Bensonella* sp., *Pupoides anapacifica*, *Pupisoma circumlitum*, *Amimopina macleayi*, *Stenopyllis coarctata*, *Coneuplecta* sp., *Westracystis tentus*, *Pseudopeas interioris*, *Amplirhagada* sp. form 1, *Setobaudinia collingii*.
- C1-2a.** Palmoondoor Creek in Worriga Gorge about 0.5 km downstream from Morgan Falls. Grid ref. as in C1-2. B. R. Wilson.
Lymnaea sp., *Velesunio angasi*, ?*Westralunio* sp., *Corbiculina* sp.
- C1-3.** Western side of Worriga Gorge on Palmoondoor Creek, about 2 km downstream from Morgan Falls; King Leopold Sandstone; wooded and grassy scree slope with sparse liane scrub. Grid ref. Sheet 4267, series R611, 491:389. B. R. Wilson. (see Part III, fig. 20 for similar habitat on eastern side of gorge.)
Coneuplecta sp., *Westracystis tentus*, *Amplirhagada* sp. form 1, ?*Gabbia* sp.
- C1-4.** Western rim of Worriga Gorge, about 1 km south of Morgan Falls; laterite boulders; open woodland of low eucalypts and high grass. Grid ref. Sheet 4267, series R611, 492:360. B. R. Wilson.
No molluscs.

- C1-5.** Elasmias Creek, 0.5 km upstream from junction with Palmoondoorra Creek below Morgan Falls; liane scrub on eastern slope of valley. Grid ref. Sheet 4267, series R611, 493:366. B. R. Wilson. (see Part III, fig. 21; Part X, fig. 1.)
Elasmias sp., *Nesopupa* sp. A, *Nesopupa* sp. B, *Gastrocopta* sp. B form 1, *Pupoides hedleyi*, *Pupisoma circumlitum*, *Amimopina macleayi*, *Coneuplecta* sp., *Liardetia* sp., *Westracystis tentus*, *Setobaudinia collingii*.
- C1-5a.** Elasmias Creek; quiet-flowing stream with shallow pools; stony bottom with some sand, water plants and dead leaves. Grid ref. as in C1-5. B. R. Wilson. (see Part X, fig. 2.)
Lymnaea sp., *Amerianna* sp., *Physastra* sp., *Gyraulus* sp., *Ferrissia* sp.
- C1-6.** Worriga Gorge on Palmoondoorra Creek, western side of gorge just south of Morgan Falls; King Leopold Sandstone; tall grass on deep red soil. Grid ref. Sheet 4267, series R611, 489:369. B. R. Wilson.
Gastrocopta sp. B form 1, *Pupoides anapacifica*, *Westracystis tentus*, *Pseudopeas interioris*, *Setobaudinia collingii*.
- C1-7.** East side of valley of Colochasia Creek entering Palmoondoorra Creek to the north-east of Worriga Gorge; King Leopold Sandstone; high grass and eucalypts; some litter beneath rocks. Grid ref. Sheet 4267, series R611, 490:394. B. R. Wilson.
Westracystis tentus, *Pseudopeas interioris*, *Setobaudinia collingii*, *Xanthomelon obliquirugosa*.
- C1-8.** Eastern bank of Palmoondoorra Creek in Worriga Gorge; basaltic outcrop in bottom of gorge adjacent to creek; fig trees. Grid ref. Sheet 4267, series R611, 492:388. B. R. Wilson.
Succinea sp., *Setobaudinia collingii*.
- C2-1.** West of Carson River and north of its junction with Woorakin Creek; Carson Volcanics; low hills with rock outcrops at summits and on slopes; sparse low eucalypts with grass and *Triodia*; very little leaf litter. Grid ref. Sheet 4267, series R611, 585:347. S. M. Slack-Smith. (see Part III, fig. 23.)
Pupoides anapacifica, *Pseudopeas interioris*, *Setobaudinia collingii*, *Xanthomelon obliquirugosa*.
- C2-1a.** At base of hills at junction of Carson Volcanics and King Leopold Sandstone; sparse low eucalypts, few small shrubs and grass. Grid ref. as in C2-1. S. M. Slack-Smith.
No molluscs.
- C2-2.** East of Carson River just south of its junction with Woorakin Creek; dry creek bed in Carson Volcanics with some sandstone boulders; tall grass. Grid ref. Sheet 4267, series R611, 585:340. S. M. Slack-Smith.
Amplirhagada sp. form 2, *Setobaudinia collingii*.
- C2-3.** Creek flowing west into Carson River about 0.5 km north of junction with Woorakin Creek; above low waterfall about 0.5 km from river; shallow water flowing over Carson Volcanics with areas of sedges, overhung by broad-leaved trees. Grid ref. Sheet 4267, series R611, 590:345. S. M. Slack-Smith.
Lymnaea sp., *Gyraulus* sp., *Amplirhagada* sp. form 2, *Xanthomelon obliquirugosa*.
- C2-3a.** Below waterfall about 0.5 km from river; swampy ground with tall grass and few eucalypts. Grid ref. as in C2-3. S. M. Slack-Smith.
Lymnaea sp., *Amplirhagada* sp. form 2, *Setobaudinia collingii*.
- C2-4.** Carson River about 0.5 km north of junction with Woorakin Creek; fast-flowing water over rock, and backwaters with coarse sand; large *Melaleuca* trees and *Pandanus*. Grid ref. Sheet 4267, series R611, 589:348. S. M. Slack-Smith.
Corbiculina sp.
- C2-5.** Woorakin Creek just upstream from C2 campsite; area off main creek bed sheltered by low sandstone cliffs with seepage from walls; overhung by figs and other broad-leaved trees; abundant leaf litter. Grid ref. Sheet 4267, series R611, 571:346. S. M. Slack-Smith. (see Part X, fig. 3.)
Nesopupa sp. B, *Gastrocopta* sp. A, *Gastrocopta* sp. B form 1, *Pupisoma circumlitum*, *Stenopylis coarctata*, *Westracystis tentus*, *Pseudopeas interioris*.
- C2-6.** At edge of plateau and on south-east wall of Woorakin Creek Gorge about 1 km upstream from C2 campsite; fig trees growing on ledges in sandstone cliff about 6 m above stream level; sparse leaf litter in deep sheltered crevices among boulders. Grid ref. Sheet 4267, series R611, 565:345. S. M. Slack-Smith.
Gastrocopta sp. A, *Gastrocopta* sp. B form 1, *Bensonella* sp., *Stenopylis coarctata*, *Westracystis tentus*, *Pseudopeas interioris*, *Setobaudinia collingii*.
- C2-7.** Woorakin Creek Gorge about 2 km upstream from C2 campsite; north-west side of narrow gorge with *Melaleuca* trees and *Pandanus* on floor, and fig trees on ledges of wall about 3-5 m above clear fast-flowing stream; no accumulation of leaf litter on gorge floor, but some litter below fig trees on ledges. Grid ref. Sheet 4267, series R611, 555:341. S. M. Slack-Smith.
Gastrocopta sp. B form 1, *Bensonella* sp., *Stenopylis coarctata*, *Westracystis tentus*.
- C2-8.** East of Carson River about 0.5 km south of junction with Woorakin Creek; Carson Volcanics; rocky foothills at base of Carson Escarpment; open woodland of low eucalypts and grass. Grid ref. Sheet 4267, series R611, 583:337. S. M. Slack-Smith.
Setobaudinia collingii.

- C2-9.** Carson River about 0.5 km south of junction with Woorakin Creek; fast-flowing river over sandstone with banks of coarse muddy sand; *Melaleuca* trees and tall *Pandanus*. Grid ref. Sheet 4267, series R611, 580:339. S. M. Slack-Smith.
Ferrissia sp., *Corbiculina* sp.
- C2-10.** East bank of Carson River south of junction with Woorakin Creek; stagnant pools in muddy coarse sand; decaying *Pandanus* leaves. Grid ref. Sheet 4267, series R611, 582:338. S. M. Slack-Smith.
Gyraulus sp., *Corbiculina* sp.
- C2-10a.** West bank of Carson River; stagnant pools in fine alluvial soil; large *Melaleuca* trees and *Pandanus*. Grid ref. Sheet 4267, series R611, 579:339. S. M. Slack-Smith, K. F. Kenneally, N. L. McKenzie.
Lymnaea sp., *Amerianna* sp., *Physastra* sp., *Gyraulus* sp., *Corbiculina* sp.
- C2-11.** Above south-east wall of Woorakin Creek Gorge about 1 km upstream from C2 campsite; dissected sandstone with sparse eucalypts and *Triodia*, and fig trees growing in fissures. Grid ref. Sheet 4267, series R611, 560:342. S. M. Slack-Smith.
Nesopupa sp. B, *Gastrocopta* sp. A, *Pseudopeas interioris*.
- C2-11a.** Plateau on north-west side of Woorakin Creek Gorge near C2-11; sandstone; low eucalypts and *Triodia*; display bower of Great Bowerbird. Grid ref. Sheet 4267, series R611, 560:341. J. Dell.
Xanthomelon prudhoensis.
- C2-12.** South-east wall of Woorakin Creek Gorge about 1 km upstream from C2 campsite; deep fissure at edge of sandstone cliff shaded by fig trees and other large-leaved trees; abundant leaf litter. Grid ref. Sheet 4267, series R611, 560:342. S. M. Slack-Smith.
Nesopupa sp. B, *Gastrocopta* sp. A, *Westracystis tentus*, *Pseudopeas interioris*.
- C2-13.** Woorakin Creek above falls about 2.5 km west of C2 campsite; open woodland of mixed eucalypts, shrubs and grass. Grid ref. Sheet 4267, series R611, 550:340. S. M. Slack-Smith.
No molluscs.
- C2-14.** In Woorakin Creek Gorge just downstream from falls; ledges on north-west sandstone wall 3-6 m above level of stream; leaf litter under fig trees. Grid ref. Sheet 4267, series R611, 551:342. S. M. Slack-Smith.
No molluscs.
- C2-14a.** Ledges about 3-4.5 m above stream level on south-east sandstone wall; leaf litter under large-leaved trees. Grid ref. as in C2-14. S. M. Slack-Smith.
Nesopupa sp. B, *Gastrocopta* sp. A, *Gastrocopta* sp. B form 1, *Pseudopeas interioris*.
- C4.** Carlia Creek running into Carson Escarpment 1-2 km east of Carson River; edge of sandstone cliffs; open liane thicket; leaf litter. 15° 01' S, 126° 49' E. R. Johnstone.
Westracystis tentus, *Amplirhagada* sp. form 2, *Setobaudinia collingii*, *Xanthomelon prudhoensis*.
- C5a.** Dysphania Gorge, upstream from campsite. 14° 39' S, 126° 56' E. M. Upton.
Xanthomelon obliquirugosa.
- C5b.** Sandy pool near C5 campsite at Dysphania Gorge. 14° 39' S, 126° 56' E. B. Hutchins.
Velesunio wilsonii, *Velesunio angasi*, *Corbiculina* sp.
- C5-1.** Forest Creek about 0.2 km upstream from C5 campsite at Dysphania Gorge; on banks of stream; woodland of mixed eucalypts, *Livistona* palms and shrubs; some leaf litter under sandstone boulders. Grid ref. Sheet 4268, series R611, 785:790. S. M. Slack-Smith.
Setobaudinia collingii.
- C5-2.** Forest Creek about 0.4 km upstream from C5 campsite at Dysphania Gorge; south-west side of creek on steep boulder slope about 2 m above stream level; shaded by figs and other large-leaved trees; litter among boulders; had been burned about one year previously. Grid ref. Sheet 4268, series R611, 768:789. S. M. Slack-Smith.
Westracystis tentus, *Setobaudinia collingii*.
- C5-3.** Forest Creek about 0.5 km upstream from C5 campsite at Dysphania Gorge; north-east side of creek about 6 m above stream level; large-leaved trees and *Livistona* palms; leaf litter among sandstone boulders; had been burned perhaps two or more years previously. Grid ref. Sheet 4268, series R611, 786:788. S. M. Slack-Smith.
Westracystis tentus, *Amplirhagada* sp. form 2, *Setobaudinia collingii*, *Xanthomelon obliquirugosa*.
- C5-4 & 5.** Forest Creek about 0.75 km upstream from C5 campsite at Dysphania Gorge; sides of valley with 45° slope; large sandstone boulders shaded by large-leaved trees and *Pandanus*; leaf litter between boulders and in crevices about 6 m above stream level. Grid ref. Sheet 4268, series R611, 786:785. S. M. Slack-Smith.
Westracystis tentus, *Setobaudinia collingii*, *Xanthomelon obliquirugosa*.
- C5-6.** Forest Creek about 1 km upstream from C5 campsite at Dysphania Gorge; sides of valley with 60° slope; dense forest of large-leaved trees and lianes; shaded ground with sandstone boulders and abundant but dry leaf litter. Grid ref. Sheet 4268, series R611, 792:778. S. M. Slack-Smith.
Westracystis tentus, *Amplirhagada* sp. form 2, *Setobaudinia collingii*.

LIST OF SPECIES

LAND MOLLUSCS

GASTROPODA: PULMONATA

FAMILY TORNATELLINIDAE

Subfamily Auricullelinae.

Elasmias sp. cf. *E. wakefieldiae* (Cox, 1868).

= *E. eucharis* (Brazier, 1876) and *E. terrestris* Brazier, 1876). (See Pilsbry and Cooke, 1915; I. Rensch, 1937).

Recorded at C1-5.

Found alive in liane scrub on underside of leaves of large trees *Diospyros nitens*, *Canarium australianum*, *Randia cochinchinensis*, *Cassine melanocarpa* and on trunk of small tree *Celtis philippensis*.

FAMILY VERTIGINIDAE.

Subfamily Nesopupinae.

Nesopupa sp. A.

Shell shape, sculpture and apertural teeth have much in common with *Nesopupa* (*Indopupa*) *moreleti* (Brown, 1875) from the Philippines, Borneo etc. (See Pilsbry and Cooke, 1920).

Recorded at C1-2, C1-5.

Found alive in liane scrub under bark of *Ficus* and *Pouteria*, on lichen-covered trunk of *Diospyros nitens* and trunk of small tree *Celtis philippensis*.

Nesopupa sp. B.

= *Pupa mooreana* Smith, 1894.

P. mooreana was placed in *Gastrocopta* by Pilsbry in 1917, and in *Australbinula* (*Westracopta*) by Iredale in 1939, both of which are chondrinid genera. Shell shape, sculpture and apertural teeth of this species fit *Nesopupa* better than *Gastrocopta* and show a close resemblance to the Indo-Malayan vertiginids *Nesopupa* (*Insulipupa*) *barrackporensis* (Gude, 1914) and *N. (I.) malayana* (Issel, 1874) (See Pilsbry and Cooke, 1920).

Recorded at 1, C1-2, C1-5, C2-5, C2-11, C2-12, C2-14a.

Alive and dead. Found in leaf litter in liane scrub, and low on tree trunks.

FAMILY CHONDRINIDAE.

Subfamily Gastrocoptinae.

**Gastrocopta* sp. A cf. *G. mcdonnelli* (Brazier, 1875).

? = *G. macleayi* (Brazier, 1876) (See Pilsbry, 1916).

= Prince Regent River Nature Reserve *Australbinula* sp.

The large down-turned columellar lamella relates this species to subgenus *Sinalbinula* Pilsbry, 1916, rather than *Australbinula* Pilsbry, 1916 in which the lamella recedes upwards.

Recorded at B1-5, C2-5, C2-6, C2-11, C2-12, C2-14a.

Found dead in leaf litter in sheltered places in liane scrub and under fig trees.

Gastrocopta sp. B cf. *G. pediculus* (Shuttleworth, 1852). (See Pilsbry, 1916).

Gastrocopta sp. B is smaller and more cylindrical in shape than sp. A and has a horizontal columellar lamella. Two forms were found, both of similar size, colour, shape and position of basic teeth, but differing in number and thickness of teeth.

Form 1: 5-6 apertural teeth, basal tooth usually missing.

Recorded at C1-5, C1-6, C2-5, C2-6, C2-7, C2-14a.

Found dead and alive in small numbers in leaf litter in sheltered places in liane scrub and under fig trees, also under dead log in grassy area.

Form 2: 8 apertural teeth when fully mature, including infraparietal, interpalatal and almost sub-columellar basal tooth. Teeth are usually thicker than in Form 1.

Recorded at B1-2.

Alive and dead. Found under dead burnt log in grassy eucalypt woodland.

Subfamily Hypselostomatinae.

? *Bensonella* (*Paraboysidia*) sp.

Genus uncertain, possibly undescribed. Shell characters come closest to *Paraboysidia* Pilsbry, 1917, but there are marked differences in apertural teeth. (See Pilsbry, 1917, van Benthem Jutting, 1952, Zilch, 1959-60).

Recorded at B1-5, C1-2, C2-6, C2-7.

Found dead in small numbers in leaf litter in crevices and under stones in liane scrub and below fig trees in gorges.

FAMILY PUPILLIDAE.

Subfamily Pupillinae.

Pupoides (*Glyptopupoides*) *hedleyi* Pilsbry, 1926.

Recorded at C1-5.

Found alive under bark of living tree in liane scrub and in leaf litter below.

* *Pupoides* (*Themapupa*) *anapacifica* Iredale, 1939.

? = *Pupa pacifica* Pfeiffer, 1846.

Recorded at B1-2, C1-2, C1-6, C2-1.

Found alive and dead in caves, crevices, under rocks, in leaf litter under liane scrub and under logs in grassy eucalypt woodland.

FAMILY VALLONIIDAE.

Subfamily ?*Acanthinulinae*.

Pupisoma (*Imputegla*) *circumlutum* Hedley, 1897.

Pilsbry considered that this species could be a form of *Pupisoma orcula* (Benson, 1850) which is known from Africa, India, Japan, the Philippines and Indonesia (See Pilsbry, 1920).

Recorded at 1, 2, B1-5, C1-2, C1-5, C2-5.

Found alive and dead on trunk of trees *Celtis philippensis* and *Diospyros nitens* and in leaf litter in liane scrub and under fig trees.

* Indicates also found in Prince Regent River Nature Reserve.

FAMILY ENIDAE.

Subfamily Cerastuinae.

**Amimopina macleayi* (Brazier, 1876).

= Prince Regent River Nature Reserve *Amimopina* sp.

All Australian *Amimopina* are now considered to be the same species. (See Solem, 1964).

Recorded from 1, 2, C1-2, C1-5.

Found alive and dead on *Pouteria* and *Ficus* trees, and under stones in liane scrub.

FAMILY SUCCINEIDAE.

Subfamily Succineinae.

Succinea (*Austrosuccinea*) sp.

Placed in *Austrosuccinea* because of faint criss-cross sculpture on shell. (See Solem, 1959). Average height of shell is 5 mm.

Recorded at C1-8.

Found alive on bark of fig tree.

FAMILY HELICODISCIDAE. (See Solem, 1975).

**Stenopylis coarctata* (Moellendorff, 1894).

Recorded at C1-2, C2-5, C2-6, C2-7.

Found dead and alive in leaf litter under fig trees and on dry rock ledges.

FAMILY HELICARIONIDAE.

Subfamily Euconulinae.

**Coneuplecta* sp.

= Prince Regent River Nature Reserve "punctid" sp. A.

This species corresponds well to *Helix* (*Conulus*) *elleryi* described by Brazier in 1875 from Fitzroy Island, N.E. Australia and placed in the genus *Eclipsea* by Iredale in 1937. It also bears a close resemblance to the Indo-Pacific species *Coneuplecta* (*Sitalina*) *microconus* (Mousson, 1865). (See Baker, 1938; Solem, 1959; van Benthem Jutting, 1950).

Recorded at B1-5, C1-2, C1-3, C1-5.

Found alive on dead leaves in litter under stones in liane scrub, and dead in leaf litter.

Subfamily Microcystinae.

**Liardetia* sp.

= Prince Regent River Nature Reserve "punctid" sp. B.

This species is very similar to *Helix* (*Conulus*) *russelli* Brazier, 1875, also described from Fitzroy Island, N.E. Australia, and subsequently placed in the genus *Sodaleta* by Iredale in 1937. It is possibly synonymous with the Indonesian *Liardetia* (*Belopygmeus*) *doliolum* (Pfeiffer, 1846), and differs from the Pacific *L. samoensis* (Mousson, 1865), which has similar shell characteristics, in the paler pigmentation of the animal and in the numerous faint striations on the base of the shell. (See Baker, 1938; Solem, 1959; van Benthem Jutting, 1950).

Recorded at C1-5.

Found alive and dead in liane scrub on trunks of trees *Celtis philippensis*, *Ficus* sp. cf. *F. virens*, *Pouteria* sp., lichen-covered trunk of the shrub *Diospyros nitens*, on dead leaves caught by vines, and dead in leaf litter below.

**Westracystis tentus* Iredale, 1939.

? = *Lamprocystis lissa* Smith, 1894.

All specimens found had engraving on the intrusive keel entering the umbilicus which Iredale stated separated *tentus* from *lissa*, though the engraving may have been missed by Smith because of the gum-like substance which often fills the umbilicus. The species has been left in the genus *Westracystis* Iredale, 1933, because its umbilical features fall between *Lamprocystis* Pfeiffer, 1883 and *Microcystis* Beck, 1837 i.e. it has the spiral cord on the columella like *Lamprocystis*, but is umbilicate like *Microcystis*. (See Iredale, 1939; Baker, 1941).

Recorded at 1, 2, B1-5, C1-2, C1-3, C1-5, C1-6, C1-7, C2-5, C2-6, C2-7, C2-12, C4, C5-2, C5-3, C5-4, C5-5, C5-6.

Found alive and dead in leaf litter in crevices, under boulders and stones, and under trees in liane scrub.

FAMILY SUBULINIDAE.

Subfamily Subulininae.

**Pseudopeas* (*Eremopeas*) *interioris* (Tate, 1894).

= Prince Regent River Nature Reserve *Eremopeas* sp.

This species of *Eremopeas* was first described from Central Australia but appears to be widely distributed in the Kimberley district of Western Australia. (Solem, pers. comm., 1976; see also Pilsbry, 1906).

Recorded at 1, 2, B1-2, B1-5, B2-3, C1-2, C1-6, C1-7, C2-1, C2-5, C2-6, C2-11, C2-12, C2-14a.

Found aestivating and dead in soil and leaf litter in small caves, crevices, under stones, boulders and trees in liane scrub, and under logs near base of trees in grassy eucalypt woodland.

FAMILY CAMAENIDAE.

Subfamily Camaeninae.

Amplirhagada sp.

Form 1 recorded at B1-2, B1-3, B1-4, B1-5, B1-7, B1-8, C1-2, C1-3.

Form 2 recorded at C2-2, C2-3, C2-3a, C4, C5-3, C5-6.

Conchologically similar to an undescribed species from the Prince Regent River Nature Reserve (camaenid species A and B), but is most closely related to another undescribed species from Kalumburu. Form 1 is consistently larger and has a nearly-closed umbilicus. (Solem, pers. comm., 1977).

Both forms were found alive and dead under boulders near caves, under slabs on scree slopes, in leaf litter under stones in liane scrub and grassy eucalypt woodland.

**Setobaudinia collingii* (Smith, 1893).

= Prince Regent River Nature Reserve *Setobaudinia* sp.

This species corresponds very well to the type description of *S. collingii*. (See Iredale, 1939).

Recorded at B1-3, B1-4, B1-5, B1-8, C1-2, C1-5, C1-6, C1-7, C1-8, C2-1, C2-2, C2-3a, C2-6, C2-8, C4, C5-1, C5-2, C5-3, C5-4, C5-5, C5-6.

Found alive and dead in soil and leaf litter in small caves, crevices, on bark of fig tree, in leaf litter under liane scrub, and under boulders in grassy eucalypt woodland.

Xanthomelon obliquirugosa (Smith, 1894).

The shell has characteristic obliquely-wrinkled sculpture, especially on the earlier whorls. (See Smith, 1894).

Recorded at 1, 2, B1, B1-2, B1-3, B2-1, B3, C1-1, C1-7, C2-1, C2-3, C5a, C5-3, C5-4, C5-5.

Found alive and dead in soil and leaf litter in crevices between boulders, under rocks, on ledges and under trees in liane scrub and grassy eucalypt woodland.

**Xanthomelon prudhoensis* (Smith, 1894).

=Prince Regent River Nature Reserve *Xanthomelon* sp.

Recorded at C2-11a, C4.

Found dead in bowerbird's bower on plateau and at edge of escarpment cliffs.

FRESHWATER MOLLUSCS

GASTROPODA: PROSOBRANCHIA

FAMILY VIVIPARIDAE.

Subfamily Bellyaminae.

Notopala sp. A cf. *N. essingtonensis* (Frauenfeld, 1862). (See Prashad, 1928; Cotton, 1935).

Shell green, with dark spiral bands; whorls with slight peripheral and pre-sutural angulations; aperture sub-ovate; microscopic spiral sculpture.

Recorded at B2-2.

Found dead on flood plains alongside Drysdale River.

Notopala sp. B.

Shell black, unbanded; whorls more inflated than sp. A, with only occasional peripheral angulation; aperture and sculpture similar to sp. A, to which it seems closely related; embryo shells with spiral bands of periostracal chaetae posterior to the periphery of the body whorl.

Recorded at A1, B4.

Found alive grazing on rocks covered with slimy black algal mat in fast-flowing river.

Notopala sp. C.

Shell green, unbanded; whorls not angulated; aperture semi-lunate; sculptured with clearly visible spiral lirae; periostracum densely pilose along lirae of body whorl.

Recorded at A1.

Found dead with sp. B.

FAMILY BITHYNIIDAE

?*Gabbia* sp.

Recorded at C1-3.

One dead specimen found among terrestrial species in leaf litter in gorge, presumably flood debris.

GASTROPODA: PULMONATA

FAMILY LYMNAEIDAE.

Subfamily Lymnaeinae.

**Lymnaea* sp. or spp.

Lymnaeids from Northern Australia of similar form to Drysdale River National Park and Prince Regent River Nature Reserve species have been attributed to *Lymnaea lessoni* (Deshayes, 1831) by Hubendick, 1951 and Boray (pers. comm. to W.A. Department of Agriculture, 1970, 1972). Hubendick also refers to the presence in Darwin of *Lymnaea tomentosa* (Pfeiffer, 1855), but considered that this may have been introduced. Further investigation is needed to establish the identity of the Kimberley lymnaeids.

Recorded at B1-1b, C1-2a, C1-5a, C2-3, C2-3a, C2-10a.

Found alive in shallow pools with stony or sandy bottom, water weeds and decaying leaves. Juveniles found on *Naias* and attached to the "roots" of the floating fern *Marsilea*.

FAMILY PLANORBIDAE.

Subfamily Planorbinae.

Amerianna sp. cf. *A. carinata* (H. Adams, 1861).

North-western Australian *Amerianna* have been identified as *A. carinata* by Butot, 1954.

Recorded at B1-1a, B3a, C1-1a, C1-5a, C2-10a.

Found alive in large stagnant pools, or pools in slow-flowing creeks.

Physastra sp.

Recorded at B1-1a, B1-1b, B2-3a, C1-5a, C2-10a.

Found alive in slow-flowing streams and crawling on sand in shallow pools.

Gyraulus sp.

Recorded at C1-5a, C2-3, C2-10, C2-10a.

Found alive on aquatic plants and ferns, under stones and rotting leaves in pools in slow-flowing streams and in stagnant billabongs.

FAMILY ANCYLIDAE.

Ferrissia (Pettancylus) sp. cf. *F. (P.) petterdi* (Johnston, 1879).

North-western Australian species of *Pettancylus* have been placed in the form group *petterdi* by Hubendick, 1967.

Recorded at B1-1b, C1-5a, C2-9.

Found alive on rotting vegetation in pools in slow-flowing streams.

BIVALVIA

FAMILY HYRIIDAE.

Subfamily Velesunioninae.

**Velesunio wilsonii* (Lea, 1859).

Recorded at B2-2, C5b.

Found alive and dead in sandy river banks.

**Velesunio angasi* (Sowerby, 1867).

Recorded at B2-2, B3a, C1-1a, C1-2a, C5b.

Found alive and dead in sandy river banks and pools.

?*Westralunio* sp.

One pair of worn valves with large serrated cardinal teeth characteristic of *Westralunio* was found with *Velesunio angasi*. If identification is confirmed, this would represent an extension of range for a genus which is at present recorded only from South-Western Australia and New Guinea. (See McMichael and Hiscock, 1958).

Recorded at C1-2a.

Found dead in pool.

FAMILY CORBICULIDAE.

Corbiculina sp.

Recorded at B1-1b, B1-3, B1-6, B2-2, C1-2a, C2-4, C2-9, C2-10, C2-10a, C5b.

Found alive in sandy pools and dead in sand of river banks.

DISCUSSION

The list of species is unlikely to include the whole molluscan fauna of the Drysdale River National Park although our collecting was sufficiently thorough for us to be confident that it includes the majority of species which live there.

Table 1 compares the terrestrial molluscan faunas of the Drysdale River National Park and the Prince Regent River Nature Reserve, and gives a simplified indication of the habitats in which the snails live.

The most striking difference between the two reserves is the diverse fauna of camaenids (16 species) in grassed sandstone ridges and open-woodland country in the Prince Regent River Reserve, and the relative paucity of this family (4 species) in comparable habitats in the Drysdale area. The list of collecting stations may suggest habitat bias in our selection of collecting sites in the Drysdale in favour of liane thickets and other shaded places with deep leaf litter. Yet we tramped many miles across open-woodland and grassed sandstone and laterite ridges and gullies on our prospecting traverses. Few traces of molluscs were found there which is the reason so few collecting stations were established in those habitats. We are confident that camaenids are in fact poorly represented in the Drysdale country.

Table 1 shows a greater variety of arboreal snails in the Drysdale liane thickets than in similar habitats in the Prince Regent River Reserve. All three Prince Regent arboreal snails (*Amimopina macleayi*, *Coneuplecta* sp. and *Liardetia* sp.) were present in the Drysdale plus five additional species (*Elasmias* sp., *Nesopupa* sp. A, *Pupoides hedleyi*, *Pupisoma circumlitum*, and a very small *Succinea* sp.). Although living specimens of most of these species were sometimes found in leaf litter on the ground, their normal dry season habitat seems to be on

the trunks or leaves of trees in dense shaded thickets along the sides of gorges. All eight species were found alive sealed by a thin layer of mucus to the underside of leaves or to bark. Though the liane thickets were deeply shaded and relatively cool, the soil and ground litter were very dry and the arboreal snails were evidently aestivating over the dry season. Whether or not they remain and feed on the trees during the wet season is unknown.

Thus, while on the one hand it is apparent that the Prince Regent River Reserve is rich in camaenids and poor in arboreal snails, the Drysdale River National Park has a relatively diverse arboreal fauna and is poor in camaenids. The dryer conditions prevailing in the Drysdale area could perhaps explain the paucity of camaenids there but it is difficult to explain the greater variety of arboreal snails in the same terms. It seems likely that historical factors are involved as well as present day environmental conditions. Iredale (1937) and McMichael & Iredale (1959) have shown the whole Kimberley Block as lying within the "Caurine Faunula" area of North-Western Australia, west of its boundary with the "Torresian Faunula" area which includes most of the Northern Territory and north-eastern Queensland. The Caurine Faunula was said to be characterized by the predominance of the "*Rhagada*" group of camaenid species which is represented in the Prince Regent area but apparently absent in the Drysdale. The ground-living pupoid snails and most of the arboreal species seem to have their close affinities with the fauna of the Torresian region. Perhaps the North-West Kimberley molluscan fauna is basically Caurine, enriched with a few Torresian species, while the North Kimberley supports a westwards and possibly impoverished extension of the Torresian fauna. Much more study of the relationships and distribution of Kimberley land snails is needed to throw light on this question.

Table 2 shows the habitats of freshwater molluscs in these survey areas. It also illustrates the paucity of species in the Prince Regent River Reserve. In this case the faunal difference between the two reserves is probably due to very different terrain and character of the streams. Though the Prince Regent River itself is a large stream, it has a straight rocky course. Even in the dry season it flows relatively fast and there are few sandy pools and billabongs. Similarly, the smaller ephemeral streams flow along narrow gorges and fissures cut into the rugged sandstone terrain. In contrast the Drysdale and the Carson are wide rivers flowing over plains country with a deep soil. Extensive sandy pools and billabongs remain as the rivers contract during the dry season. Small ephemeral streams then tend to become chains of muddy or sandy pools, often choked with vegetation.

Freshwater molluscs are uncommon in the larger streams except for three of the four bivalves and the three species of the operculate snail genus *Notopala*. The bivalves require sandy substrates in large permanent pools and they were found in such situations in the Drysdale, Carson and Prince Regent Rivers. *Notopala* species require permanently flowing water and a rocky substrate. The absence of this genus in the Prince Regent River is surprising.

The majority of freshwater species in the Kimberley live in small ephemeral streams on the plains with deep soil. This habitat is uncommon in the Prince Regent River Reserve but occurs further south in the West Kimberley where a freshwater snail fauna occurs which is comparable to that in the Drysdale River National Park.

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Figure 1—Liane thicket with rocks and deep leaf litter on the valley slope on the eastern side of Elasmias Creek (C1-5).



Figure 2—Shallow pool in Elasmias Creek (C1-5a).



Figure 3—Shaded cliff ledges above Woorakin Creek (C2-5).

TABLE 1
 LAND MOLLUSCS—COMPARISON OF HABITAT TYPES AND SPECIES COLLECTED IN
 PRINCE REGENT RIVER NATURE RESERVE AND DRYSDALE RIVER NATIONAL PARK.

Species	Prince Regent River Reserve	Drysdale River National Park	Liane Scrub		Grassy sandstone and laterite ridges, and open eucalypt wood- land
			Arboreal	On ground in litter or under stones	
<i>Pleuropoma walkeri</i>	(*)			(*)	
<i>Elasmias</i> sp. cf. <i>E. wakefieldiae</i>		X	X		
<i>Nesopupa</i> sp. A.		X	X		
<i>Nesopupa</i> sp. B.		X		X ¹	
<i>Gastrocopta</i> sp. A cf. <i>G. mcdonnelli</i>	(*) ²	X		Xd	
<i>Gastrocopta</i> sp. B cf. <i>G. pediculus</i> form 1		X		Xd	Xd
form 2		X			X
? <i>Bensonella</i> (<i>Paraboysidia</i>) sp.		X		Xd	
<i>Pupoides</i> (<i>Glyptopupoides</i>) <i>hedleyi</i>		X	X	X	
<i>Pupoides</i> (<i>Themapupa</i>) <i>anapacifica</i>	(*)	X		(*) X	(*) X
<i>Pupisoma</i> (<i>Imputegla</i>) <i>circumlitum</i>		X	X	X	
<i>Amimopina macleayi</i>	(*)	X	(*) X	(*) X	
<i>Succinea</i> (<i>Austrosuccinea</i>) sp. cf. <i>S. (S.) caurina</i>	(*)				(*)
<i>Succinea</i> (<i>Austrosuccinea</i>) sp.		X	X		
<i>Stenopylis coarctata</i>	(*)	X		(*)d X	
<i>Coneuplecta</i> sp. [= P.R.R. "punctid" A]	(*)	X	(*) X?	Xd	
<i>Liardetia</i> sp. [= P.R.R. "punctid" B]	(*)	X	(*) X	(*) X	
<i>Westracystis tentus</i>	(*)	X		(*) X	(*)
<i>Pseudopeas</i> (<i>Eremopeas</i>) <i>interioris</i>	(*)	X		(*) X	(*) X
<i>Xanthomelon prudhoensis</i>	(*)	X		(*) Xd	(*) Xd
<i>Xanthomelon obliquirugosa</i>		X		X	X
<i>Rhagada</i> sp. cf. <i>R. reinga</i> [= P.R.R. <i>Rhagada</i> sp. cf. <i>R. construd</i>]	(*)				(*)
<i>Amplirhagada</i> sp. form 1		X		X	X
<i>Amplirhagada</i> sp. form 2		X		X	X
<i>Baudinella</i> sp. A.	(*)			(*)	(*)
<i>Baudinella</i> sp. B.	(*)			(*)	(*)
<i>Setobaudinia collingii</i>	(*)	X		(*) X	(*) X
Camaenid sp. A.	(*)			(*)	(*)
Camaenid sp. B.	(*)				(*)
Camaenid sp. C.	(*)			(*)d	(*)
Camaenid sp. D.	(*)			(*)	(*)
Camaenid sp. E cf. <i>Torresitrachia monticola</i>	(*)			(*)	(*)
Camaenid sp. F	(*)				(*)
Camaenid sp. G	(*)				(*)
Camaenid sp. H	(*)			(*)	(*)
Camaenid sp. I	(*)			(*) ³	(*)
Camaenid sp. J cf. <i>Hadra</i> sp.	(*)				(*)
Camaenid sp. K cf. <i>Quistrachia</i> sp.	(*)				(*)

d = dead specimens only.

²Shells stuck to base of mangrove trees.

¹Occasionally found low on tree trunks.

³Small area of vine thicket surrounded by open eucalypt woodland.

TABLE 2
FRESHWATER MOLLUSCS—COMPARISON OF HABITAT TYPES AND SPECIES COLLECTED IN
PRINCE REGENT RIVER NATURE RESERVE AND DRYSDALE RIVER NATIONAL PARK.

Species	Prince Regent River Reserve	Drysdale River National Park	Pools in major streams		Pools in small ephemeral streams		Stagnant pools (billabongs)
			Sandy bed	Rocky bed	Sandy Bed	Rocky Bed	
<i>Notopala</i> sp. A		X		X ¹ d			
<i>Notopala</i> sp. B		X		X			
<i>Notopala</i> sp. C		X		Xd			
? <i>Gabbia</i> sp.		X			X ² d		
<i>Lymnaea</i> sp. or spp.	(*)	X			(*) X	X	
<i>Amerianna</i> sp. cf. <i>A. carinata</i>		X				X	Xd
<i>Physastra</i> sp.		X			X	X	Xd
<i>Gyraulus</i> sp.		X			X		X
<i>Ferrissia</i> (<i>Pettancylus</i>) sp. cf. <i>F. (P.) pet- terdi</i>		X			X	X	
<i>Velesunio wilsonii</i>	(*)	X	X ¹		(*) X		
<i>Velesunio angasi</i>	(*)	X	X		(*) X		
? <i>Westralunio</i> sp.		X			Xd		
<i>Corbiculina</i> sp.		X	X		X		X

d = dead specimens only.

¹Flood plains alongside Drysdale River.

²Found on ledge above creek; probably flood debris.

PART XI

A REPORT ON INSECTS COLLECTED IN THE DRYSDALE RIVER NATIONAL PARK NORTH KIMBERLEY, WESTERN AUSTRALIA

by I. F. B. COMMON¹ and M. S. UPTON¹

INTRODUCTION

The insect collection which is the subject of this report was made in the Drysdale River National Park in August, 1975. Since it was made during the driest period of the year, it fails to reflect the great upsurge of insect activity which usually follows the early summer storms and the post-wet flush of plant growth characteristic of tropical Australia. The only large general collections of insects previously made in the Kimberley were from near Kununurra on the Ord River (Richards 1968) and in the Prince Regent River Reserve (Bailey and Richards 1975), some 180 km south-east and south-west respectively of the Drysdale River National Park. The more comprehensive of the two collections was made in the Prince Regent River area, which receives some 250 mm per annum more rainfall than the Drysdale area and is nearer the coast (see Kabay, George and Kenneally, this publication). This climatic difference, resulting in a more depauperate flora in the Drysdale River area, must have a marked effect on the extent and composition of the insect fauna. Rain-forest plants are restricted to only a few of the gorges and even then are few in number and species compared with the Prince Regent River Reserve. Accordingly, the insect fauna of the Drysdale area probably lacks many species present in the Prince Regent area, although it may be expected to include some that are adapted to more arid areas.

COLLECTING SITES

Insect collecting was restricted to four of the main collecting sites described by Kabay, George and Kenneally (this publication). These were:

- A1 (15° 02' S, 126° 55' E) Drysdale River (3–8 August 1975)
- B1 (14° 49' S, 126° 49' E) Carson Escarpment (9–15 August 1975)
- C1 (15° 02' S, 126° 40' E) Morgan Falls (16–17 August 1975)
- C5 (14° 39' S, 126° 57' E) Dysphania Gorge, Drysdale River (18–21 August 1975).

A small collection was also made at Old Doongan homestead (Base Camp) (15° 19' S, 126° 32' E) on 2 August 1975. It was originally planned to collect at only the first three sites, but a bushfire which surrounded site C1 on 17 August made further insect collecting there unprofitable. The two entomologists were therefore transferred to site C5 which they had already visited briefly on 14 August.

METHODS

The insects are a very large and diverse group of animals requiring specialist collecting in each order if adequate coverage is to be expected. For this reason the two

entomologists worked together at each of the four collecting sites, enabling them to specialise a little more than would have been practicable had they been collecting independently at different sites. This undoubtedly resulted in less duplication of the more obvious, widely distributed forms, and more attention being given to groups requiring special collecting techniques. Nevertheless, collections of most groups except Lepidoptera suffered by the lack of specialist knowledge and attention. Insects were collected by hand or with aspirators, by netting at blossom, along streams or watercourses and in other situations, by attracting them to light at night time, by beating foliage, and by trapping with Malaise, blowfly and pheromone traps. Most were killed in cyanide jars or tubes, or in 80 per cent ethyl alcohol; trapped blowflies were killed in a plastic bag containing paradichlorobenzene, and insects collected in the Malaise trap by dichlorvos. All Lepidoptera were pinned, the larger specimens directly into store-boxes; the smaller ones were either spread on balsa setting boards or partially spread on foam plastic in small boxes. Larger or more robust specimens belonging to other orders were also pinned in store-boxes although many of the smaller ones were layered in boxes between tissue. However, small Diptera and other very small fragile specimens were placed in boxes containing finely chopped tissue or "petal-pack". Trichoptera, ants and some other groups were preserved in alcohol. Mould growth in store-boxes, or in layered and "petal-pack" boxes was discouraged by the use of chlorocresol. Protection from ants and other pests was provided by paradichlorobenzene and insect repellent sprays.

A. Light collecting

Two 300-watt Honda generators were operated nightly at selected situations within a radius of about 500 m of each site. Each generator powered a 160-watt Philips mercury vapour lamp (type 57502B/56) suspended in front of a vertical cotton sheet, as well as a 40-watt incandescent lamp attached above a small aluminium tripod table at which specimens were pinned and mounted.

Light collecting situations were chosen to provide as wide a coverage as possible of the habitats around each site. Wherever possible collecting sheets were placed in a position sheltered from the wind or, if this were not possible, they were so oriented that insects could approach the light up-wind on the sheltered side of the sheet. Lights were operated from dusk until about midnight. The progressive intervention of the moon during the latter half of the survey interfered to some extent with collections made at light.

B. Malaise trapping

A modified Malaise trap constructed of nylon netting, approximately 2 m wide and 1.7 m high, was erected in probable insect fly-ways, and operated at sites A1, B1 and C1. Unfortunately the fierce bushfire at site C1

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approached so rapidly that the relatively isolated Malaise trap could not be saved. However, where it was operated, the Malaise trap produced excellent results, including many species that were not encountered by other collecting methods.

C. Blowfly trapping

A plastic trap containing meat or carrion was used at each site.

D. Pheromone trapping

Two plastic, tangle-foot covered pheromone traps, employing pink bollworm (*Pectinophora gossypiella* (Saunders)) pheromone, were exposed at sites A1 and C1 in order to determine if *Pectinophora* spp. were present. One was charged with the two components of the pheromone in a 1:1 ratio, the other with only one of the components.

RESULTS AND DISCUSSION

The collection contains 14 137 specimens belonging to 15 insect orders; they have been sorted into 2 415 species by the various specialists of the Division of Entomology, CSIRO. The bulk of the collection, including holotypes of new species, will be preserved in the Australian National Insect Collection at Canberra but, where possible, representative material of the named species and paratypes of new species will be deposited in the Western Australian Museum.

The very size of the collection has made it impracticable to provide lists of the species in many of the orders. However, tables are presented for each order showing the number of species and specimens in each family, and comments on the representation of species and the probable relationships of the fauna are given. In some of the better known groups, where more meaningful specific comparisons with collections from the Prince Regent River Reserve and other localities in northern Australia are possible, a list of the species has been included.

In the species lists the number in brackets after a genus name is the number of species in the collection referred to that genus. Undescribed genera or species in the Odonata and some families of Orthoptera, which are already recognized in the ANIC, are indicated by the letters or numbers used for them in ANIC. In these two orders the sites from which each species was collected are included.

	Species	Specimens
EPHEMEROPTERA (E. F. Riek)	5	173
Leptophlebiidae	2	46
<i>Jappa</i> sp.		
?Gen. nov.		
Baetidae	2	124
<i>Cloeon</i> sp.		
<i>Pseudocloeon</i> sp.		
Caenidae	1	3
<i>Tasmanocoenis</i> sp.		

As most of the Ephemeroptera in the collection were taken at light, it is difficult to draw conclusions about those that are not attracted to light. Even allowing for the time of the year when the sample was made, it is probable that the small number of species collected may indicate a restricted fauna.

The fauna is similar to that of other regions of northern Australia, including western Arnhem Land (Riek in

CSIRO 1973, Appendix 2) and the Millstream area of Western Australia, with perhaps the addition of an endemic undescribed genus of Leptophlebiidae. Although 12 specimens of the adults and subimagos of this species were collected, there were no nymphs, making direct comparison with other faunas difficult. It belongs to a complex of Asiatic genera that have extended their range only to the northern section of Australia.

The undescribed species of *Jappa* was known previously from Arnhem Land. The nymphs burrow in the stream bottom, particularly in stony areas. The nymphs of both leptophlebiids would be very sensitive to changes in water quality. The species of *Jappa* are sensitive to water conditions for egg-laying and require flowing water of reasonably high quality. However, later the nymphs can withstand quite reduced oxygen potentials but not other detrimental changes.

The nymphs of the small *Cloeon* and *Pseudocloeon* spp. live in standing waters, especially those with reeds and submerged vegetation. The nymphs of *Tasmanocoenis* occur in sandy stretches along streams, where they are able to burrow slightly if conditions become adverse.

	Species	Specimens
ODONATA* (J. A. L. Watson)	14	78
Protoneuridae	2	33
<i>Notoneura</i> sp. "1"; A1, B1		
<i>Notoneura</i> sp. No. 8**; C5		
Coenagrionidae	5	16
<i>Argiocnemis rubescens</i> Selys; B1		
<i>Austroagrion cyane</i> (Selys); A1, B1		
<i>Austrocnemis splendida</i> (Martin)***; A1		
<i>Ischnura aurora</i> (Brauer); A1		
<i>Pseudagrion ignifer</i> Tillyard; A1		
Aeshnidae	1	5
<i>Gynacantha</i> sp. "n"; B1		
Libellulidae	6	24
<i>Diplacodes bipunctata</i> (Brauer); A1		
<i>Diplacodes haematodes</i> (Burmeister); A1, B1		
<i>Macrodiplax cora</i> (Brauer); A1		
<i>Nannodiplax rubra</i> Brauer; A1, B1		
<i>Neurothemis stigmatizans</i> (Fabricius); A1, B1, C5		
<i>Orthetrum migratum</i> Lieftinck; B1		

* Specific terminology generally that of Watson (1974)

** "*Notoneura* sp. n." of Bailey and Richards (1975)

*** Not previously recorded from the Kimberley Region.

The collection from three sites, A1 (10 species), B1 (8 species) and C5 (2 species), represents just under a quarter of the odonate fauna known from the Kimberley region, 58 species (53 recorded by Watson (1974) plus five collected during the surveys of the Prince Regent River Reserve (Bailey and Richards 1975) and the Drysdale River National Park). Sixteen species were collected by Bailey and Richards, and of these ten were also taken on the Drysdale River. It is therefore impossible to assess the significance of specific gaps in the list.

The Drysdale River species fall into two broad groups—species that are widely distributed in Australia and, in

some cases, outside it, and species with narrow northern distributions. There are no species with southern affinities. The widespread group predominates, with 11 species (all the coenagrionids and libellulids) (cf. Watson 1974). In contrast, *Notoneura* sp. "1" is known only from the Kimberley and the adjacent north-western parts of the Northern Territory; *Notoneura* sp. No. 8 (Figs. 1-4) has been recorded only from the Prince Regent and Drysdale River areas; and *Gynacantha* sp. "n" ranges across far northern Australia from the west Kimberley to Cape York Peninsula (Watson 1974, 1977). Species of *Notoneura* are always associated with permanent water, *Notoneura* sp. "1" tending to frequent large pools in creeks and rivers, and *Notoneura* sp. No. 8 apparently being associated with small creeks, such as Fern Gully at site C5. *Gynacantha* sp. "n" is a crepuscular species, spending the day in caves and mine shafts; although it is known to be associated with streams (Watson in CSIRO 1973, Appendix 3), it also breeds in still waters.

The occurrence of *Austrocnemis splendida* on the Drysdale is of some interest, as the species was previously known only from the eastern seaboard of Australia. In the "top end" of the Northern Territory, and at least as far east as the McArthur River, its place is apparently taken by the Australo-Papuan species *A. maccullochi* (Tillyard) (Watson 1974, 1977).

	Species	Specimens
ORTHOPTEROID ORDERS (K. H. L. Key)		
BLATTODEA	24	100
Blattidae	8	40
Blaberidae	1	9
Blatellidae	15	51
MANTODEA	12	30
Amorphoscelidae	5	10
Mantidae	7	20
DERMAPTERA	1	7
ORTHOPTERA	55	450
Tettigoniidae	8	54
Gryllotalpidae	1	12
Gryllidae	15	101
Eumastacidae	2	38
<i>Geckomima</i> sp. P210; A1, B1, C1, C5		
<i>Drysdalopila lamellicercus</i> Key A1		
Pyrgomorphidae	1	26
<i>Atractomorpha similis</i> Bolívar; A1, B1, C5		
Acrididae	22	167
<i>Pycnostictus seriatus</i> Saussure; A1, B1		
<i>Aretza</i> sp. 2; A1, B1, C1, C5		
<i>Gesonula mundata</i> (Walker); A1		
<i>Rectitropis</i> sp.; A1, B1, C1		
<i>Goniaea vocans</i> (Fabricius); A1, B1, C1, C5, base		
<i>Goniaea furcifera</i> (Walker); A1, C1, C5		
<i>Calephorops viridis</i> Sjöstedt; A1		
<i>Macrolopholia</i> sp.; A1, B1, base		
<i>Erythropomala amaena</i> (Walker); A1, C1		

Macrotona lineosa (Walker); A1
Stenocatantops vitripennis (Sjöstedt); A1, B1, base
Aiolopus thalassinus (Fabricius); B1, base
Urnisiella rubropunctata (Sjöstedt); A1
 Genus nov. 15 sp. 8; A1, C1
Valanga irregularis (Walker); C5
Desertaria sp. 9(?) (juv.); B1, C1, C5
Sumbilvia sp. 9; C1, C5
Austracris basalis (Walker); C1
Heteropternis obscura (Blanchard); B1, C1
Macrazelota sp. (juv.); B1
Acrida conica (Fabricius) (juv.); B1
Froggattina australis (Walker); B1

Tetrigidae	5	42
Genus nov. 107 sp. 1; B1		
<i>Paratettix femoralis</i> Bolívar; A1, B1, C5		
<i>Paratettix nigrescens</i> Sjöstedt; A1, B1		
<i>Paratettix histicus</i> (Stål); A1		
Metrodorinae, sp. A; A1		
Tridactylidae	1	10
PHASMATODEA	4	35
Phasmatidae	3	34
Phylliidae	1	1

Of the 30 species in the Eumastacidae, Pyrgomorphidae, Acrididae and Tetrigidae, 11 were not included in the collection from the Prince Regent River Reserve (Bailey and Richards 1975); and of the 30 species belonging to these families reported from the Prince Regent River, 11 were not taken in the Drysdale River National Park. The difference is likely to be due mainly to inadequate (non-specialist) sampling at both localities. It should also be realised that, at the time of the year when both surveys were made, less than half of the species occurring in the two areas would have been present in their active stages and thus available for collecting.

Differences in the thoroughness of sampling make any comparison with western Arnhem Land (Key in CSIRO 1973, Appendix 5) difficult. It can be said, however, that many species are common to all three areas, but that there are almost certainly a number of real differences between the respective faunas.

	Species	Specimens
HEMIPTERA (T. A. Weir)	338	1 880
HOMOPTERA	176	786
Fulgoridae	4	11
Eurybrachidae	2	20
Derbidae	3	8
Dictyopharidae	1	2
Nogodinidae	1	10
Cixiidae	7	21
Ricaniidae	2	28
Meenoplidae	2	4
Delphacidae	7	53
Flatidae	20	81
Cercopidae	1	2
Machaerotidae	4	46

Membracidae	9	22
Eurymelidae	18	41
Cicadellidae	72	351
Psyllidae	20	61
Aleyrodidae	1	1
Margarodidae	1	23
Pseudococcidae	1	1
HETEROPTERA	162	1 094
Enicocephalidae	3	79
Ceratocombidae	2	39
Schizopteridae	2	85
Anthocoridae	2	24
Nabidae	2	2
Miridae	29	54
Tingidae	3	3
Reduviidae	13	38
Saldidae	1	1
Coreidae	1	1
Alydidae	5	17
Rhopalidae	1	1
Stenocephalidae	1	1
Colobathristidae	1	1
Lygaeidae	26	120
Largidae	1	1
Scutelleridae	3	29
Cydnidae	10	42
Pentatomidae	20	76
Gerridae	4	65
Hydrometridae	2	15
Mesoveliidae	1	5
Veliidae	6	174
Gelastocoridae	1	1
Naucoridae	1	3
Belostomatidae	2	7
Nepidae	2	17
Pleidae	2	34
Notonectidae	6	19
Corixidae	9	140

The 49 families included in the collection represent only 55 per cent of the families known to occur in Australia. This relatively low proportion can be explained in part by the lack of specialist collecting in this group and in part by the time of year. Other families which can confidently be predicted to occur in the survey area include Cicadidae, Diaspididae, Coccidae, Eriococcidae, Aphididae, Issidae and Achilidae in the Homoptera and Pyrrhocoridae, Plataspidae, Acanthosomatidae, Hebridae and Ochteridae in the Heteroptera.

A significant feature of the collection is that 41 per cent of the species are represented by a single specimen each, indicating that a substantial part of the fauna was not collected during this survey. Also, the figures for number of individuals, number of species, and number of species represented by a single specimen show a good fit to Fisher's modified negative binomial distribution, indicating that the sampling was largely unbiased. The associated "Index of Diversity" of 138 shows that the fauna is diverse and is comparable with the figure of 135 obtained for Malayan butterflies.

Over all, the sample includes few species that are likely to be endemic to the survey area. Most have affinities with the fauna of the rest of northern Australia, especially the "top end" of the Northern Territory, while some exhibit a much wider distribution over mainland Australia. The first group is exemplified by the semi-aquatic families Gerridae, Veliidae, Mesoveliidae and Hydrometridae in which all 13 species from the area are known to occur only across the "top end" of the Northern

Territory and in northern Queensland. The second group is represented by the aquatic *Laccotrephes tristis* (Stål) (Nepidae) which has been taken in all mainland States. The family Nepidae also includes a distinctive short-winged form of the recently described *Goondnomdanepa weiri* Lansbury from western Arnhem Land.

Very few economic species are represented in the sample, the only ones of note being *Nysius vinitor* Bergroth (Rutherglen bug), *Plautia ?affinis* Dallas (green stink bug) and *Riptortus* sp. (pod sucking bug), all of which are usually only minor pests.

	Species	Specimens
NEUROPTERA (E. F. Riek)	32	256
Mantispidae	4	108
<i>Austromantispa imbecilla</i> (Gerstaecker)		
<i>Mantispa</i> spp. (2)		
<i>Theristria</i> sp.		
Chrysopidae	8	44
<i>Italochrysa insignis</i> (Walker)		
<i>Italochrysa</i> sp.		
<i>Chrysopa</i> spp. (6)		
Berothidae	3	42
<i>Stenobiella</i> sp.		
<i>Spermophorella</i> sp.		
<i>Trichoberothena ferruginea</i> Hand-schin		
Hemerobiidae	1	10
<i>Notiobiella</i> sp.		
Sisyridae	1	2
<i>Sisyra</i> sp.		
Myrmeleontidae	14	49
<i>Mestressa</i> sp.		
<i>Eidoleon bistrigatus</i> (Rambur)		
<i>Formicaleo</i> spp. (5)		
<i>Myrmeleon pictifrons</i> Gerstaecker		
<i>Dendroleon indecisum</i> Banks		
<i>Glenoleon roseipennis</i> Tillyard		
<i>Glenoleon</i> spp. (4)		
Coniopterygidae	1	1

The poor representation of this order in the collection is probably not indicative of a depauperate fauna but of the time of year in which the collection was made. Most of the species collected have either a widespread distribution in the interior of the continent or occur across the whole of northern Australia. All of the species are also known from other localities. The larvae of *Sisyra* spp. feed on freshwater sponges growing on rocks and logs in slow-flowing sections of streams.

	Species	Specimens
COLEOPTERA (E. B. Britton)	403	2 789
Carabidae	51	207
Dytiscidae	28	169
Gyrinidae	3	51
Hydrochidae	6	42
Georyssidae	1	36
Hydrophilidae	28	217
Silphidae	1	7
Staphylinidae	23	215
Pselaphidae	2	11
Scarabaeidae	48	444
Helodidae	3	33
Byrrhidae	2	41
Heteroceridae	1	22
Buprestidae	2	52

Elateridae	....	....	....	8	48
Lycidae	....	....	....	1	6
Melyridae	....	....	....	1	5
Dermestidae	....	....	....	2	12
Anobiidae	....	....	....	4	13
Bostrychidae	....	....	....	5	29
Cleridae	....	....	....	5	7
Nitidulidae	....	....	....	4	48
Cryptophagidae	....	....	....	1	29
Phalacridae	....	....	....	2	28
Coccinellidae	....	....	....	10	62
Colydiidae	....	....	....	1	1
Tenebrionidae	....	....	....	7	36
Alleculidae	....	....	....	8	44
Mordellidae	....	....	....	1	1
Rhipiphoridae	....	....	....	1	6
Oedemeridae	....	....	....	2	17
Meloidae	....	....	....	1	4
Anthicidae	....	....	....	13	61
Cerambycidae	....	....	....	13	21
Bruchidae	....	....	....	3	17
Chrysomelidae	....	....	....	50	230

CURCULIONOIDEA (E. C. Zimmerman)

Anthribidae	....	....	....	3	8
Brentidae	....	....	....	3	4
Apionidae	....	....	....	13	45
Curculionidae	....	....	....	38	426
Scolytidae	....	....	....	4	34

The collection is characterized by a great abundance and diversity of the water-beetles; for example, the Dytiscidae and Hydrophilidae are each represented by 28 species. The genus *Georyssus*, which is found only rarely in collections, is represented in this collection, as it was in the collection from western Arnhem Land (Britton in CSIRO 1973, Appendix 6), by large numbers of specimens of one species. These beetles inhabit wet mud and their abundance in the Drysdale collection reflects the presence of waterholes and the use of effective lights at night to attract the adults.

The collection as a whole suggests that the fauna is considerably less diverse than that of western Arnhem land. Only the Scarabaeidae have so far been examined in detail. Two-thirds of the species of this family belong to the melolonthine genus *Heteronyx*. Five species of the genus *Liparetrus* and the only species of *Colpochila* proved to be undescribed. The introduced African dung beetle *Onthophagus gazella* (Fabricius) was collected abundantly at all sites. It is of interest to note that the nearest point of release of this species was Kalumburu, 50 km north of the Drysdale River National Park, in February, 1970.

The collection contains many interesting, rare and new species of weevils belonging to the Curculionoidea, the last five families listed, and the sample demonstrates the need for intensive and extensive collecting by specialists in the Kimberley. The series of *Curculio delicatulus* Lea is the first record of the species since the unique type in the Macleay Museum was taken in north-western Australia, probably by W. W. Froggatt in 1887-1888.

	Species	Specimens	
STREPSIPTERA (E. F. Rick)	2	154
Halictophagidae			
<i>Halictophagus</i> sp.			
Myrmecolacidae			
<i>Myrmecolax</i> sp.			

Only males of these two species were collected at light. *Halictophagus* is a parasite of leaf-hoppers, but no parasitised specimens of Homoptera were collected. *Myrmecolax* is a parasite of ants, very probably of *Camponotus*.

	Species	Specimens	
DIPTERA (D. H. Colless)	383	2 047
Tipulidae	11	77
Psychodidae	c.3	53
Ceratopogonidae	c.12	55
Culicidae	5	10
Chaoboridae	2	5
Chironomidae	c.40	105
Simuliidae	1	10
Cecidomyiidae	1	5
Scatopsidae	1	2
Sciaridae	2	5
Mycetophilidae	5	8
Tabanidae	5	11
Mydidae	1	1
Therevidae	17	70
Asilidae	10	53
Bombyliidae	9	16
Empididae	11	66
Dolichopodidae	30	240
Phoridae	10	90
Platypzeidae	1	1
Pipunculidae	1	1
Syrphidae	5	13
Otitidae	1	1
Platystomatidae	4	38
Pyrgotidae	8	93
Tephritidae	4	20
Sepsidae	2	3
Sciomyzidae	1	1
Lauxaniidae	3	3
Sphaeroceridae	3	7
Agromyzidae	4	15
Lonchaeidae	1	1
Fergusoninidae	1	1
Anthomyzidae	1	6
Ephydriidae	17	50
Drosophilidae	7	88
Milichiidae	3	10
Tethinidae	1	1
Canaceidae	2	11
Chloropidae	25	115
Muscidae	32	307
Calliphoridae	8	143
Sarcophagidae	14	57
Tachinidae	57	178
?Family (Muscoidea)	1	1

The collection is remarkably good, although far short of an estimated possible fauna of some 800 species which might have been taken during the dry season when the survey was made. A census of specimens taken per species shows a fair conformity with Fisher's modified negative binomial distribution, confirming that the sample was by and large a random one. A calculated "Index of Diversity" of 138 is respectably high, indicating a diverse fauna by world standards, and comparable with a figure of 168 for western Arnhem Land (Colless in CSIRO 1973, Appendix 7) during the dry season. The similarity of these two figures might, of course, reflect a "least common denominator" in the dry-season fauna; and the Drysdale River fauna may not blossom after the "wet" to anything like the same extent as that of Arnhem Land.

Dominant amongst the 45 families represented were Tachinidae, Chironomidae, Muscidae and Dolichopodidae. Chloropidae, Ephydriidae and Therevidae were also well represented. The abundance of Chironomidae and Dolichopodidae indicates the presence of moist refugia and permanent water; and the surprisingly high numbers of Tachinidae no doubt reflect a considerable fauna of their hosts, Lepidoptera and Coleoptera.

The few species of Culicidae taken were to be expected, but so far a relatively superficial examination of the Chironomidae suggests a rather distinctive fauna associated with springs and seepage areas. The Therevidae show remarkable diversity, as in many other areas of the continent, suggesting a very large Australian fauna by world standards. Relatively few species of Asilidae and Bombyliidae were taken; this may reflect the sampling methods or indicate a real scarcity of these two families during the dry season.

The eight species of Pyrgotidae provided some surprises. This total is equal to that collected during the entire western Arnhem Land survey, but most of the species are different. *Commoniella fredericki* Paramonov, known hitherto only from coastal regions of eastern Australia, was abundant. In addition, *Campylocera hyalipennis* Bezzi was rediscovered; it was previously known only from the holotype from Cairns, north Queensland.

Few Tephritidae were collected, including only one *Dacus* sp., apparently *D. tenuifascia* (May). As usual, the bushfly *Musca vetustissima* Walker is the dominant species in the Muscidae. Two interesting muscids, previously known only from the type series, are *Balioglutum illingworthi* Aldrich (presumably) and *Pygophora minuta* Malloch. As expected, the common species of Calliphoridae is *Chrysomya saffrana* (Bigot). The remarkably diverse collection of Tachinidae includes a number of species not previously encountered, and several that probably belong to undescribed genera.

	Species	Specimens
TRICHOPTERA (E. F. Riek)	15	325
Leptoceridae	7	161
<i>Triplectides magna</i> (Walker)		
<i>Triplectides australis</i> Navas		
<i>Oecetis pechana</i> Mosely		
<i>Oecetis</i> spp. (4)		
Calamoceratidae	2	35
<i>Anisocentropus</i> sp. nov.		
<i>Anisocentropus</i> nr. <i>latifascia</i> (Walker)		
Philopotamidae	1	57
<i>Chimarra uranka</i> Mosely and Kimmins		
Psychomyiidae	1	23
<i>Ecnomus continentalis</i> Ulmer		
Hydropsychidae	2	46
<i>Cheumatopsyche modica</i> (McLachlan)		
<i>Cheumatopsyche</i> sp.		
Helicopsychidae	1	2
<i>Helicopsyche</i> sp.		
Hydroptilidae	1	1

Most specimens in the collection were taken at light. As many species of this order are not attracted to light, it is difficult to draw any conclusions about the total fauna. However, it would appear from the very small number of species collected, even allowing for the time

of year, that the fauna is a restricted one. The sample is made up of a few species that occur throughout the inland regions of Australia, with the addition of a very few species that may be restricted to the Kimberley region. However, the extent of any endemism will remain unknown until adjoining areas are adequately sampled.

The three leptocerids all breed in standing or slow-flowing waters. *Triplectides* spp. are strong fliers and are widely distributed. *Anisocentropus* spp. breed mainly in slow-moving waters in the backwaters of streams. The larvae of *Chimarra*, *Ecnomus* and *Cheumatopsyche* spin their nets and retreats on rocks and logs in moderate to fast-flowing waters in inland Australia. One species of *Anisocentropus*, one *Oecetis* and the *Helicopsyche* are so far unknown outside the Kimberley region.

	Species	Specimens
LEPIDOPTERA (I. F. B. Common and E. D. Edwards)	961	5 163
Adelidae	1	2
Heliozelidae	1	1
Opostegidae	3	10
Cossidae	6	31
Tortricidae	31	150
Cochylidae	1	10
Psychidae	5	76
Tineidae	28	190
Lyonetiidae	6	17
Gracillariidae	9	12
Yponomeutidae	8	33
Glyphipterigidae	1	1
Choreutidae	3	10
Tinaegeriidae	9	18
Oecophoridae	130	933
Timyridae	20	125
Cosmopterigidae	48	144
Blastobasidae	4	10
Xyloryctidae	25	112
Stenomatidae	5	24
Gelechiidae	69	326
Zygaenidae	1	1
Cyclotornidae	1	2
Epipyropidae	2	12
Limacodidae	6	42
Thyrididae	3	17
Pyralidae	221	1 009
Pterophoridae	7	20
Hesperiidae	5	22
<i>Ocybadistes flavovittatus vesta</i> (Waterhouse)		
<i>Suniana lascivia</i> (Rosenstock)		
<i>Telicota augias argilus</i> Waterhouse		
<i>Cephrenes trichopepla</i> (Lower)		
<i>Pelopidas lyelli lyelli</i> (Rothschild)		
Papilionidae	1	1
<i>Papilio demoleus sthenelus</i> W. S. Macleay		
Pieridae	9	25
<i>Catopsilia pomona pomona</i> (Fabricius)		
<i>Catopsilia scylla etesia</i> (Hewitson)		
<i>Eurema laeta lineata</i> (Miskin)		
<i>Eurema herla</i> (W. S. Macleay)		
<i>Eurema hecabe phoebus</i> (Butler)		

<i>Eurema smilax</i> (Donovan)					<i>Thalatha guttalis</i> (Walker)
<i>Elodina padusa</i> (Hewitson)					<i>Nitocris</i> sp.
<i>Delias argenthona fragalactea</i> (Butler)					<i>Amyna octo</i> (Guenée)
<i>Cepora perimale scyllara</i> (W. S. Macleay)					<i>Aegle hedychroa</i> (Turner)
Nymphalidae	10	39			<i>Litoscelis tanyphylla</i> (Turner)
<i>Danaus chrysippus petilia</i> (Stoll)					<i>Catoblemma ?aplecta</i> Turner
<i>Danaus affinis affinis</i> (Fabri- cius) (sighted only)					<i>Catoblemma ?dubia</i> Butler
<i>Euploea core corinna</i> (W. S. Macleay)					<i>Epopsima fasciolata</i> (Butler)
<i>Melanitis leda bankia</i> (Fabri- cius)					<i>Eublemma paurograpta</i> Butler
<i>Hypocysta adiante antirius</i> But- ler					<i>Eublemma glaucochroa</i> Turner
<i>Ypthima arctoa arctoa</i> (Fabri- cius)					<i>Eublemma extorris</i> (Warren)
<i>Hypolimnas bolina nerina</i> (Fab- ricius)					<i>Eublemma dimidialis</i> (Fabricius)
<i>Precis orithya albicincta</i> (Butler)					<i>Eublemma anachoresis</i> (Wallengren)
<i>Acraea andromacha andromacha</i> (Fabricius)					<i>Eublemma ragusana</i> (Freyer)
Lycanidae	5	19			<i>Eublemma rubra</i> Hampson
<i>Narathura araxes asopus</i> (Water- house and Lyell)					<i>Eublemma versicolor</i> (Walker)
<i>Catopyrops florinda estrella</i> (Waterhouse and Lyell)					<i>Eublemma curvata</i> (Lucas)
<i>Euchrysops cnejus cnidus</i> Water- house and Lyell					<i>Eublemma ?phaecosma</i> Turner
<i>Famegana alsulus alsulus</i> (Her- rich-Schäffer)					<i>Eublemma haplochroa</i> Turner
<i>Candalides erinus erinus</i> (Fabri- cius)					<i>Eublemma rufipuncta</i> Turner
Geometridae	87	626			<i>Eublemma leucodesma</i> (Lower)
Epiplemidae	1	8			<i>Eublemma loxostropha</i> Turner
Lasiocampidae	7	12			<i>Eublemma parva</i> (Hübner)
Anthelidae	1	2			<i>Eublemma</i> spp. (3)
Sphingidae	5	14			<i>Hyposada hydrocampata</i> (Guenée)
<i>Agrius convolvuli</i> (L.)					<i>Pseudozarba orthopetes</i> Meyrick
<i>Hippotion boerhaviae</i> (Fabri- cius)					<i>Aplotelia pratti</i> (Bethune-Baker)
<i>Theretra latreillei</i> (Macleay)					<i>Bombotelia jocosatrix</i> (Guenée)
<i>Theretra oldenlandiae firmata</i> (Walker)					<i>Phlogetonia delatrix</i> (Guenée)
<i>Theretra silhetensis intersecta</i> (Butler)					<i>Aiteta elaina</i> Swinhoe
Notodontidae	15	119			<i>Earias huegeli</i> Rogenhofer
Lymantriidae	14	187			<i>Earias luteolaria</i> Hampson
Arctiidae	17	119			<i>Paracrama iconica</i> (Walker)
Amatidae	5	37			<i>Westermannia concha</i> Butler
Hypsiidae	1	5			<i>Xanthodes amata</i> Walker
Nolidae	13	78			<i>Xanthodes transversa</i> Guenée
Noctuidae	111	512			<i>Barasa cymatistis</i> (Meyrick)
<i>Adisura dulcis</i> Moore					<i>Characoma vallata</i> (Meyrick)
<i>Agrotis poliotis</i> (Hampson)					<i>Hypolipsa leucopolia</i> Turner
<i>Leucania leucosta</i> Lower					<i>Microthripa baota</i> (Turner)
<i>?Eurypsyche lewinii</i> (Butler)					<i>Nanaguna breviscula</i> Walker
" <i>Leucania</i> " <i>abdominalis</i> (Walker)					<i>Selepa celtis</i> Moore
" <i>Leucania</i> " spp. (2)					<i>Selepa ?geraea</i> (Hampson)
<i>Acrapex exsanguis</i> Lower					<i>Selepa</i> spp. (4)
<i>Acrapex</i> sp.					<i>Audea irioleuca</i> (Meyrick)
<i>Euplexia dolorosa</i> (Walker)					<i>Chalciope hyppasia</i> (Cramer)
<i>Euplexia</i> sp.					<i>Dermaleipa</i> sp.
<i>Caradrina maculatra</i> Lower					<i>Donuca castalia</i> (Fabricius)
<i>Caradrina obtusa</i> Hampson					<i>Donuca orbigera</i> (Guenée)
<i>Cosmodes elegans</i> (Donovan)					<i>Entomogramma torsa</i> Guenée
					<i>Euclidisema alcyona</i> (Druce)
					<i>Grammodes cooma</i> Swinhoe
					<i>Grammodes oculicola</i> Walker
					<i>Grammodes quaesita</i> Swinhoe
					<i>Mocis alterna</i> (Walker)
					<i>Mocis frugalis</i> (Fabricius)
					<i>Nizuga spiramioides</i> Walker
					<i>Parallelia senex</i> (Walker)
					<i>Acantholipes australis</i> Lower
					<i>Antarchaea deterrentalis</i> (Walker)
					<i>Cophanta funestalis</i> Walker
					<i>Diatenes marmarinopa</i> (Meyrick)
					<i>Diatenes</i> sp.
					<i>Elusa</i> sp.
					<i>Eporectis</i> sp.
					<i>Ericeia</i> sp.
					<i>Gesonina similis</i> (Moore)
					<i>Homodes bracteigutta</i> (Walker)
					<i>Meyrickella torquesauria</i> (Lucas)

Pandesma submurina (Walker)
Pantylia capistrata Lucas
Plecoptera juba (Swinhoe)
Prionopterina grammatistis
 (Meyrick)
Rhesala asphalta Swinhoe
Rhesala imparata Walker
Rivula bioculalis Moore
Rivula ommatopis Meyrick
Zophochroa sp.
Bathystolma brunnea Turner
Hypena acrocompsa Turner
Hypena caerulealus Walker
Hypenodes lithina Swinhoe
 ?gen. ?sp. (7)

Since the Lepidoptera received specialist attention, they are better represented in the collection than any of the other groups. Dominant amongst the 45 families collected are the Pyralidae with 221 species, followed by the Oecophoridae with 130 species, and the Noctuidae with 111 species. Together these three families account for 48 per cent of the total species. The larger Lepidoptera, including the Pyralidae, are represented by 548 species and the microlepidoptera by 413 species.

There is no previous record of Lepidoptera having been collected in the central-north Kimberley, and the 244 species recorded by Bailey and Richards (1975) from the Prince Regent River Reserve in the west Kimberley, and the 219 species by Richards (1968) in the east Kimberley, are the only substantial collections from the whole of the Kimberley region. The Prince Regent River collection is more comparable with the present collection because it was made over a similar period of three weeks at the same time of the year, whereas Richards's (1968) collection was accumulated over a much longer period. However, neither of these collections was claimed to be fully representative since the microlepidoptera were largely excluded.

The 30 species of butterflies (Hesperiidae, Papilionidae, Pieridae, Nymphalidae and Lycaenidae) from the Drysdale River compare favourably with the 36 species taken on the Prince Regent River, as a rather larger fauna might be expected in the latter area of higher rainfall. However, a total of 50 species was recorded from the Kimberley by Common and Waterhouse (1972), to which eight were added by Bailey and Richards (1975) and a further two, *Ocybadistes flavovittatus* and *Elodina padusa*, in the present Drysdale collection. Together the Prince Regent and Drysdale collections yielded 45 species, of which only 21 (47 per cent), are common to both. Although there is little doubt that the butterfly fauna of the Kimberley is not rich, further species will certainly be recorded in the future, and the total butterfly fauna of the region may well exceed 80 species. All of the species collected, and in fact all of the species known from the Kimberley, occur elsewhere, and the majority are wide-ranging in northern Australia. A few are restricted to the north-west, including the Northern Territory, or are represented in the north-west by subspecies of more widely distributed species.

The Drysdale collection yielded 111 species of Noctuidae compared with 57 from the Prince Regent collection. Together the two include 129 species, of which only 36 (28 per cent) are common to both. It is clear, therefore, that the noctuid fauna of the Kimberley must far exceed this figure; it may well approach 300. About 20 per cent of the Drysdale Noctuidae are thought to be

undescribed. Most of the remainder have a wide distribution in northern Australia, and it is unlikely that any of the species is restricted to the Kimberley.

In size and family representation the Drysdale River collection compares well with the Lepidoptera collected during October-November in western Arnhem Land (Common, in CSIRO 1973, Appendix 9). The total Drysdale collection is only slightly exceeded by the 5492 specimens of 1016 species from Arnhem Land. The proportions of the larger Lepidoptera and the microlepidoptera in the two collections are also very comparable, 548:413 species from Drysdale and 553:463 from Arnhem Land. There is a strong overlap in the species representation in the two collections, and the relative abundance of the families is also remarkably similar, with Pyralidae, Oecophoridae and Noctuidae the most dominant families.

This family representation is very characteristic of tropical Australia, with Pyraustinae and Phycitinae the dominant subfamilies amongst the Pyralidae, and the Erastrinae, Westermanniinae, Catocalinae and Ophiderinae in the Noctuidae. These are the groups with strong Oriental relationships. In contrast the Oecophoridae, with an enormous Australian fauna, is well distributed throughout the continent but especially numerous in the southern half. The majority of the oecophorids from the Drysdale collection show little relationship to the Oriental fauna but belong to genera characteristic of the eucalypt areas of northern Australia. Australia is unique in having a fauna of Oecophoridae far in excess of the Gelechiidae, with a ratio of about 5:1. In the northern half of the continent, however, the ratio of oecophorids to gelechiids is much less: in the Drysdale collection it is 1.9:1 and in the dry season collection from western Arnhem Land 2.2:1.

Few characteristically southern species are represented in the collection. Perhaps the most noteworthy is *Danima banksiae* (Lewin) (Notodontidae) (Fig. 5), which is widely distributed in southern Australia, although known in the east as far north as the Cape York Peninsula. Its larvae feed on Proteaceae and are presumably dependent on *Grevillea* in the Drysdale area. Examples of northern Australian species that are poorly represented in collections are the lasiocampid *Crexa dianipha* Turner, and the noctuids *Eublemma dimidialis* (Fabricius), *Niguza spiramioides* Walker, *Aplotelia pratti* (Bethune-Baker) and *Aiteta elaina* Swinhoe (Figs. 6-10). The large blue and yellow day-flying geometrid *Dysphania fenestrata* (Swainson) (Plate 10) is the most spectacular moth collected.

It is amongst the more sedentary microlepidoptera that one might expect to find species endemic to an area such as the Drysdale River National Park, but even here the known species are widely distributed in northern Australia. However, some 70 per cent of the micros from the Drysdale collection are thought to be undescribed, compared with about 30 per cent of the larger Lepidoptera, although a fair proportion of the undescribed species in both groups were already known to occur in other northern localities. Many were included in the Arnhem Land collection, which contained an estimated 40 per cent of undescribed species.

It is interesting that many common, widespread species, which must occur in the Drysdale area, were not collected. Notable amongst these are *Heliothis* spp., *Spodoptera* spp., *Mythimna loreyminima* (Rungs), *Pseudalletia convecta* (Walker) and *Othreis materna* (L.) in the Noctuidae, and *Precis villida calybe* (Godart), *Anaphaeis*

java teutonia (Fabricius), *Zizina otis labradus* (Godart) and *Lampides boeticus* (L.) in the butterflies. No doubt these and many other wide-ranging species would be taken later in the season. No *Pectinophora* spp. were captured in the pheromone traps, although a single specimen of *P. gossypiella* (Saunders) was collected at light at site C5.

	Species	Specimens
HYMENOPTERA (E. F. Riek)	166	650
Eumenidae	6	17
Sphecidae	15	105
Vespidae	1	5
<i>Polistes</i> sp.		
Tiphidae	12	60
Mutillidae	5	27
Chrysididae	3	7
Bethylidae	2	23
<i>Goniozus</i> sp.		
Ichneumonidae	8	26
Braconidae	25	60
Pompilidae	11	20
Proctotrupidae	1	9
Scelionidae	1	2
Dryinidae	3	3
<i>Anteonella</i> spp. (3)		
CHALCIDOIDEA	12	20
APOIDEA (J. C. Cardale)		
Colletidae	13	98
Halictidae	8	63
Megachilidae	2	4
Anthophoridae	6	36
Apidae	2	17
<i>Trigona</i> spp. (2)		
FORMICOIDEA (R. W. Taylor)		
Formicidae	30 (48 series)	

The very small sample of Hymenoptera almost certainly indicates that the collection was made too early in the season for most species of the order. It consists mainly of small bees, Sphecidae and Ichneumonoidea, with very few Eumenidae, Pompilidae, Chalcidoidea and Proctotrupeoidea. The poor representation of the very small parasitic Hymenoptera was no doubt due to the methods used by the non-specialist collectors. Very few, if any, of the Hymenoptera are distinctive of the area.

Most of the Sphecidae are small species of Larrinae and Trypoxyloninae. *Sceliphron* was not collected, but as the genus has an Australia-wide distribution it would undoubtedly be present later in the season. The Eumenidae are mainly species of *Abispa* and *Eumenes* and one species of *Paralastor*. *Odynerus* was not collected although species of that genus undoubtedly occur there. The Tiphidae are all small species of Thynninae, without representatives of the larger, brightly coloured species that emerge later in the season in other regions.

Most of the Mutillidae are males, another indication that the season was too early for the larger Hymenoptera. The three chrysidid species occur commonly in the tropics and *Goniozus*, the only bethylid, is a common genus throughout Australia. The Ichneumonidae are represented mostly by widespread species of *Enicospilus*, and the Braconidae by Braconinae and Microgasterinae, with some Agathidiinae, Cheloninae and Rhogadinae. Common widespread species of Pepsinae and Pompilinae represent the Pompilidae. The three species of *Anteonella* (Dryinidae) are all large, as are most of the Chalcidoidea, made up mainly of Chalcididae, Cleonyminae and Encyrtinae.

The species of Apoidea are similar to those found in the Millstream area of Western Australia and in western Arnhem Land (Cardale in CSIRO 1973, Appendix 10). The small collection reflects the paucity of available blossom, most of the specimens having been taken on small bushes of *Grevillea mimosoides*.

The 30 species of ants (Formicidae), belonging to 20 genera, must represent less than 20 per cent of the fauna, judging from our knowledge of other localities in northern Australia. Twenty-one species were taken at one site only, three at two sites, four at three sites, and one each at four and five sites. All seven subfamilies of Formicidae known from Australia are represented.

The Myrmeciinae (bulldog ants) are here reported from the Kimberley for the first time, represented by *Myrmecia desertorum* Wheeler. However, Kimberley specimens of this widespread species were already present in several museums, and in the Western Australian Museum there are also specimens of *M. varians* Mayr collected at Beverley Springs in 1960. The Dorylinae (army ants) are represented in the collection by numerous males (presumably *Aenictus ceylonicus* Mayr) taken at light; this is the first record of these ants from Australia west of Darwin. The Leptanillinae, collected previously in Australia only near Perth and Brisbane, are represented by two males (presumably *Leptanilla swani* Wheeler). A single species of *Tetraponera* (?*kimberleyensis* Forel) represents the Pesudomyrmecinae.

Several ants which range widely from south-east Asia to Melanesia and Australia were collected, including *Cerapachys longitarsus* Mayr, *Trachymesopus darwini* Forel (both Ponerinae), the green tree ant *Oecophylla smaragdina* Fabricius (Formicinae), and *Aenictus ceylonicus* Mayr (mentioned above). The two ponerine species, represented by light-collected alates, are here reported from Western Australia for the first time.

With some notable exceptions, the remaining ants belong to an array of genera which one might expect to find commonly in the survey area. These include in the Ponerinae: *Rhytidoponera* (2 spp.), *Brachyponera*, and *Odontomachus*; in the Myrmicinae: *Monomorium*, *Cardiocondyla*, *Meranoplus* (2 spp.), *Pheidole*, and *Crematogaster*; in the Dolichoderinae: *Iridomyrmex* (5 spp.); and in the Formicinae: *Opisthopsis*, *Camponotus* (3 spp.), *Polyrhachis* (3 spp.) and *Paratrechina*.

ACKNOWLEDGEMENTS

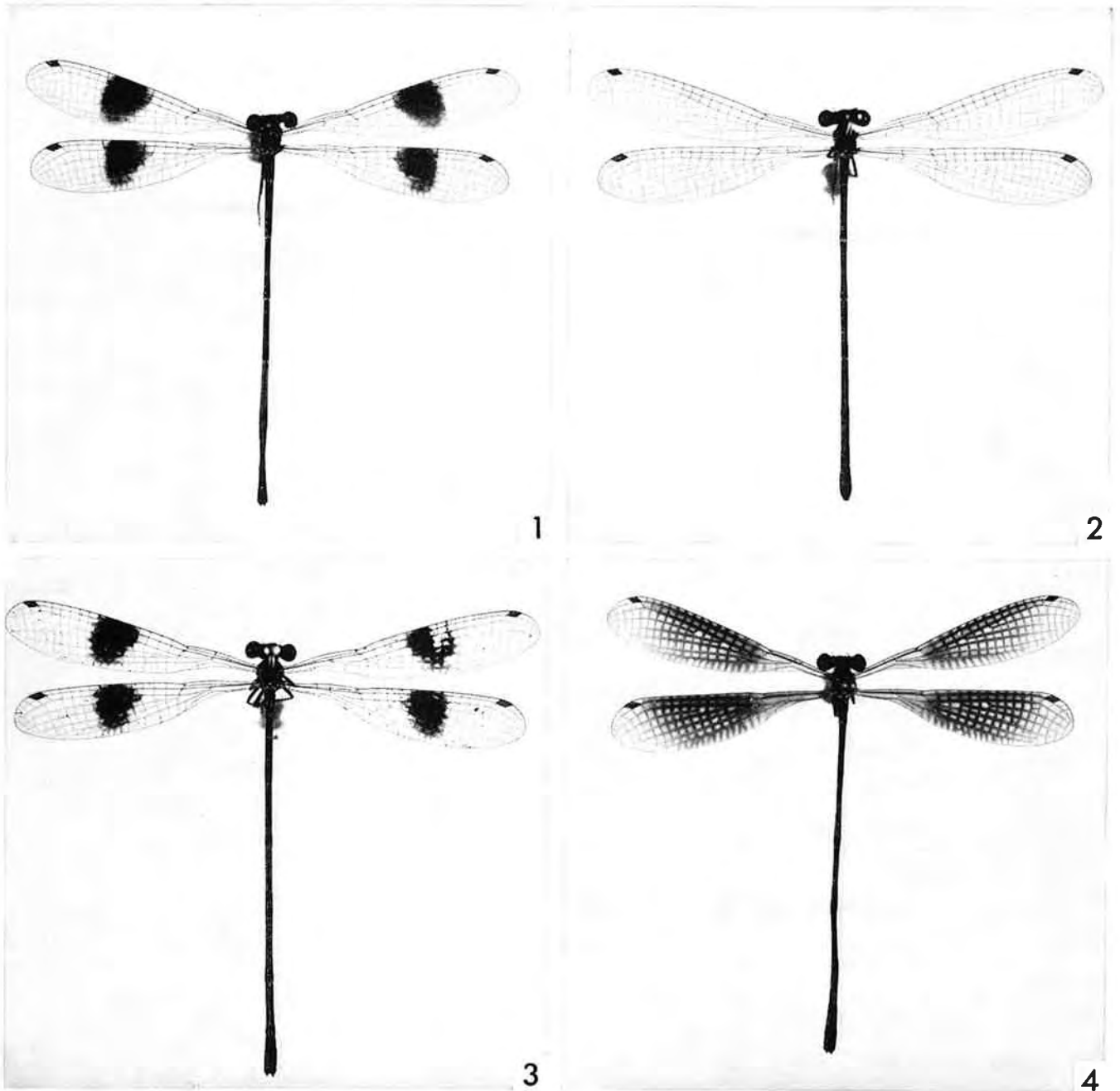
Thanks are due to the following taxonomists of the Division of Entomology, CSIRO, who contributed to this report: Dr. E. B. Britton, Miss J. C. Cardale, Dr. D. H. Colless, Mr. E. D. Edwards, Dr. K. H. L. Key, Dr. E. F. Riek, Dr. R. W. Taylor, Dr. J. A. L. Watson, Mr. T. A. Weir and Dr. E. C. Zimmerman.

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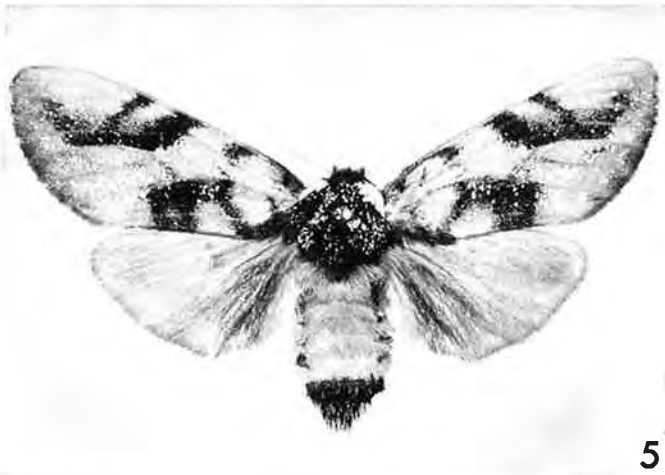


Figures 1-4—*Notoneura* (Odonata) from the Kimberley and the Northern Territory.

Figures 1-2—Male and female *Notoneura* sp. No. 8 from C5; sexual dimorphism is common in the pigmentation of *Notoneura*.

Figure 3—Male *Notoneura* sp. No. 8 from the Prince Regent River Nature Reserve.

Figure 4—Male *Notoneura* sp. "b" from western Arnhem Land; this species appears to be the most closely related of the six other Australian species to *Notoneura* sp. No. 8 (wingspan of (1) 3.6 cm, other figures at the same scale).



5



6



7



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9



10

Figures 5-10—Unusual Lepidoptera from northern Australia.

Figure 5—*Denima banksiae* (Lewin), female, Notodontidae (wingspan 8 cm) (Al). The male is of more slender build, with pale hindwings.

Figure 6—*Eublemma dimidialis* (Fabricius) male, Noctuidae (wingspan 2 cm). An attractive small species not well represented in collections. (Photo by C. Lourandos.)

Figure 7—*Crexa dianipha* Turner, female, Lasiocampidae (wingspan 3.8 cm).

Figure 8—*Niguza spiramioides* Walker, male (wingspan 4.2 cm).

Figure 9—*Aplotelia pratti* (Bethune-Baker), female (wingspan 3.3 cm)

Figure 10—*Aiteta elaina* Swinhoe, male (wingspan 4 cm) (Noctuidae).

PART XII

CONCLUSIONS AND RECOMMENDATIONS

by A. A. BURBIDGE¹

CONCLUSIONS

The Drysdale River National Park (DRNP) provides a representative section of the north Kimberley.

Scenically it is diverse, gorges and cliffs contrasting with broad rivers and plains. Spectacular waterfalls are found on Palmoondoora Creek (Morgan Falls), on the Drysdale River (Solea Falls) and on Johnson Creek (Cracticus Falls) as well as on many of the smaller tributaries.

The Park encompasses a cross section of the main geological formations of the north Kimberley—only the laterites are poorly represented. This is in marked contrast to the Prince Regent River Nature Reserve (PRRNR) in which one rock type, the King Leopold Sandstone, predominates (Miles and Burbidge 1975).

Biologically the Park is intermediate between the sub-humid north-west Kimberley (of which the PRRNR is representative) and the semi-arid east Kimberley. The vegetation is predominantly low open-forest, low woodland and low open-woodland but there are small areas of vine thickets and, just outside the Park at present, a unique area of tall closed-forest. Fringing communities occur along creeks and rivers and around swamps.

The mammal collection, apart from the bats, was disappointing, only 28 native species being recorded. To some extent this may be due to the area being less rugged when compared to the Prince Regent but it also must be due to the lower rainfall. Three species of *Pseudomys* (Australian native mice) were common, reflecting the widespread occurrence of grassland and savannah woodland habitats. Some species of the more humid north-west Kimberley which occur in the Prince Regent appear to be absent from the Drysdale, e.g. the Little Rock Wallaby (*Peradorcas cincinna*) and Woodward's Rock-Rat (*Zyzomys woodwardii*). In contrast a *Planigale* and the Sugar Glider (*Petaurus breviceps*) which occur in the DRNP are not known from the PRRNR. The comparatively large number of 15 species of bats were recorded, including three species new to Western Australia.

The bird and reptile faunas of the Drysdale River area are intermediate between those of the north-west and east Kimberley although the rich tree frog list is identical with that of the PRRNR. Some north-west species reach their easternmost known limit at the Drysdale, e.g. the Green-winged Pigeon (*Chalcophaps indica*), Silver-backed Butcherbird (*Cracticus torquatus*) and a gecko (*Diplodactylus* sp.). However, 14 species of north-west Kimberley birds do not extend to the Drysdale. Most of these are primarily inhabitants of closed-forests and many of them are wholly or mainly fruit eaters. Non-forest species which do not extend to the DRNP include the Black Grass-Wren (*Amytornis housei*). There is a similar picture in some reptile groups e.g. the dragon lizards *Diporiphora a. albilabris*, *D. superba* and *Amphibolurus micropelidotus* are not found in the Drysdale River National Park.

The freshwater fish fauna of the Drysdale River National Park is the richest known in the Kimberley, 26 species being recorded. However, this number falls short of the known freshwater fish fauna of parts of the Northern Territory. Among those collected were three species known only from the Park.

The mollusc collection provides some interesting contrasts between the Drysdale River National Park and the Prince Regent River Nature Reserve. More aboreal snails and freshwater molluscs were found in the DRNP while the PRRNR has many more terrestrial snails inhabiting open-woodlands and grassed sandstone ridges.

The insect collection contains some 2 415 species. The lack of collections from much of the Kimberley makes interpretation difficult but this has been done for some of the better known groups. One interesting point is the abundance of one of the African dung beetles introduced into Australia to control flies. The nearest point of release of this species was Kalumburu, 50 km to the north, in February, 1970.

The list of plants so far contains 594 taxa, including 25 ferns and 537 flowering plants. Only 39 per cent of these were recorded in the PRRNR, indicating the difference between the two reserves. Several genera and species are not known elsewhere in the Kimberley, e.g. *Homalocalyx*, *Rapanea* and *Christella dentata*. The aquatic flora is quite rich with 30 species.

With the completion of biological surveys of the only two large conservation reserves in the Kimberley, a better appreciation is available of the degree of protection by reservation of Kimberley ecosystems. In considering the north and north-west Kimberley the degree of protection is high but improvements are still possible. Two obvious problems are the inadequate representation of the better quality vine-thickets (or "monsoon forest") and the complete lack of protection of the palm communities growing on laterite at Mitchell Plateau and elsewhere. Both could be overcome by providing a reserve at, or near, Mitchell Plateau—a matter now under consideration by the Conservation Through Reserves Committee of the Environmental Protection Authority. When considering the Kimberley as a whole it is clear that adequate conservation reserves are needed in other areas. Thus, among the mammals, the Northern Nail-tailed Wallaby (*Onychogalea unguifera*) and Dalgyte (*Macrotis lagotis*) are not protected by reservation because they do not inhabit the types of country in the two large northern reserves. These species appear to be most plentiful in the pindan country of the West Kimberley, a vegetation formation inadequately included in conservation reserves at present.

The biological survey reported in this publication shows that the Drysdale River National Park is an outstanding conservation area, rich in flora and fauna and with areas of spectacular scenery. The Park is inadequately served by roads and at present its development for tourist use would be difficult. However, it is already possible to enter parts of it via the adjacent cattle stations to the west and it is only a matter of time before the area begins

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to receive a significant visitor impact. Certainly the Park is much more accessible than the Prince Regent River Nature Reserve. Apart from the control of tourists an obvious management problem is the presence of wild cattle.

RECOMMENDATIONS

The survey showed that the existing reserve was largely adequate. However, in two areas the Park can be greatly improved.

In the first place, the western portion of the National Park is cut off from the main part by a stock route. Unfortunately, the stock route contains much of the Carson Escarpment, one of the most striking physiographic features of the region. It is doubtful if the stock route has ever been used for its gazetted purpose. Cattle are now transported by road train, the days of droving being over. There would seem no impediment, therefore, to those parts of the stock route adjoining and dividing the National Park being included in it.

Secondly, there is a unique area of tall closed-forest in Dysphania Gorge at our site C5 and, just to the west, there is a permanent swamp of biological interest (Galaxy Swamp). In this region the Park boundary follows the Drysdale River, the west side of the river being part of Carson River Station. Not only does this mean that Dysphania Gorge and Galaxy Swamp are outside the Park but also that half of the spectacular Solea Falls lies outside. This somewhat incongruous situation could be remedied by excising a small area from Carson River Station and adding it to the National Park (see Fig. 1 in Kabay, this publication). The area concerned consists of rugged Warton sandstones and has no pastoral value.

One other point on which no firm recommendation can be made concerns the representation of King Leopold Sandstones in the Park. The survey of the Prince Regent River Reserve (Miles and Burbidge 1975) showed

that this rock type is extremely rich in fauna. In comparison the area within the Park did not produce anything like the diversity expected. This is probably due to the relatively even terrain which does not provide suitable shelter. During the survey it was noted that there was an area of rugged King Leopold Sandstone to the north of the Park within Theda Station. This country was not examined during the survey and there are no data available on which to base any firm recommendation.

Finally, there seems to be no reason why this outstanding National Park should not receive Class A status under the Land Act. Such classification has no effect under the existing or proposed Mining Act but would provide proper recognition of its importance in the conservation of Australian ecosystems.

It is therefore recommended that:

1. those parts of the stock route adjoining and dividing the Drysdale River National Park, be included in it;
2. an area of Carson River Station, as shown in Fig. 1 in Kabay (this publication), be purchased by negotiation and added to the Park; specifically the north-west boundary of this addition would be the line going north-west from the top westerly most corner of the Park to a point grid ref. Sheet 4268, series R611, 730:830, thence eastward to the left bank of the Drysdale River;
3. reserve B32853 be proclaimed Class A.

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DRYSDALE RIVER NATIONAL PARK

REFER TO THIS MAP AS
SD 52-13 SD 52-9 VEGETATION

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126°45'49"

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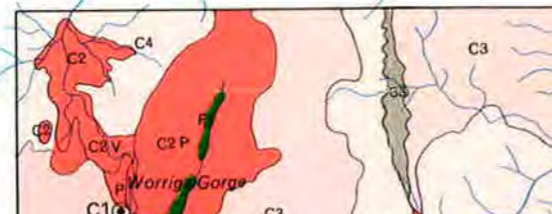
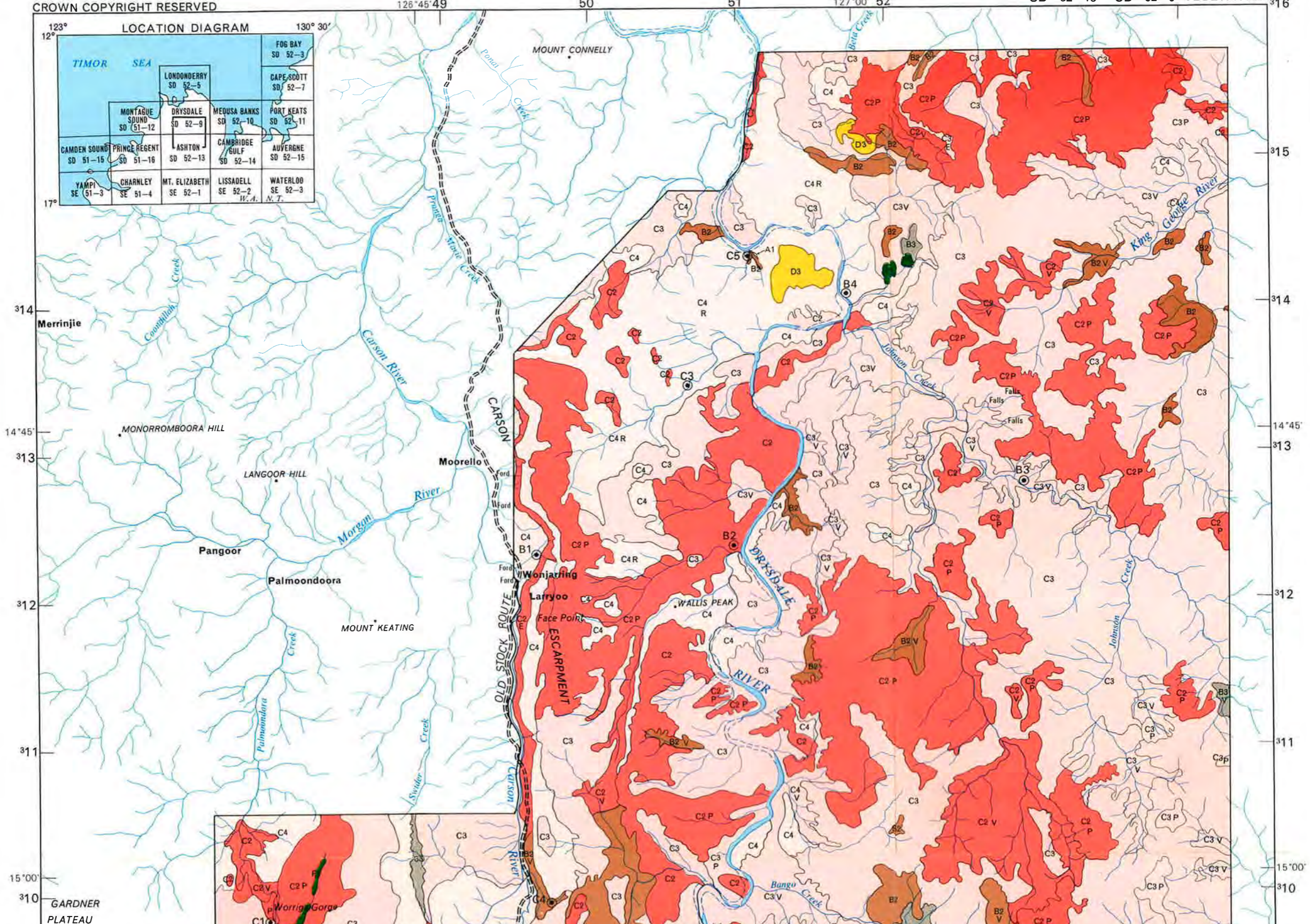
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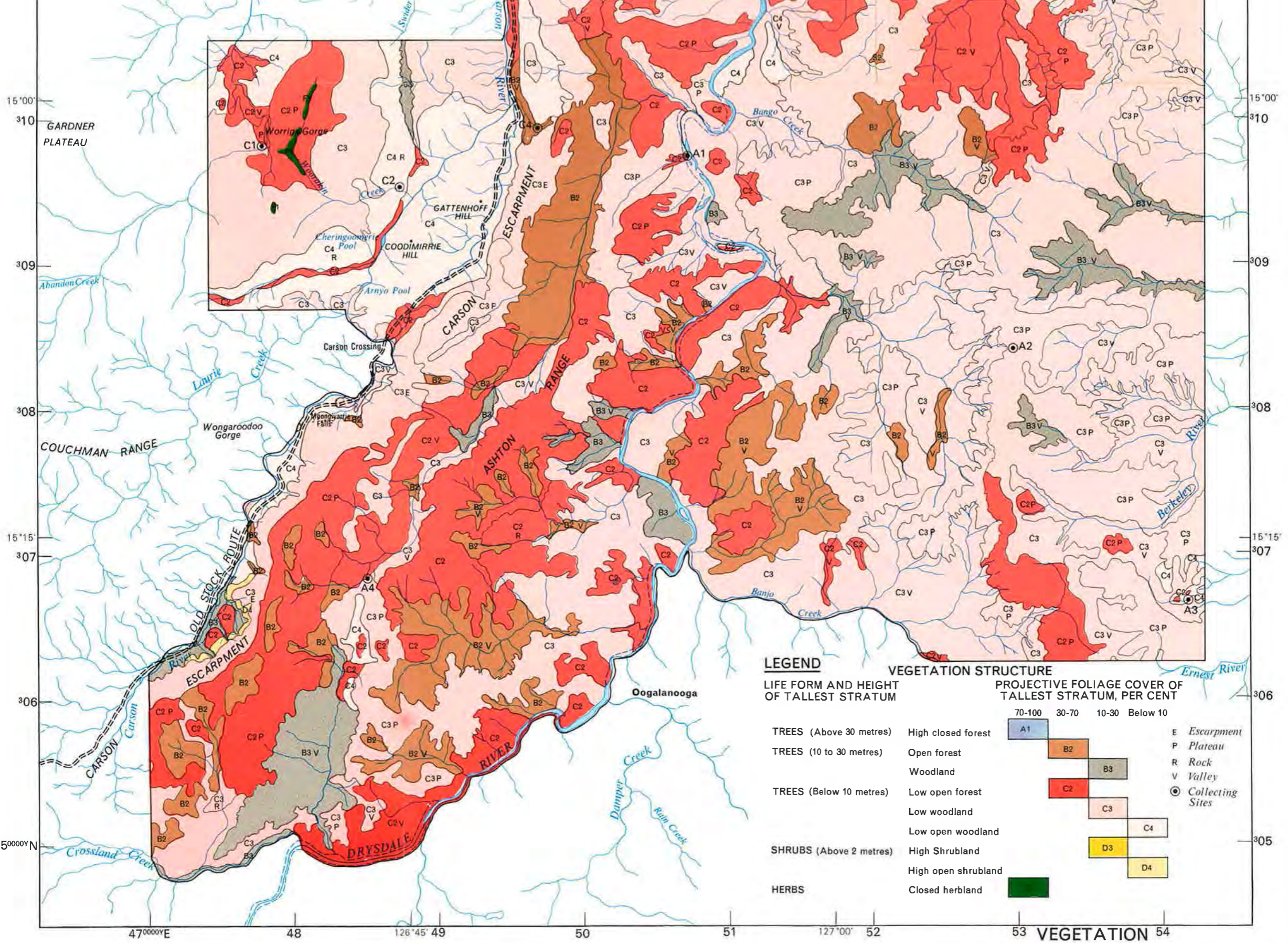
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LOCATION DIAGRAM

123°		130° 30'	
TIMOR SEA			
LONDONDERRY SD 52-5		FOG BAY SD 52-3	
MONTAGUE SOUND SD 51-12		CAPE SCOTT SD 52-7	
DRYSDALE SD 52-9		MEUSA BANKS SD 52-10	
PORT KEATS SD 52-11			
CAMDEN SOUND SD 51-15	PRINCE REGENT SD 51-16	ASHTON SD 52-13	CAMBRIDGE GULF SD 52-14
YAMPI SE 51-3	CHARNLEY SE 51-4	MT. ELIZABETH SE 52-1	LISSADELL SE 52-2 W.A.
			WATERLOO SE 52-3 N.T.





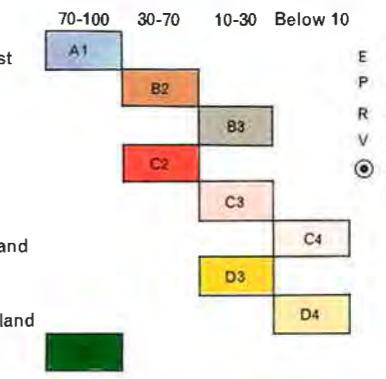
LEGEND

LIFE FORM AND HEIGHT OF TALLEST STRATUM

- TREES (Above 30 metres)
- TREES (10 to 30 metres)
- TREES (Below 10 metres)
- SHRUBS (Above 2 metres)
- HERBS

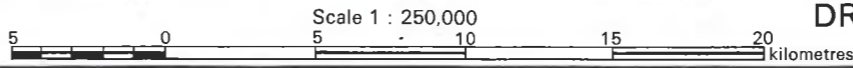
VEGETATION STRUCTURE

PROJECTIVE FOLIAGE COVER OF TALLEST STRATUM, PER CENT



- E Escarpment
- P Plateau
- R Rock
- V Valley
- Collecting Sites

Compiled by Dr. F. G. Smith, Director of National Parks from aerial photography flown June 1969 and helicopter traverse carried out by the author August 1975, on 1 : 250,000 base maps.



**DRYSDALE RIVER NATIONAL PARK
WESTERN AUSTRALIA**