DRAFT MANAGEMENT PLAN
PALLINUP/BEAUFORT INLET AREA

Environmental Protection Authority
Perth, Western Australia
Bulletin 178 August 1987

Draft Management Plan

Pallinup/Beaufort Inlet Area

Prepared for the

Environmental Protection Authority

by

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1. INTRODUCTION

1.1 LOCATION

The "Study Area", is a coastal strip 4-10 km in width, centred on the Beaufort Inlet (estuary of Pallinup River) about 113 km ENE of Albany (Figure 1). The Study Area, which covers about 19 000 ha (Table 1), is bounded on the west by the Jerramungup/Albany Shire boundary, on the east by the "Dog Fence", and on the north by farmland (Figure 2).

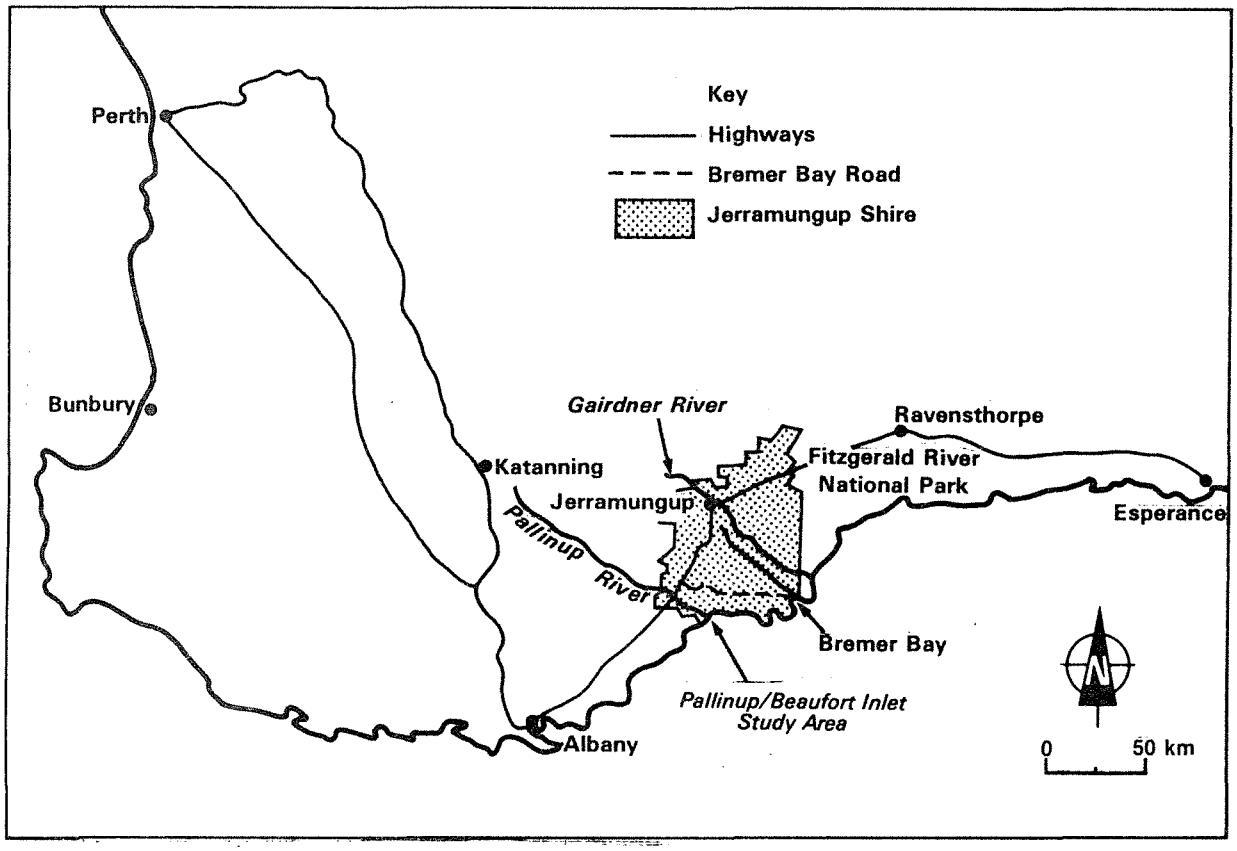


Figure 1. Jerramungup Shire and Pallinup/Beaufort Inlet Study Area.

Table 1. Crown Reserves in the Study Area.

RESERVE	PURPOSE	VESTING	AREA (ha)
14986	Parklands & Recreation	NV	526
14987	Recreation & Camping	JSC	1092
14988	Recreation & Camping	JSC	32
21647	Recreation & Camping	JSC	404
27102 (part)	Common & Recreation	NV	7384
31240 (part)	Government Requirements	NV	8262
33257 (part)	Parklands & Recreation	NV	600 approx
22353	Camping & Recreation	NV	809

JSC = Jerramungup Shire Council
NV = Not Vested

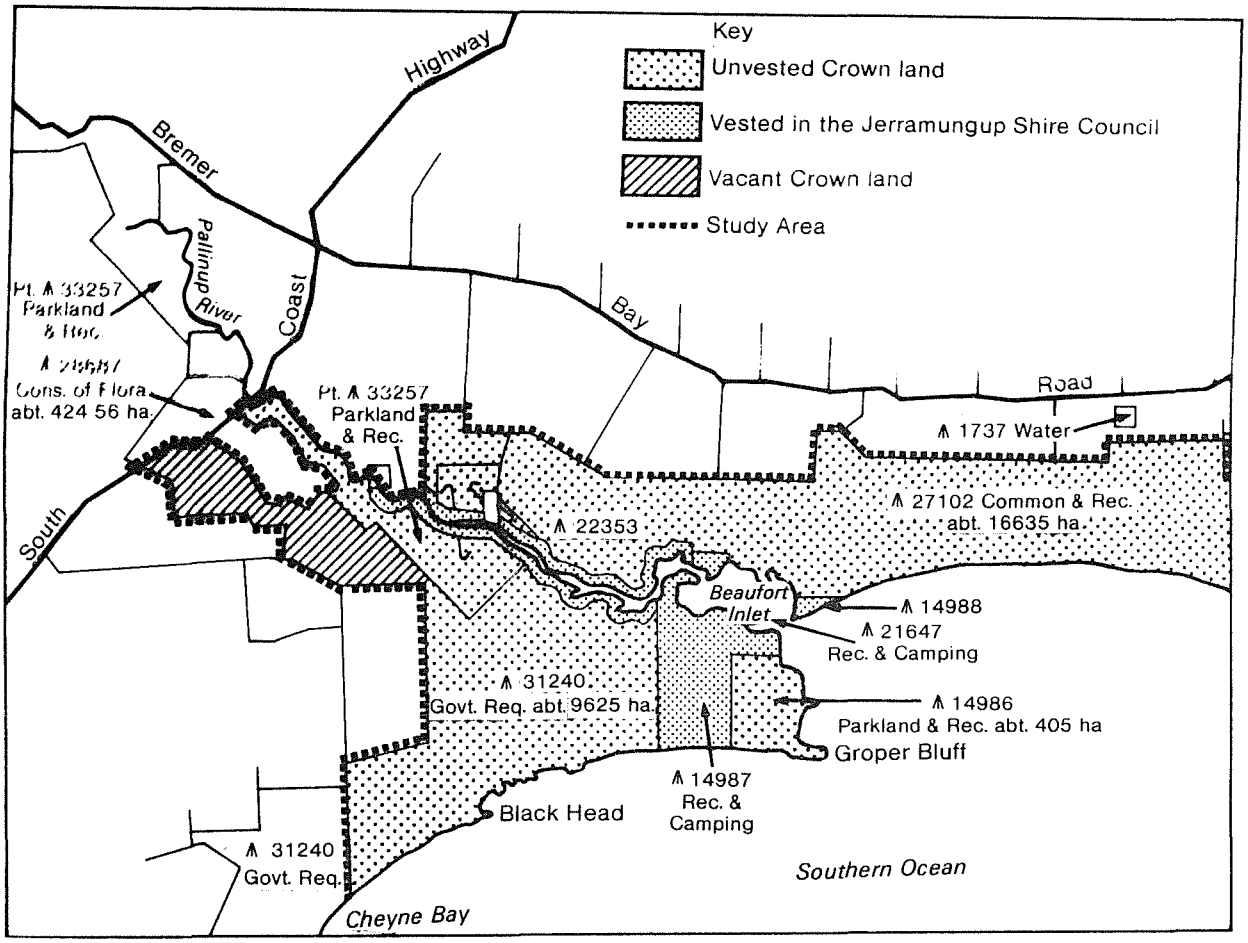


Figure 2. Land tenure of Study Area

The western and eastern boundaries were selected for administrative and management purposes. If the Study Area had been extended further west, then administration would have also involved the Albany Shire. The "Dog Fence" is also a definite boundary, whereas the boundaries of grazing leases at Cape Knob are not fenced.

1.2 BACKGROUND

In 1976, the Environmental Protection Authority (EPA) published recommendations for conservation reserves along the south coast of Western Australia.(1) The Study Area is within System 3. One of the recommendations outlined the establishment of coastal working groups. Each was to contain representatives of Local Government and State Government Departments, and people with specialized or localized knowledge.

During 1981, the Gnowangerup Shire Working Group was formed. In 1982, the Shire was divided and the coastal areas came under the control of the Jerramungup Shire. A Jerramungup Shire Working Group was formed during February 1983. One of the Group's recommendations was for further investigation of the resources and management requirements of the Pallinup River/Beaufort Inlet area, which is the purpose of this report.(2)

The need for coastal management plans is paramount as coastal areas are experiencing increased use, facilitated by 4WD vehicles. Landscape degradation has resulted and people are expressing their concern. Further, Governments are strongly promoting tourism which adds to the people pressure on the environment.

1.3 LAND TENURE

Land tenure in the Study Area is shown in Figure 2 and Table 1. It comprises Crown land, which can be sub-divided into:

- reserved Crown land, held on behalf of the public; the land usually being directed to certain purposes by public authorities; and

- unreserved (vacant) Crown land for which no use has yet been determined and is under the control of the Department of Land Administration.

Most of the Study Area is occupied by unvested Crown reserves.

1.4 MANAGEMENT PLAN

The plan has been prepared to present coastal management information to council and local residents of the Jerramungup Shire, Government and the interested public.

Sound coastal management takes into account:

- climatic, geological and biological features and processes which relate to land capability for specific uses;

- expectations of the community; and

- present and predicted use pressures.

An important aspect of a draft plan is that recommendations are made which can be further developed through collaboration and discussion. There will be adequate opportunity to direct comments to the Jerramungup Shire Council on the draft plan.

1.5 SOURCES OF INFORMATION

This report is based on a detailed report summarizing unpublished data on landforms, soils, vegetation, flora, birds, mammals, reptiles and amphibians.(3)

2. NATURAL ENVIRONMENT

2.1 CLIMATE

As climatic data have not been recorded for the Study Area, Cape Riche (about 12 km from the Study Area), Bremer Bay and Albany meteorological records are used.

The Study Area experiences warm to hot summers and cold winters. More rain falls during winter than summer. The weather results mainly from the west to east passage of lows about once every few days. During summer, the lows are forced well south of the Study Area by ridges that form from a large high in the Indian Ocean. Temperatures are warm and pleasant with low humidity while the ridge is forming. Strong, hot northerly winds precede the passage of the trough. The temperature and humidity rise with the passage of the trough and associated thunderstorms sometimes result in rain.

During winter, the lows and highs have moved further north, temperatures are lowered and the "lows" have a greater influence on the weather. The troughs are absent and heavier rain is associated with cold fronts.

The heaviest falls of rain have one of two origins. Firstly, when a cold front joins up with moist tropical air near the west coast and forms a deep depression that moves along the south coast. This may happen at any time of the year. Secondly, when a tropical cyclone has moved inland, degenerated into a rain-bearing depression, and passed over the Study Area.

The Study Area is under strong marine influence. During summer there is usually a strong sea breeze by midday. Onshore winds sometimes bring drizzle which increases during winter. Onshore convergence sometimes results in thunderstorms and heavy localized coastal falls.

2.1.1 RAINFALL

The average annual rainfall for Cape Riche is 567 mm (Table 2). The largest proportion (68%) falls between May and October inclusive.

Table 2. Rainfall (mm)/Rainy Days - Cape Riche (over 70 years).

	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
Rainfall	22	23	32	50	65	72	68	66	59	56	31	23	567
Rainy Days	4	4	5	8	10	12	12	12	11	10	6	5	99

Falls associated with thunderstorms are generally of short duration and heavy (from 10 to 50 mm). The following cold front may bring scattered light showers (1-8 mm). Onshore winds may bring drizzle (1-5 mm). Degenerated cyclones and deep depressions bring the heaviest falls (25-100 mm) over periods of 1 to 3 days. The highest monthly total at Cape Riche was 225 mm for October 1910, and the highest 2-month total was for June (195 mm) and July (202 mm) 1978. Rainfall is reliable at Cape Riche where the lowest recording was 273 mm in 1936, and the highest was 957 mm in 1917.

The average number of rainy days at Cape Riche is 99 (Table 2), compared to 120 days at Bremer Bay and 178 days at Albany.

2.1.2 TEMPERATURE

The nearest coastal station with long-term temperature records is Albany (Table 3).

Table 3. Temperatures ($0^{o}C$) - Albany.

	J	F	M	A	M	J	J	A	S	O	N	D
Av Maximum	25.4	25.3	24.2	21.3	18.6	16.5	15.8	15.8	17.0	18.7	20.9	23.8
Av Minimum	13.6	14.4	13.1	11.5	9.6	8.0	7.5	7.2	7.6	9.0	10.6	12.5
Highest Temperature	45.6	41.6	40.5	38.8	32.6	23.6	22.5	24.1	27.8	33.1	38.1	40.9
Lowest Temperature	5.6	5.1	4.5	4.9	1.9	0.0	1.1	1.4	0.7	1.8	2.9	3.7

2.1.3 WINDS

During summer, a fresh sea breeze usually blows by noon. Occasional, hot northerly winds occur during summer. Strong winds are associated with most storms during the winter and blow from west to south.

2.2 GEOLOGY

Thom & Chin have described the geology of the Study Area at the scale of 1:250,000.[4] Symbols in brackets in the following sections are those used by Thom & Chin (1984) on their geological map.[5] The Study Area has been covered by the sea at least twice and most of the present landforms have resulted from marine action.

2.2.1 ARCHAEAN GNEISSES

Underlying the whole Study Area is an ancient bedrock of gneisses (Agn & Ahn). These rock types were granite that was metamorphosed (altered) by heat, pressure and the intrusion of molten rock and associated super-hot gasses. The original granite was part of the Yilgarn Block, one of the oldest rock masses in the world, that covers much of southern Western Australia. The last metamorphic event occurred more than 2 000 million years ago and the rocks are referred to as Archaean in age.

2.2.2 PROTEROZOIC SEA LEVEL RISE

Australia was once part of Gondwanaland; but about 1 500 million years ago a zone of weakness had already developed across the super-continent approximately where the south coast is today. A rift valley developed in the zone of weakness and the Study Area was on the valley floor. Later, the sea level rose about 100 m above the present level due to melting of the ice caps about 1 400 million years ago. This incursion by the sea laid down sediments of sand, silt and clay that were later metamorphosed into the rock that formed the Stirling Ranges and the Barrens. Effects on the Study Area while covered by the sea are not clear. However, some levelling of the landscape by marine erosion would have occurred.

2.2.3 EOCENE SEA LEVEL RISE

The sea level then fell to somewhere near its present level until 43-40 million years ago (Eocene). During the breaking away of Australia from Antarctica, the sea level rose about 140 m above its present level. Sediments of clays, sponge spicules and some sands were laid down over extensive areas along the south coast from Nornalup to Balladonia. The sediments are called the Plantagenet Beds (Tp) and consist almost entirely of the rock called spongolite. The Plantagenet beds have been separated into two formations. The lower formation (Werillup Formation) contains beds of poor quality brown coal (lignite), though it is not found in the Study Area. However, the upper formation (Pallinup Siltstone) is one of the major geological elements of the Study Area. Its type locality is on the eastern margin of Beaufort Inlet. The cream and pale yellow soft spongolite is commonly exposed around the Beaufort Inlet, on slopes of the Pallinup River, and on some coastal landforms between Boat Harbour and Cape Riche. A number of marine fossils of warm and shallow waters have been recorded.[6]

Pallinup Siltstone covered much of the Study Area including the Pallinup River valley, and extended further out to sea than the present coastline. As

the sea level fell, the soft spongolite was easily eroded. Waves also eroded coastal deposits as is now evident just west of Cape Riche.

2.2.4 PLEISTOCENE SEA LEVEL FALL

Sometime during the last 2 million years, an expansion of the ice-caps caused the sea level to fall about 80 m below its present level. The climate during this period was also drier than at present. As a result, large quantities of limestone sands on the exposed sea floor were blown inland against, and over the existing coastline. Sand dunes were formed up to at least 180 m above the existing sea level. The dunes lithified (became rock) and have since been eroded. Mt Groper (180 m), the highest point in the Study Area, is a remnant of the former sand dunes (Photograph 1). These dunes (Qpl) appear to be of the same age and origin as dunes west of the Study Area, consisting of Tamala Limestone of Pleistocene age.

Photograph 1. Looking east from Mount Groper. Note eroded track over limestone in foreground.

Another effect of sea level being lower than at present was to deepen the Beaufort Inlet and erode the Pallinup River into its gneissic bedrock. With a return to the present sea level, Beaufort Inlet became a drowned estuary.

2.2.5 RECENT GEOLOGICAL PROCESSES

Since the fall of the Eocene sea, the extensive flat spongolite plains have weathered into mainly sandy or gravelly sand soils (Czs). During the last arid period about 15 000 years ago, mobile sand dunes (Qn) developed over the older and lithified sand dunes (Qpl). Silt is still being deposited in Beaufort Inlet, as well as in small depressions and swamps (Qrp) on the plateau and within some sand dune areas. Small areas of colluvium (material

washed down slopes) have developed (Qc) along the Pallinup River. Along the coastline, the foredune (Qf) is frequently changing.

The Study Area has been geologically stable for at least the last 1 400 million years, and has not experienced major movements or glaciation.

2.3 LANDFORMS

The sweeping coastline is backed mainly by Old Dunes and the Plateau. Young Dunes cover some of the Old Dunes and extend onto the Plateau slope. Crossing the Study Area is the saline Pallinup River and Beaufort Inlet. The River has ephemeral flows which results in the estuary being closed off from the sea by a sand bar for long periods. River level refers to when the estaury is open to the sea.

2.3.1 COASTLINE

The shape of the coastline is controlled by gneisses exposed at sea level at Cape Riche, Black Head, Groper Bluff, Point Irby and at the base of the cliffs where the Dog Proof Fence reaches the sea. The gneisses are much harder than either limestone or spongolite, and weather at a much slower rate. Wide sweeping beaches are present between most of the gneissic exposures. The beaches, 20-50 m wide, consist mainly of ground-up sea shells and include a small amount of quartz sand. Backing most beaches is a low and unstable foredune 1-2 m in height.

2.3.2 OLD DUNES

These consist of former dunes which have been lithified into limestone and now covered largely by shallow soils. Where they reach the sea, the slope is eroded. Bare bedrock and rubble are common, particularly on steeper slopes. The limestone slopes vary in steepness and may form cliffs 150 m in height. Generally the steeper and higher slopes are eroded by water run-off.

Two major areas of old dune fields are present in the Study Area: Black Head to Beaufort Inlet, and from Beaufort Inlet to the Dog Fence. The former field is up to 2 km wide, and 35-180 m above sea level. Remnants of the former dune landscape still remain as ridges 1-3 m high. The latter field is 20-50 m above sea level.

Caves are frequently associated with thicker limestone deposits but none are known in the Study Area, or in any other limestone deposit along the Jerramungup coast.

2.3.3 YOUNG DUNES

These are recent in origin and have not been lithified. They consist largely of material weathered from the old dunes, supplemented by beach sands blown inland. Aerial photography indicates that an extensive area is covered by these sands west of where the Dog Fence reaches the sea. The young dunes are 1-6 m in height with the tallest of them generally having steeper slopes. Generally, the soils are barely stabilized by vegetation and blowouts are common. These dunes also cover Pallinup Siltstone in some places.

2.3.4 RIVER VALLEY AND ESTUARY

The ancient river valley was cut into gneisses and covered with Pallinup Siltstone during the Eocene sea level rise. Erosion of the soft siltstone

followed the fall in sea level. When the sea level remained at one level for hundreds of years, estuarine benches were cut into the spongolite and these are a feature of some areas. At present, most of the valley slopes are still covered with Pallinup Siltstone. Exposures of bedrock gneisses become more common inland.

The Pallinup River has a relatively narrow channel and flanking the river are a few narrow flats (Photograph 2). Near Millers Point is a flat about 2 m above river level that is both colluvial and alluvial in origin. Both the estuary and the river are saline. The water level varies depending on whether the estuary is separated from the sea by a sand bar or not. If separated, the estuary level may fall up to 60 cm, or rise to 100 cm above sea level before the sand bar is breached. During periods of high levels, low-lying flats become submerged eg the extensive saline flat opposite Millers Point. During periods of low water levels, some small areas of rock become visible. The salt content rises as the water level falls.

Photograph 2. Pallinup River-gneissic rock in foreground.

2.3.5 PLATEAU

The landform consists of three units. First is an extensive and almost flat plain, about 100 m above sea level. Eroded flat when last covered by the sea, the plain is largely underlain by Pallinup Siltstone. Most of the plain has uncoordinated drainage with some depressions (50-200 m across) and swamps (100-1 000 m across). Abnormally heavy rains are required to fill the depressions (to 60 cm) and swamps (to 100 cm).

Second is the old coastal slope now 1-4 km inland of the coastline. In places the slope is steep and stony. Third are few V-shaped gullies cut into the plain along the old coastal slope.

2.4 SOILS

All the soils of the Study Area are infertile for agriculture. The pH of the limestone soils varies from 8.0 to 8.25, while that of the other soils is around 6.5.

2.4.1 COASTLINE

Beaches and foredunes consist of ground-up sea shells and small amounts of quartz sand.

2.4.2 OLD DUNES

These soils are sandy and vary in depth from skeletal (less than 20 cm) to shallow (20-60 cm). They are calcareous and profile development is not apparent.

2.4.3 YOUNG DUNES

Two soil types have been recorded. The first is similar to those on the old dunes but may be up to 6 m thick. The second is an older soil with some profile development.

2.4.4 RIVER VALLEY AND ESTUARY

A number of soil types are present and they often grade into one another. Skeletal sandy loams occur on the estuarine benches, with shallow clay loams or loams on the slopes. Along the river margins are saline quartz sands, mainly eroded off the gneisses further inland. The salt flat consists of saline clays, silts and sands. Clay loam is the main soil present on colluvial flats near Millers Point.

2.4.5 PLATEAU

Pallinup Siltstone has weathered to a depth of 80-100 cm, and has formed mainly a duplex soil of well-drained sandy loams or gravelly sands over sandy clays. In some places, sheets of siliceous sands have been spread over this surface. The origin of the sand is uncertain but it may be remnants of dunes formed during arid periods. Some of the Plateau is poorly drained and may be waterlogged following heavy falls of rain. Silts, clays and sands are present on the bottom of depressions and swamps.

2.5 VEGETATION

The Study Area is within the Eyre Botanical District and consists of parts of two vegetation systems.(7) West of the Pallinup River and Beaufort Inlet is the Cape Riche Vegetation System, and the remainder is part of the Bremer Bay Vegetation System. The vegetation of the study area has been mapped at the scale of 1:40 000.(8)

2.5.1 CLASSIFICATION AND DISTRIBUTION

The vegetation types are separated according to aspects of the upper plant layer (stratum):

- life form (trees, mallees, shrubs etc);
- height class; and
- density class (canopy cover).

Some vegetation types have major changes in life form and height class over a metre or so. The changes are usually related to dramatic variations in soil depth. These vegetation types are called "complexes". Most formations occur on more than one distinct soil type. Formations may be separated into vegetation types by reference to the dominant species in the tallest layer, for example, closed mallee Angle-fruited Mallee (Eucalyptus angulosa).

The main vegetation types on each landform are discussed briefly below.(9) Often, there are transitional areas between vegetation types. The relationships between landforms, soils and vegetation types are presented in Table 4.

2.5.2 COASTLINE

Most of the beaches are bare but are backed by a foredune with Olearia axillaris complex. Exposures of gneissic bedrock support Coastal Granite complex in less exposed areas.

2.5.3 OLD DUNES

Most of the inland dunes east of Beaufort Inlet are covered with open mallee Redheart (Eucalyptus decipiens). The stony crests of lithified dunes support mallee or Melaleuca pentagona thicket and exposed coastal areas have Melaleuca pentagona as a dense low heath.

West of Beaufort Inlet, Angle-fruited Mallee and Redheart grow over skeletal soils of the lithified dunes. Melaleuca pentagona thicket and dense low heath occur in similar areas.

2.5.4 YOUNG DUNES

A large proportion of the young dunes are covered by Melaleuca pentagona thicket grading to low dense heath near the coastline. Redheart, Acacia cochlearis or Melaleuca thymoides occur in more sheltered areas.

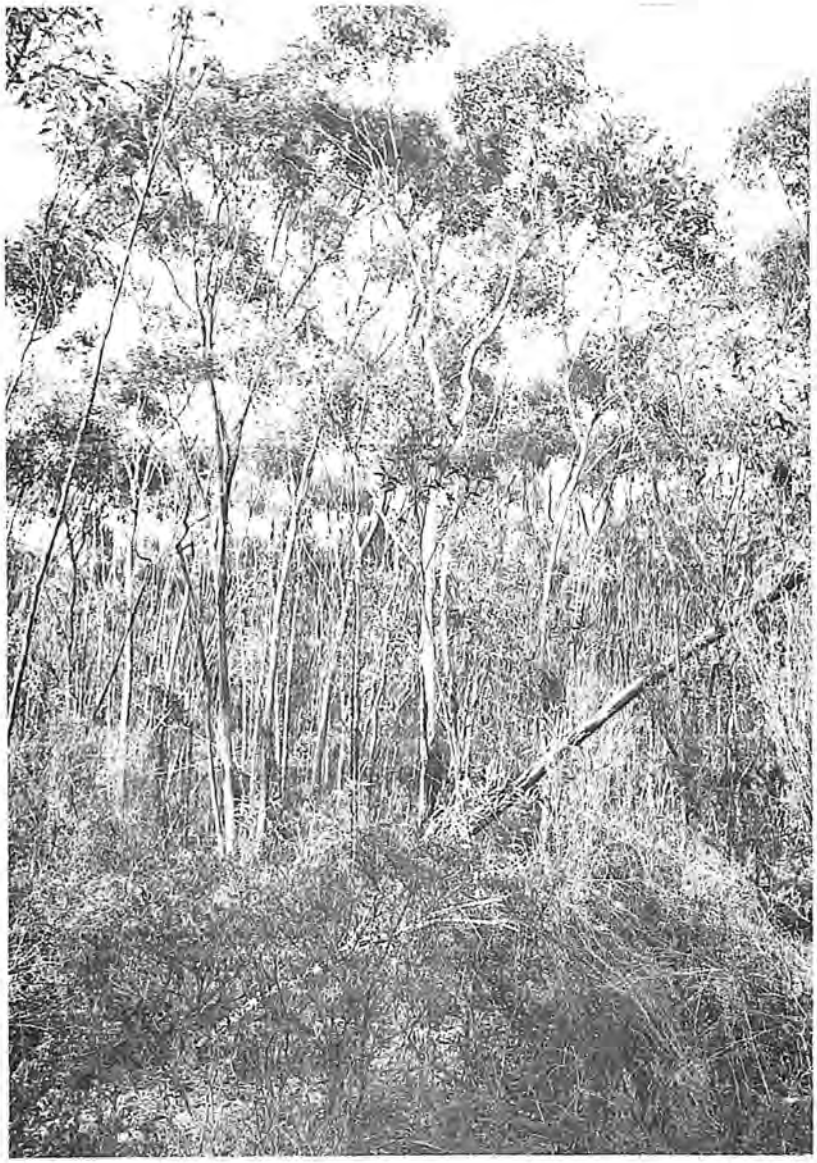
2.5.5 RIVER VALLEY AND ESTUARY

Spongolite sections support open mallee Blue Mallee (Eucalyptus gardneri) with open mallee Port Lincoln Mallee (Eucalyptus conglobata) growing on colluvial deposits. Note that Eucalyptus gardneri grows both as a mallee (Blue Mallee) and as a tree (Blue Mallet). Larger spongolite breakaways have open low woodland as Brown Mallet (Eucalyptus astringens) (Photograph 3) while low forest is present on smaller exposures and their colluvial slopes. Further inland on the shallow soils over gneissic bedrock there is an open woodland of Granite She-oak (Allocasuarina huegeliana) or open mallee Tallerack (Eucalyptus tetragona). Granite complex is present on skeletal soils.

Vegetation along the river margins is markedly different from the lower slopes due to greater soil moisture, and salinity. Open low woodland Swamp Yate (Eucalyptus occidentalis) is the most common species on the lower slopes. Dwarf forest Paperbark (Melaleuca cuticularis) is common on waterlogged saline soils of the river margin, for example at the "Paperbarks" camping area (Photograph 4), while small areas of Casuarina obesa are present. An extensive low-lying flat opposite Millers Point supports a low heath Samphire (Halosarcia spp).

Table 4. Relationships between Landforms, Soils and Vegetation

LANDFORM	SOIL	VEGETATION	STRUCTURAL CLASSIFICATION[10] (MODIFIED)
COASTLINE			
Foredunes	Loose sands	*Olearia axillaris*	complex
Exposed gneisses at sea level	Saline to sub-saline loamy sands	Coastal Granite	complex
OLD DUNES (East of Beaufort Inlet)			
Dunes	Deep loose sand	*Eucalyptus decipiens*	open mallee
Stony crests of lithified dunes	Skeletal limestone sands	*Eucalyptus* unnamed	mallee
		Melaleuca pentagona	thicket
Stony coastal slopes	Skeletal limestone sands	*Melaleuca pentagona*	dense low heath
(West of Beaufort Inlet)			
Lithified dunes	Skeletal limestone sands	*Eucalyptus angulosa*	mallee
		Eucalyptus angulosa	open mallee
		Eucalyptus angulosa	very open mallee
		Melaleuca pentagona	thicket
Stony coastal slopes	Skeletal limestone sands	*Melaleuca pentagona*	dense low heath
YOUNGER DUNES			
Exposed lithified dunes	Skeletal limestone sands	*Melaleuca pentagona*	thicket
Exposed coastal steep slopes	Skeletal limestone sands	*Melaleuca pentagona*	low heath
Sheltered inland dunes	Deep loose sands	*Eucalyptus decipiens*	open mallee
		Acacia cochlearis	low heath
		Melaleuca thymoides	low heath
RIVER VALLEY & ESTUARY			
Spongolite slopes	Shallow to skeletal loams	*Eucalyptus gardneri*	open mallee
	Colluvial loams	*Eucalyptus conglobata*	open mallee
Spongolite breakaways	Skeletal loams	*Eucalyptus astringens*	open low woodland
Base of breakaways	Colluvial loams	*Eucalyptus astringens*	low forest
Middle and upper slopes (gneissic)	Skeletal loamy gritty sands	*Allocasuarina huegeliana*	open dwarf woodland
		Granite	complex
	Shallow loamy sands over sandy clays	*Eucalyptus tetragona*	very open mallee
Lower slopes (gneissic)	Loamy sands/sandy clays	*Eucalyptus occidentalis*	low woodland
River margins	Saline alluvium	*Casuarina obesa*	low woodland
		Melaleuca cuticularis	dwarf forest
Saline flats	Saline alluvium	*Halosarcia* spp	low heath
PLATEAU			
Plains	Well-drained loamy sand/sandy clays	*Eucalyptus marginata*	very open mallee
		Eucalyptus decipiens	very open mallee
	Well-drained gravelly sands	*Eucalyptus buprestium*	very open mallee
	Poorly-drained shallow loamy sands over sandy clays	*Eucalyptus angulosa*	very open mallee
	Well-drained, deep white sands	Proteaceous	scrub
Stripped margins of plateau	Skeletal to shallow loams	*Eucalyptus gardneri*	open mallee
Depressions	Alluvium	Depression	complex
Swamps	Alluvium	*Eucalyptus occidentalis*	low woodland

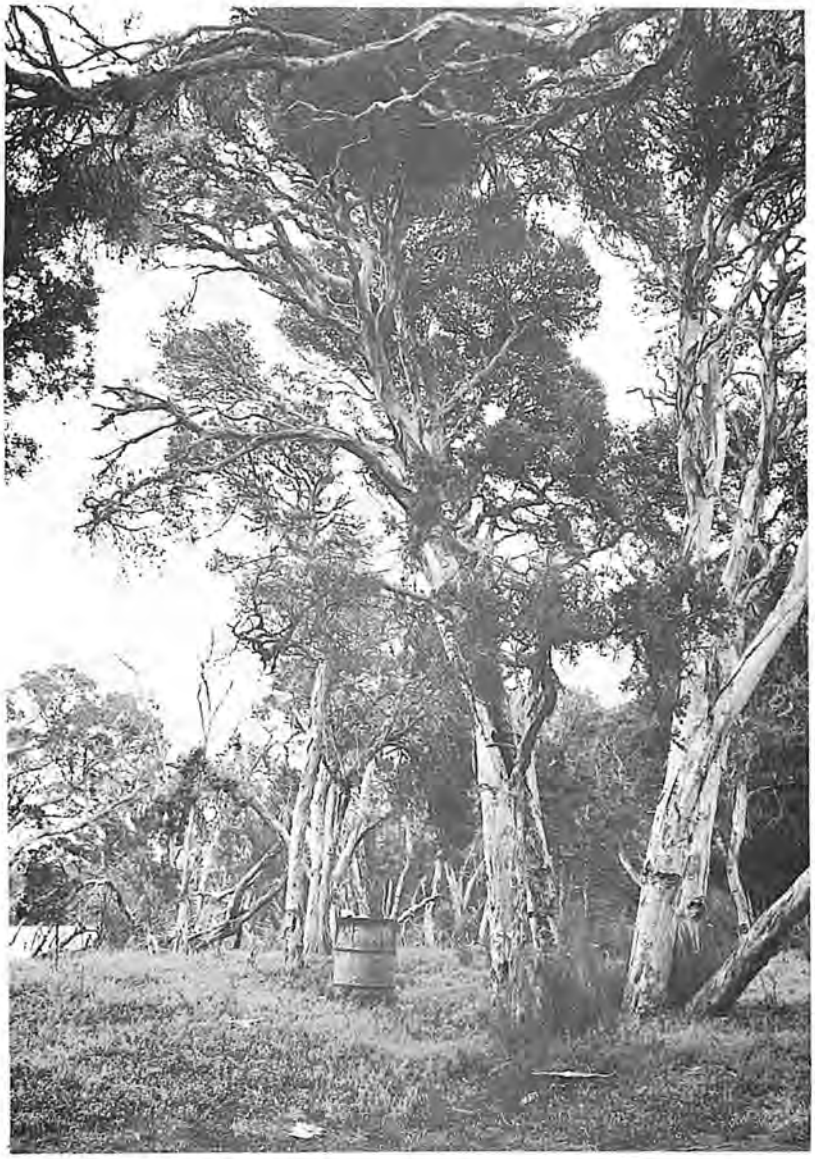


Photograph 3. Low forest of Brown Mallet (Eucalyptus astringens).

2.5.6 PLATEAU

West of Beaufort Inlet, very open mallee Jarrah (Eucalyptus marginata) and very open mallee Redheart are the most common vegetation types on well-drained sandy soils while Apple Mallee (Eucalyptus buprestium) is more common on gravelly sands. Although Jarrah is well known as a forest timber tree, a mallee form occurs from roughly east of the Kalgan River, to the Pallinup River.

East of Beaufort Inlet open mallee Redheart is common, with a few small areas of Proteaceae scrub on deep sands (Photograph 5). Angle-fruited Mallee is present on shallow sandy loams that are often waterlogged during much of winter. Along the boundary between the river valley and the plateau, erosion has bared areas of spongolite and open mallee Blue Mallee grows on skeletal soils overlying the spongolite. Depressions within the plain support Depression complex while low woodland Swamp Yate occurs in the swamps.



Photograph 4. The "Paperbarks" camping area.

2.6 FLORA

The Study Area is within the South-west Botanical Province,[11] one of the world's outstanding botanical areas.[12] Important early plant collections in the general area were made by James Drummond (professional plant collector) in 1848 and by George Maxwell (Sandalwood cutter) around 1890.

Newbey recorded one species of fern, and 566 species, four sub-species and nine varieties of flowering plant in the Study Area.[13] The flora is typical of that found along the south coast from Cape Riche to Hopetoun. Eight species were recorded for the first time in the Study Area (Table 5).

2.7 VERTEBRATE FAUNA

2.7.1 BIRDS

In January 1985, 85 bird species were recorded (see Appendix 1), including two species gazetted as rare in Western Australia: Western Whipbird (*Psophodes nigrogularis*) and Red-eared Firetail (*Emblema oculata*). Many

Photograph 5. Proteaceous scrub on deep sand with Banksia baxteria in foreground.

species not recorded are known in nearby areas with similar habitats to the Study Area eg Fitzgerald River National Park.(14)

A wide range of bird habitats are present in the Study Area, including low woodlands, mallee/shrublands, Samphire flats, permanent water bodies - river and estuary, beach and the sea. Some of the woodland plants are particularly attractive to birds, such as Swamp Yate and Banksia media as these have heavy nectar flows.

Some migratory birds stopover at the estuary during summer. However, the number of species and individuals are thought to be lower than at Bremer Bay or Albany because Beaufort Inlet lacks suitable mud flats and low sand patches.

2.7.2 MAMMALS

There is little information on mammals. The Western Australian Museum has records of six species: Honey possum (Tarsipes rostratus), House Mouse (Mus musculus), Western Grey Kangaroo (Macropus fuliginosus), Bush Wallaby (M irma), Echidna (Tachyglossus aculeatus) and Southern Bush Rat (Rattus fuscipes). Based on their known distribution, another 24 species may occur in the Study Area.(15)

2.7.3 REPTILES AND AMPHIBIANS

In January 1985, 12 species of reptile were recorded (see Appendix 2). Forty two species of reptile and eleven frog species are expected to be present in the Study Area. (16)

Table 5. Important Plant Species.

SPECIES	FIRST RECORD	RARE
Acacia dictyoneura	.	X
Acrotriche plurilocularis	.	X
Baeckea sp (Photograph 4)	X	.
Beyeria latifolia	.	.
Dodonaea trifida	.	X
Epacridaceae genus indet.	X	X
Eucalyptus doratoxylon	.	X
Eucalyptus newbeyi	X	X
Hydrocotyle hispidula	.	X
Hemigenia sp	.	X
Hopskinia ascendens	.	X
Isolepis stellata		
Kunzea pauciflora	.	X
Kunzea aff recurva	.	X
Lasiopetalum rosmarinifolium var latifolium	.	.
Lepidosperma ustulatum	.	X
Leucopogon sp	X	.
Leucopogon sp	X	.
Leucopogon sp	X	.
Leucopogon sp	X	.
Microcorys virgata		X
Pomaderris racemosa	.	X
Ricinocarpus glaucus	.	E
Santalaceae genus indet	.	X
Scaevola myrtifolia	.	X
Scaevola sp	X	.
Stylidium sp	.	X
Styphelia hainesii	.	E
Thomasia cognata	.	X
Thomasia triphylla	.	X
Tricostularia sp	.	X

E = Extension of Range

2.8 SYNOPSIS FOR RESOURCES

2.8.1 CLIMATE

The weather is pleasant for much of the year. Even during winter, places such as Millers Point have vegetation tall and dense enough to provide a protected and pleasant environment. Cape Riche, near the Study Area, averages only 99 rain days per year compared to 120 at Bremer Bay and 178 at Albany. During summer, the sea breeze is usually present by midday so that nights are cool.

2.8.2 LANDSCAPE

The coastline is attractive with sweeping white beaches. The river valley has a permanent but saline river and estuary. Exposed Pallinup Siltstone, occasionally occuring as cliffs, enhances the valley appearance. Some plant species are in flower at all times of the year, with the best displays

between August and November. Overall, the natural landscape prevails as man-made facilities still have a low impact.

2.8.3 GEOLOGY, LANDFORMS AND SOILS

The Pallinup Siltstone on the eastern margin of Beaufort Inlet is an important geological feature. Near Boat Harbour, are excellent examples of where the the Pallinup Siltstone is overlain by the Old Dunes.

The landforms and soils are not unique or the best examples known. However, they are responsible for much of the Study Area's character (Figure 3).

2.8.4 VEGETATION AND FLORA

While most of the vegetation is in good condition, all the types present occur elsewhere. There is a small area of Eucalyptus cornuta woodland north of Millers Point that is of particular interest. This is an isolated patch some distance from its usual occurrence along many streams in the Jarrah woodlands.

The flora of the Study Area is outstanding, although no species gazetted as rare flora has been recorded.(17) So far, the record of important species in the Study Area is eight new species, 21 additional rare species and two major extensions of range (Table 5).

2.8.5 VERTEBRATE FAUNA

Two gazetted rare birds have been recorded in the Study Area, and another two may be present. The Western Whipbird (Psophodes nigrogularis) is also present in denser stands of open mallee between Mount Manypeaks and the Ravensthorpe Range, and populations in the Fitzgerald River National Park. The Red-eared Firetail (Emblema oculatum) is present in dense vegetation in gullies from at least the mouth of the Fitzgerald River, to the Moore River.

Both the Ground Parrot (Pezoporus wallicus) and the Western Bristlebird (Dasyornis longirostris) are likely to occur in the Study Area. Over the last decade, the Ground Parrot has been recorded from Augusta to Cape Arid with the main permanent population known from the North Fitzgerald area.(18)

The Western Bristlebird has been recorded near Mount Manypeaks and in the Fitzgerald River area in very open mallee with a dense understorey of low shrubs. Both species are extremely rare.

The poor knowledge of mammals in the south coast region prevents any meaningful discussion on species with high conservation values. However, the Dibbler (Parantechinus apiculis) could be present in the dense shrublands of the Study Area. Since 1967, this very rare species has been recorded at Hassall Beach (three times), Jerdacattup (two times), Boullanger and Whitlock Islands,(19) and recently near the northern boundary of the Fitzgerald River National Park.(20)

Figure 3. Landforms, slopes and drainage.

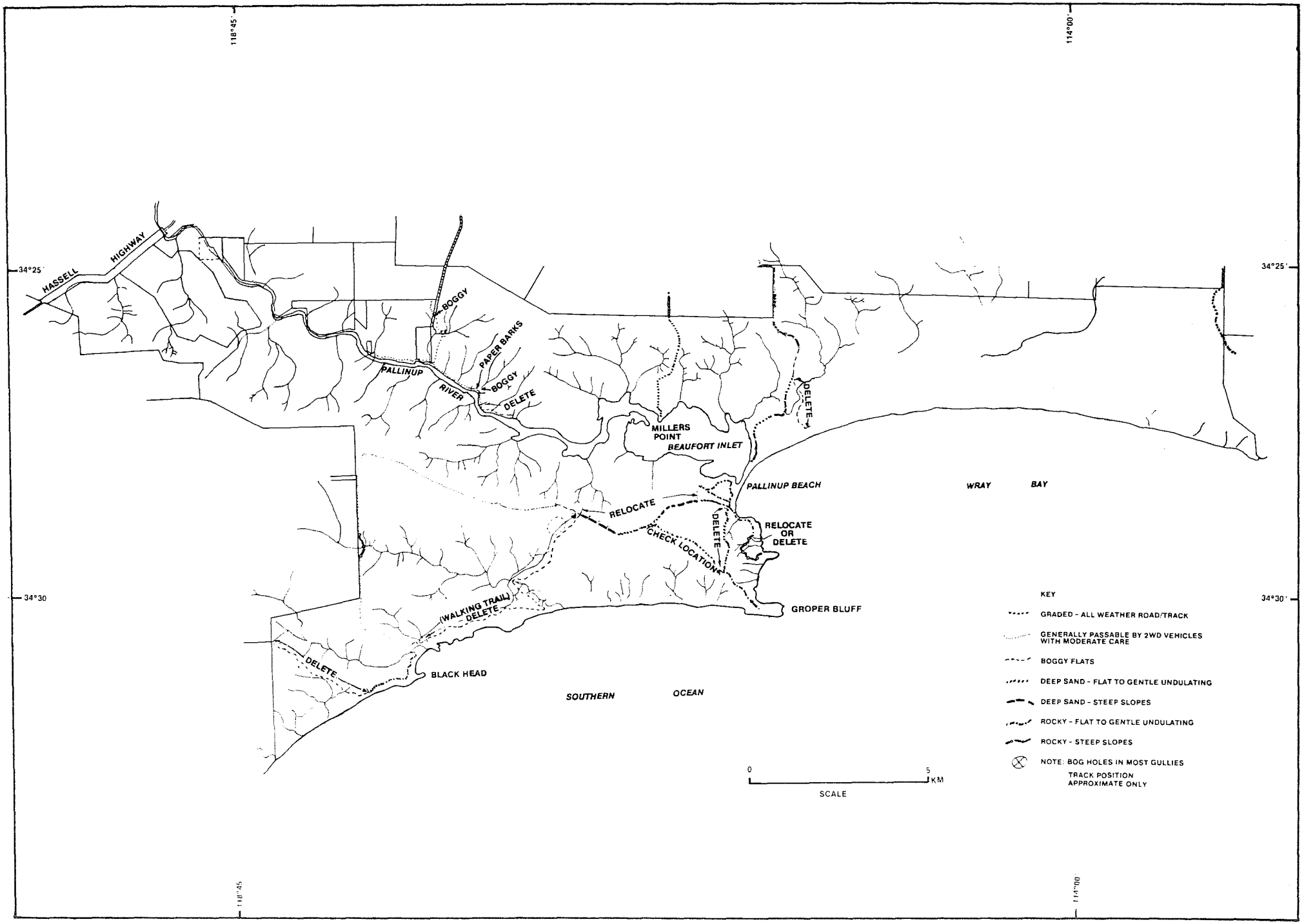


Figure 4. Tracks and their condition.

3. HUMAN ENVIRONMENT

3.1 HISTORY

3.1.1 ABORIGINES

To date, the Western Australian Museum has not recorded archaeological or ethnographic sites within the Study Area. However, it is known that aborigines occupied the area and systematic investigations may disclose sites which need to be protected in the future.(21)

3.1.2 EUROPEANS

The Study Area was explored by Europeans in the middle of the last century. The earliest activities were seeking pastoral or agriculture areas and subsequently Sandalwood (Santalum spicatum) cutting. This century, people's activities have concentrated on the river, estuary and coastline for fishing and recreation. In recent years the area has become important for small-scale wildflower picking and seed collecting.

3.2 EXISTING ACCESS AND FACILITIES

3.2.1 ACCESS

Roads and tracks in the Study Area are shown in Figure 4.

3.2.2 CAMPING AREAS

Camping only occurs at a number of locations; the most popular being Millers Point, West Pallinup Beach, Boat Harbour and East Pallinup (Figure 2).

3.2.3 SHACKS

There are permanent shacks and caravans at Millers Point, Pallinup Beach, near Mount Groper and Boat Harbour.

3.2.4 TOILETS

Bore-hole toilets are provided at Millers Point to service the designated camping area.

3.2.5 FIRE BREAKS

A double fire break with a low fuel buffer zone has been constructed along most of the northern boundary of the Study Area, abutting agricultural land and acting as the main wildfire control between the Study Area and farmland, and vice versa. The Pallinup River and Beaufort Inlet act as major natural firebreaks.

3.2.6 BOAT LAUNCHING

Boats are launched from the northern river foreshore (Millers Point).

3.3 USE PRESSURES

Limited information has been recorded on coastal recreation in the Jerramungup Shire. A survey was carried out to assist coastal management

during January 1984.[22] Most of the information listed below is from the author's personal experience of the Study Area since 1950.

3.3.1 HOLIDAY ACCOMMODATION

Some holiday shacks have been established at Millers Point (Photograph 6). The Jerramungup Shire supports supervision of the area through an honorary warden. A caravan park at Millers Point has been proposed in the past.

Photograph 6. Shacks at Millers Point under Blue Mallet trees (Eucalyptus gardneri).

3.3.2 AMATEUR FISHING

Favoured fishing sites include the Pallinup River and Beaufort Inlet (for Black Bream and Sea Mullet), Pallinup Beach (Salmon and Herring), Groper Bluff and Boat Harbour (Skipjack and Groper). However, fishing off the rocks at the last two localities is regarded as dangerous due to King Waves.

Fishermen camp mainly at Millers Point, "Paperbarks", "West Beaufort", "East Beaufort" and Boat Harbour (Figure 2).

Amateur net fishing in the Pallinup River and Beaufort Inlet was surveyed during January 1981.[23] Thirty three fishing parties were interviewed and 73% of these said that they used set nets.

3.3.3 PROFESSIONAL FISHING

The professional activity is centred on the seasonal catch of Salmon and Herring at the western end of Pallinup Beach and Boat Harbour. Professional fishermen also illegally net the Pallinup River from time to time. Access tracks to fishing sites are degraded by wind erosion and bog-holes. Fisher-

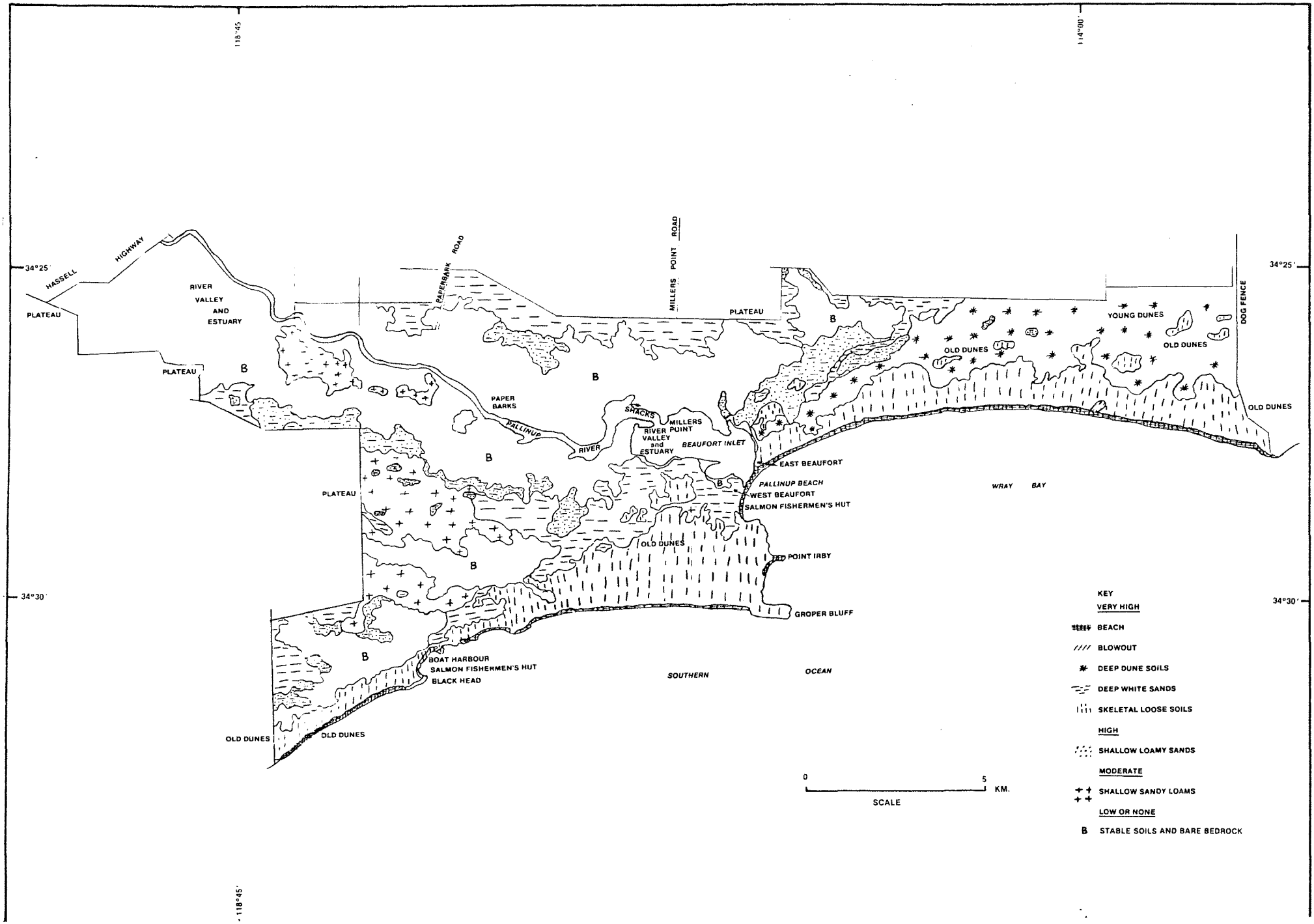


Figure 5. Erosion hazards.

men's shacks are sited close to the Salmon beaches. As they are used on a seasonal basis, they are usually poorly constructed of second-hand material.

3.3.4 RECREATION

Beach recreation is mainly confined to Millers Point with its attractive environment and a small safe river beach ideal for young children. The honorary Ranger at Millers Point recorded visitor comments about the area between 10 March and 11 May, 1984 (Figure 6). Some use is made of other sections of the river bank but access is limited. The coastline beach is not popular as it lacks shade, the sand is soft and the sea usually has a strong undertow. The river and estuary are generally accessible over most of their area by small boats, except when the river water level is low. Bush walking is rare due to dense vegetation, rugged terrain and few tracks.

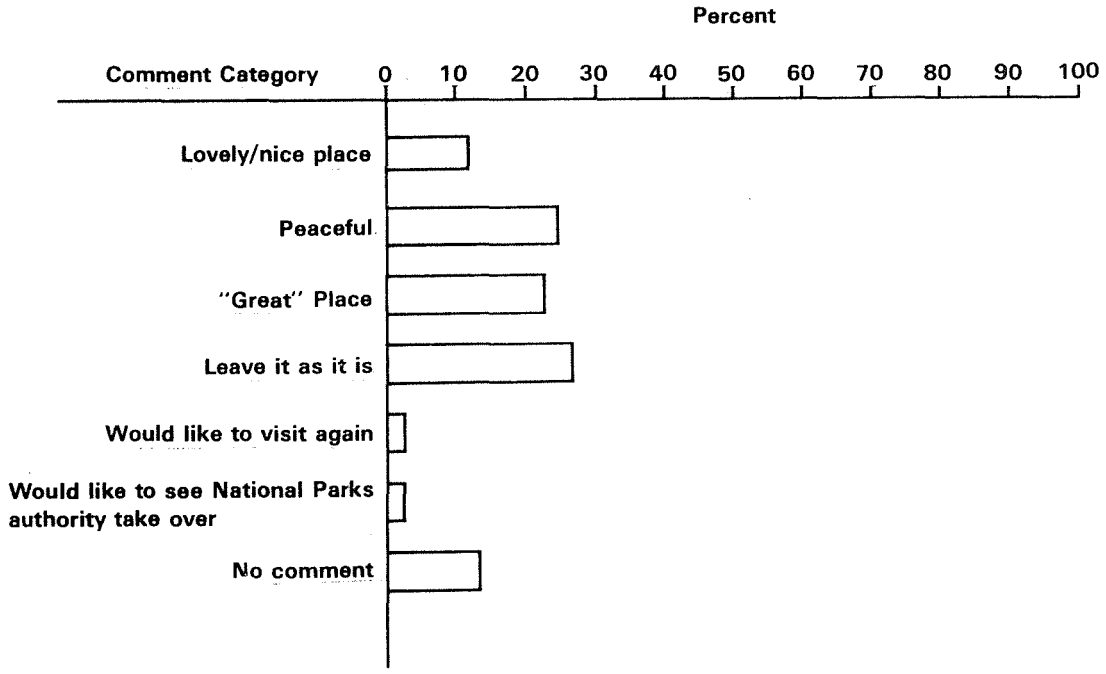


Figure 6. Visitors' comments about Millers Point.

3.3.5 ACCESS

The Millers Point road provides good access to a low-key recreation area. Tracks within the Study Area are generally in poor condition due to wind and water erosion. New sections of track are being established to bypass the boggy sections and steep slopes.

3.3.6 CAMPING

Millers Point is usually clean and tidy, but some uncontrolled camping has resulted in destruction of vegetation. "Paperbarks" site is in need of attention for a rubbish problem (Photograph 4). Other sites are generally clean.

3.3.7 AMATEUR FISHING

3.3.7.1 Beach Fishing

Pallinup Beach is not popular for rod fishing. Access to the beach is unreliable and strong winds from the west to south-east are unpleasant and cause difficulty with casting.

3.3.7.2 Ocean Fishing

The waters along the coastline are generally too rough for ocean fishing. Launching a boat is only possible at West Pallinup Beach under calm conditions.

3.3.7.3 River Fishing

Fishing for Black Bream or Mullet is possible by three methods: hand-line or rod from the shore; hand-line or rod from a boat; and by set net. The river is narrow and can only support a small fish population. Illegal netting frequently devastates fish numbers and many fish also die when the river level is low because of an increase in salinity and a low oxygen content. The frequency of the bar opening to sea is important to both the size of the fish population and their health.

3.3.7.4 Rock Fishing

The rocky coastline provides a variety of habitats for ocean fish. However, the coastline experiences King Waves and a number of fishermen have been washed off the rocks and drowned.

3.4 POTENTIAL USES

3.4.1 APIARY SITES

A moderate number of the plant species present are suited to honey production. However, European bees compete with native insects and the bees' presence is undesirable in conservation areas.

3.4.2 AGRICULTURE

The coastline, old dunes, young dunes and river valley are totally unsuited for cultivation due to steep slopes, exposed bedrock, shallow soils and the loose sandy nature of most soils.

Some sections of the Study Area were grazed by sheep during the severe drought of 1969. This was unsuccessful, because of the lack of fresh water and the heavy infestation of sheep by parasites. The vegetation requires burning every three to four years to promote new growth attractive to sheep. Frequent burning would bare the fragile dune soils and result in extensive wind erosion.

3.4.3 CAMPING

Many suitable sheltered camping spots are present along the river and around the estuary. There is a shortage of camping sites along the coast because of the exposed landscape and low vegetation.

3.4.4 CONSERVATION

3.4.4.1 Bird Watching

Many bird species utilize the wide range of habitats present: shore, estuary, river, woodlands, mallees, shrublands and swamps. Some birds are attracted (eg Honeyeaters) following the heavy flowering of some eucalypts, and Proteaceous species such as Banksia and Grevillea.

3.4.4.2 Exploring

Much of the Study Area is scenic: Mount Groper has excellent panoramic views of the coastline, Pallinup River and Beaufort Inlet. The Stirling Ranges, north-west of the Study Area, are prominent in the distance. The river and estuary can be viewed from some places on the plateau.

Much of the vegetation is dense and prickly and unsuitable for exploring. The steep coastal limestone slopes and Pallinup Siltstone areas are fragile. They are only suited to carefully sited walking tracks.

3.4.4.3 Photography and Art

The Study Area offers a wide range of subjects such as landforms, flowers, birds and insects.

3.4.5 OFF-ROAD VEHICLES

On the coastline only Pallinup Beach is suitable for off-road vehicles and then only at low tide. Outcrops of limestone prevent movement along the beach at other times. Dune vegetation needs to be protected.

3.4.6 RECREATION

3.4.6.1 Picnicking

Most of the coastline is not suited to picnicking because of its exposure and lack of shade. However, many river and estuarine areas have shelter, shade and attractive views. Problems for picnickers include flies, ants, mosquitoes, and the lack of facilities (toilet, barbecue or rubbish bin). Bore-hole toilets are present only at Millers Point.

3.4.6.2 Sailing

There is little opportunity for sailing, as the sea is generally too rough and much of the estuary is too shallow.

3.4.6.3 Surfing

Pallinup Beach does not have suitable waves for surfing.

3.4.6.4 Swimming

Pallinup Beach has a strong undertow most of the year and is dangerous for swimming. West Pallinup Beach is moderately calm. Millers Point has a small beach suitable for toddlers and small children. Most of the estuary margin is shallow with a mud bottom; while the river is unsafe with submerged rocks, snags and rubbish.

3.4.6.5 Diving

The rugged limestone and gneissic coastline provides numerous attractive areas for skin diving. However, the sea is often rough and climbing out of the water on these sections is often hazardous.

3.4.7 SEED COLLECTION AND CUT FLOWER PICKING

Of the 566 plant species recorded in the Study Area, many are suited to cultivation. Collecting seed of native plants is well established in Western Australia. Large quantities of seed are sent overseas as well as supplying the Australian market. A number of species have flowers and foliage suitable for the cut flower trade eg Banksia baxteri, B coccinea.

4. USE CONSTRAINTS

Three main constraints limit use of the Study Area:

. Wind Erosion

Most landforms of the Study Area have very definite limits on various potential uses by man. Most soils are sandy and loose. They will be quickly eroded by the wind if bared of vegetation. This is evidenced by extensive blowouts within the coastal section.

. Water Erosion

Valley slopes are long and frequently steep. Run-off is increased in many areas due to breakaways, and bare areas of Pallinup Siltstone or gneisses.

. Waterlogged Areas

Some areas of the Plateau are poorly drained and remain waterlogged for several weeks after heavy rains. The clay B horizon is prone to bogging and use by 4WD vehicles has resulted in some large "bog-holes".

Numerous eroded tracks are evidence of the fact that the environment is fragile (Photograph 1). Therefore, any alteration of the vegetation or landforms will require careful management.

5. MANAGEMENT STRATEGIES

5.1 OBJECTIVES

From the foregoing, it is clear that the Study Area is important for a number of reasons, has various constraints to human use, and that an overall management strategy is needed to avoid ad hoc decision making. The following objectives are proposed to guide management:

. to protect landforms, soils, flora and fauna;

. to provide for recreation within environmental limitations;

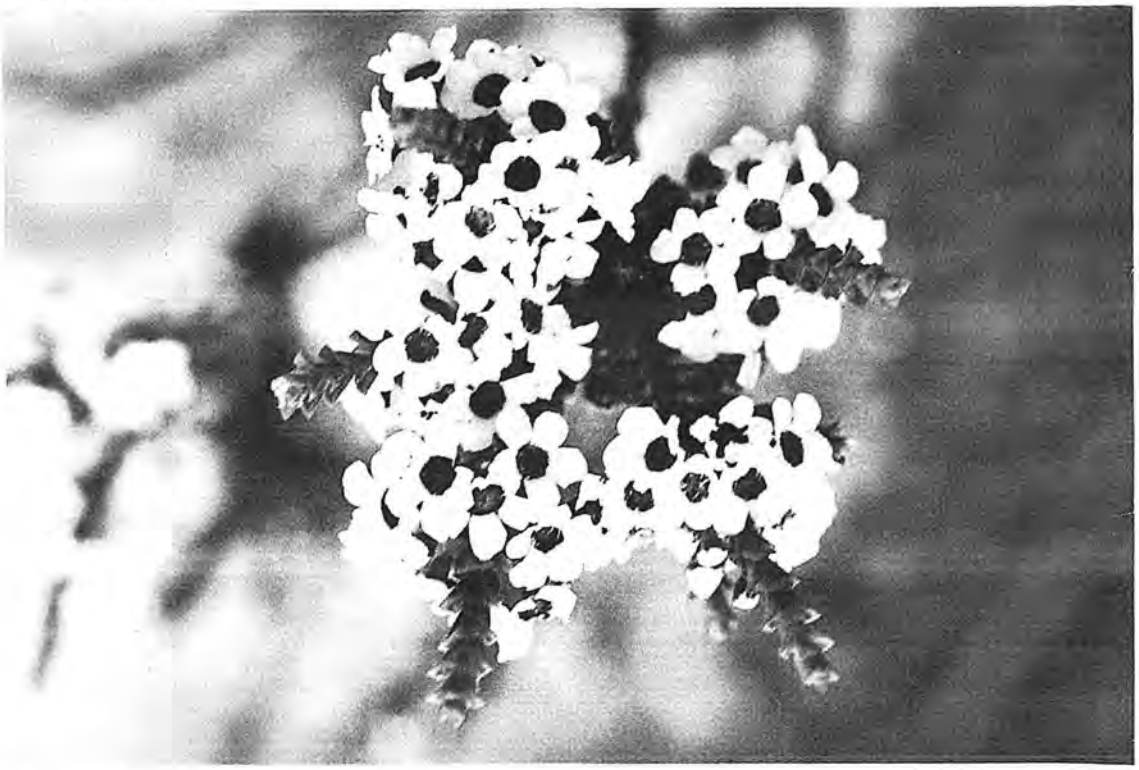
. to educate the public on the values and use of the area; and

. to provide beach access for professional fishermen.

5.2 MANAGEMENT PROPOSALS

5.2.1 CONSERVATION

The conservation value of the Study Area is high, as evidenced by the large number of important plant species and gazetted rare birds present (Photograh 7).



Photograph 7. Unnamed Baeckea sp known only from one small population in the Study Area.

Recommendation (1)

The conservation value of the Study Area should be recognized and given top priority when any land use is proposed.

Recommendation (2)

A professional biologist should assess requirements for the planning of any roadworks (upgrading, realignment, gravel pits etc) or developments (camp sites, car parks, nature trails etc).

5.2.2 ACCOMMODATION

Within the Shire of Jerramungup, Bremer Bay and its surrounds are being developed for moderate-intensity tourism. A few low-standard but well-kept dwellings are present at Millers Point. This is a sheltered and attractive setting, but limited for holiday accommodation development because the colluvial flat on which the present shacks are sited is small. Also, water erosion of the valley slopes is a potential problem. Potable water does not appear available, and sewerage disposal would be a problem as the shacks are only about 3 m above river level.

Reserve 14987 is vested in the Jerramungup Shire Council for camping and recreation purposes, and holiday shacks or commercial developments do not represent a legitimate land use of this reserve especially considering the fragility of the area and its high conservation value. Visitor comments about Millers Point, between 10 March and 11 May 1984, indicate that 25% of respondents were attracted to the peacefulness of the area, and 30% wanted the area left as is, ie in an undeveloped state (Figure 6).

The coastline is not suitable for development as the environment is too fragile and exposed.

Recommendation (3)

In general, holiday and residential accommodation would be better concentrated at Bremer Bay than in the Study Area.

Recommendation (4)

Residential development or holiday accommodation are not compatible with the objectives of management of the area. However, if holiday accommodation is developed in the Study Area, some areas of the plateau or river valley (gentle slopes) may be suitable.

Recommendation (5)

Do not develop accommodation such as a caravan park or chalets at Millers Point.

Recommendation (6)

Gradually remove existing holiday shacks at Millers Point, though possibly retain one as a ranger's residence.

5.2.3 CAMPING

Camping only occurs at a few localities at present, though most sites need tidying. Many suitable sites are present along the river and around the estuary but are limited along the exposed coastline. Millers Point is particularly suited to low-key camping. Ad hoc camping may damage the coastal/riverine environment and increase management costs.

The popular camping area on the eastern side of Beaufort Inlet bar is not well sited and erosion is occurring on dunes exposed to the prevailing wind (Photograph 8).

Recommendation (7)

Restrict camping to specific sites and provide basic facilities including rubbish bins and bore-hole toilets.

Recommendation (8)

Base priority for location of specific campsites and their management on the level of use and condition/fragility of the environment.

Photograph 8. Camping site on east bank of Pallinup River mouth "East Beaufort".

Recommendation (9)

Relocate the East Pallinup campsite further north, away from the Point and inland from the beach. Plant shelter trees such as Eucalyptus platypus var heterophylla.

5.2.4 PROFESSIONAL FISHING

Recommendation(10)

Retain professional fishermen's shacks in their present location for the foreseeable future.

Recommendation (11)

Professional fishermen should be required to keep buildings and surrounds tidy.

5.2.5 RECREATION

Given the inherent fragility of much of the Study Area, and responses to a survey carried out at Millers Point which indicated strong attraction to the peacefulness of that area, passive recreational use of the Study Area would seem appropriate.

Recommendation (12)

Encourage passive recreation activities in the Study Area.

5.2.6 ACCESS

Increasing use of the Study Area will result in a growing need for a rationalization of access to the coast. This need should be met by an access system that takes into account aesthetic and environmental aspects and which complements proposed facilities. Many tracks in the area are unnecessary or in poor condition.

Recommendation (13)

Ensure that measures are taken, through access control, and road design and maintenance, to minimize the spread of dieback disease, especially in more susceptible areas such as waterlogging-prone sites.

Recommendation (14)

Retain the Millers Point road for all-weather access ie maintained as a graded gravel road in good condition.

Recommendation (15)

Upgrade the track to West Pallinup Beach with graded limestone or gravel. Possibly realign the track to make it more aesthetically acceptable. Council may need to enter into a financial arrangement with salmon fishermen for track maintenance by the Shire.

Recommendation (16)

Upgrade eroded sections of the 4WD track to "East Beaufort". Close all unnecessary branch and by-pass tracks.

Recommendation (17)

Relocate the 4WD track from the fishermen's shacks to Mount Groper away from the steep and stony slopes over which it now passes.

Recommendation (18)

Realign and surface treat the track to Boat Harbour.

Recommendation (19)

Downgrade to a walking path the 4WD track between the graded track to "West Beaufort" and Boat Harbour.

Recommendation (20)

Surface treat the "Paperbarks" track with gravel sheeting and establish a fenced car park to define the end point of the track.

Recommendation (21)

Cover unused or unnecessary tracks with brush or top soil to assist revegetation.

Recommendation (22)

Where practical, obtain sheeting material for tracks and roads from existing quarries outside the Study Area. Where a quarry is necessary in the Study Area, every effort should be made to minimize its impact on the environment: including suitable location, proper management and rehabilitation.

5.2.7 Fire Control

Farmers in the area show concern about wildfires in natural areas moving onto their land and destroying crops, improvements etc. Wildfires are often deliberately lit, or escape from unextinguished camp fires.

No studies have been completed on the fire ecology of south coast mallee and shrubland vegetation. Burning frequency and pattern are both critical to landscape and nature conservation. In June 1985, a trial study of aerial burning of firebreaks was undertaken in the Fitzgerald River National Park. Results from this study will be useful for fire management/control.

Recommendation (23)

Until this study has been completed:

- **No other firebreaks should be constructed**
- **Preventative burning should be restricted to the low fuel strip.**

The following considerations are important with regard to preparing and implementing a burning programme:

(a) Maintenance of vegetation for the prevention of soil erosion by wind or water, both within the Study Area and on adjoining farmland.

(b) Maintenance of a diversity of vegetation to preserve fauna habitats. For instance, both the Dibbler and Ground Parrot have only been recorded in vegetation more than 25 years ago.

(c) Ensure that some vegetation sections containing suitable populations of plants species with heavy nectar flows will always be present.

(d) In burning procedures, provide sufficient time for all plant species to replenish their seed bank in the soil.

(e) Minimal burning so that weed infestation is minimal.

(f) Protection of Aboriginal sites as burning will make access easier, and valuable artefacts could be removed by the public.

(g) Cooperation with local farmers and their Bush Fire Brigade.

Recommendation (24)

As part of a public education programme (see next section) make steps to minimize the occurrence of wildfires including provision of signs, and a Ranger presence as well as the provision of barbeque sites.

5.2.8 PUBLIC EDUCATION

Through education of the public, a better understanding of coastal environments will develop amongst the local communities and visitors, as well as an increased appreciation of the reasons for conservation. The enjoyment of an area may also increase with greater environmental awareness.

Recommendation (25)

Erect a sign (information board) detailing the location of the Ranger's residence, roads, tracks, walking trails, camping sites and facilities.

Recommendation (26)

Erect signs near the Salmon fishermen's shacks at Pallinup Beach and Boat Harbour detailing the location of fishermen's lease areas and information about Salmon fishing at each beach.

Recommendation (27)

Encourage use of the Study Area as an environmental education resource for nearby schools and other interested groups.

Recommendation (28)

With minimal environmental disturbance establish nature trails exhibiting a variety of features and descriptive literature, particularly at Millers Point and Mount Groper.

5.2.9 VERMIN, EXOTIC PLANTS AND PETS

Introduced vermin (foxes, feral cats and rabbits) cause significant damage to native flora and fauna, pasture and crops. Some native fauna, including the Western Grey Kangaroo and Emu are destructive to fences of adjoining farms and compete with stock for pasture. Farms joining natural areas must be prepared for the presence of limited numbers of kangaroos and emus.

Recommendation (29)

Control vermin with whatever practical means available, except "1080" poison.

A few exotic plant species have been established at Millers Point, however, their areal extent is small.

Recommendation (30)

Retain existing exotic plant species at Millers Point but discourage further spread.

Recommendation (31)

Only plant exotic species where no local species meets the requirements for rehabilitation work.

Some people enjoy taking their pets on holidays or for a day's outing. Generally, pets are undesirable in popular areas and where conservation values predominate.

Recommendation (32)

Discourage the presence of pets in the Study Area.

5.2.10 ADMINISTRATION

The western boundary of the Study Area is also the Jerramungup-Albany Shire boundary. The Crown land from this boundary to Cape Riche has high conservation value.

Recommendation (33)

Maintain close liaison with the Albany Shire so that management objectives are compatible across the common Shire boundary.

Camping fees are probably not acceptable at present, except possibly at Millers Point. Facilities would need to be provided before fees would be warranted. Fees would assist funding management of the area.

Recommendation (34)

Examine the possibility of charging fees for camping, at Millers Point in the first instance.

It is essential that the authority which manages the area has the resources, the interest and commitment to do so properly.

Recommendation (35)

A single Authority with the resources, interest and commitment to managing the area be given that responsibility as a matter of priority.

5.2.11 NATURE WALKS

The Study Area provides excellent scope for nature walks, particularly at Millers Point and Mount Groper. Experience in Fitzgerald River National Park has shown nature walks to be well used and educational.

Recommendations (36)

Examine the possibility of establishing nature walks with minimum environmental impact and enabling good viewing of a variety of natural features in the Study Area.

5.2.12 RESEARCH

Many aspects of the Study Area are poorly known eg vertebrate fauna (distribution and conservation needs), Aboriginal sites, on-going monitoring of fire ecology, fish populations, and dissolved material in both the Pallinup River and Beaufort Inlet.

Recommendation (37)

Carry out or commission a survey of fauna and Aboriginal sites in the Study Area.

Recommendation (38)

Assess the priority for other research needs and opportunities in the Study Area.

5.2.13 AMATEUR FISHING

The main issue is amateur fishing in Pallinup River, which is a fragile ecosystem with limited and fluctuating fish resources.

Recommendation (39)

To enhance line fishing, prohibit all set netting in Pallinup River for a trial period of two years.

6. MANAGEMENT PRIORITIES

Management should be focused on the most popular sites, especially where environmental damage is evident. Such sites include:

. Millers Point

. "Paperbarks" camping sites

. Coastal foreshore west and east of Beaufort Inlet.

Detailed management plans outlining a proposed works programme are required for these sites. In general, priority should be given to the following management requirements:

. establish a Ranger service, initially on a part-time basis;

. realign and maintain 4WD tracks;

. develop fire management strategies and safety measures with the local bushfire brigade;

. survey fauna and Aboriginal sites;

. provide for rubbish disposal and management of campsites;

. encourage environmental awareness through informative signs, brochures, etc.

7. REFERENCES

1. Environmental Protection Authority (1976), Conservation Reserves for Western Australia, Systems 1, 2, 3, 4 and 5, EPA, Perth, Western Australia.

2. Van Steveninck, A & Craig, G F (1984), Jerramungup Coastal District Draft Management Plan, Department of Conservation and Environment, Perth, Western Australia, Bulletin 167.

3. Newbey, K R (1986, in edit), A Preliminary Bio-Physical Report on the Beaufort Inlet Area, Near Albany, Western Australia, Department of Conservation and Environment, Western Australia.

4. Thom, R O & Chin, R J (1984), Bremer Bay, Geological Survey of Western Australia 1:250 000 Geological Series Explanatory Notes, Geological Survey of Western Australia.

5. Ibid.

6. Cockbain, A E (1968), 'The stratigraphy of the Plantagenet Group, Western Australia', Geological Survey of Western Australia, Annual Report 1967, pp 61-63.

7. Beard, J S (1981), Swan, Vegetation Survey of Western Australia, University of Western Australia Press, Perth.

8. Newbey, K R (1979), The Vegetation of Central South Coastal Western Australia, M Phil thesis, Murdoch University.

9. Newbey K (1986 in edit), op cit.

10. Muir, B G (1977), 'Biological survey of the Western Australian Wheatbelt. Part 2: Vegetation and habitat of Bendering Reserve', Records of the Western Australian Museum, Supplement 3.

11. Beard, J S (1980), 'A new phytogeographic map of Western Australia', Western Australian Herbarium Research Notes 3, 37-58.

12. Marchant, N G (1973), 'Species diversity in the southwestern flora', Journal of the Royal Society of Western Australia 56 (102), 23-30.

13. Newbey, K R (1986, in edit), op cit.

14. Newbey, B J & Newbey, K R (1985), Checklist of Birds, Fitzgerald River National Park, National Parks Authority, Western Australia.

15. Strahan, R (1983), Complete Book of Australian Mammals, Angus & Robertson, Melbourne.

16. Newbey, K R (1986, in edit), op cit.

17. Patrick, S J & Hopper, S D (1982), A Guide to the Gazetted Rare Flora of Western Australia: Supplement 1, Department of Fisheries and Wildlife, Perth, Western Australia, Report 54.

18. Watkins, D (1984), Report of the RAOU Ground Parrot Survey in Western Australia, RAOU, Melbourne.

19. Christensen, L (1986), 'Islands in the Sun', Landscape 1 (4), 25-29.

20. Muir, B G (1985), 'The Dibbler (Parantechinus apicalis: Dasyuridae) found in the Fitzgerald River National Park, Western Australia', The Australian Naturalist 16 (2/3), 48-51.

21. Merrilees, D, Dix, W C, Hallam, S H, Douglas, W G & Berndt, R M (1973), 'Aboriginal man in south western Australia', Journal of the Royal Society of Western Australia 56 (1 & 2), 44-45.

22. Van Steveninck, A (1984), Jerramungup Coast District Recreation Survey, Department of Conservation and Environment, Perth, Western Australia, Bulletin 162.

23. Heald, D I (1984), Amateur Net Fishing Survey of Two Western Australian South Coast Estuaries in January 1981, Department of Fisheries and Wildlife, Western Australia, Report 60.

APPENDICES

APPENDIX 1

LIST OF BIRDS

During a 3-day survey (January 1985), the following bird species were recorded by B J Newbey, A Chapman and K R Newbey.

COMMON NAME	SCIENTIFIC NAME
Emu	Dromaius novaehollandiae
Australian Little Grebe	Podiceps novaehollandiae
Hoary-headed Grebe	Podiceps poliocephalus
Australian Pelican	Pelecanus conspicillatus
Little Black Cormorant	Phalacrocorax sulcirostris
Great Black Cormorant	Phalacrocorax carbo
Pied Cormorant	Phalacrocorax varius
Little Pied Cormorant	Phalacrocorax melanoleucos
White-face Heron	Ardea noveahollandiae
Black Swan	Cygnus atratus
Australian Shelduck	Tadorna tadornoides
Pacific Black Duck	Anas superciliosa
Grey Teal	Anas gibberifrons
Chestnut Teal	Anas castanea
Maned Duck	Chenonetta jubata
Musk Duck	Biziura lobata
Square-tailed Kite	Lophoictinia isura
Whistling Kite	Haliastur sphenurus
Australian Hobby (Little Falcon)	Falco longipennis
Brown Falcon	Falco berigora
Australian Kestrel	Falco cenchroides
Sooty Oystercatcher	Haematopus fuliginosus
Black-fronted Plover	Charadrius melanops
Greenshank	Tringa nebularia
Common Sandpiper	Tringa hypoleucos
Silver Gull	Larus novaehollandiae
Caspian Tern	Sterna caspia
Crested Tern	Sterna bergii
Common Bronzewing	Phaps chalcoptera
Crested Pigeon	Ocyphaps lophotes
Purple-crowned Lorikeet	Glossopsitta porphyrocephala
Port Lincoln Ringneck	Platycercus zonarius
Red-capped Parrot	Platycercus spurius
Elegant Parrot	Neophema elegans
White-tailed Black Cockatoo	Calyptorhynchus latirostris
Tawny Frogmouth	Podargus strigoides
Australian Owlet-nightjar	Aegotheles cristatus
Laughing Kookaburra	Dacelo gigas
Sacred Kingfisher	Halcyon sancta
Rainbow Bee-eater	Merops ornatus
Welcome Swallow	Hirundo neoxena
Tree Martin	Hirundo nigricans
Richard's Pipit (Ground Lark)	Anthus novaehollandiae
Black-faced Cuckoo-shrike	Coracina novaehollandiae
Hooded Robin	Petroica cucullata
Golden Whistler	Pachycephala pectoralis

APPENDIX 1

LIST OF BIRDS (contd)

COMMON NAME	SCIENTIFIC NAME
Grey Shrike-thrush	Colluricinla harmonica
Crested Bellbird	Oreoica gutturalis
Western Whipbird	Psophodes nigrogularis
Grey Fantail	Rhipidura fuliginosa
Willie Wagtail	Rhipidura leucophrys
Restless Flycatcher	Myiagra inquieta
Weebill	Smicrornis brevirostris
Inland Thornbill	Acanthiza apicalis
Western Thornbill	Acanthiza inornata
Yellow-rumped Thornbill	Acanthiza chrysorrhoa
White-browed Scrub Wren	Sericornis frontalis
Calamanthus (Field Wren)	Sericornis fuliginosus
Splendid Fairy-wren	Malurus splendens
Blue-breasted Fairy-wren	Malurus pulcherrimus
Southern Emu-wren	Stipiturus malachurus
Varied Sittella.	Daphoennositta chrysoptera
Yellow-rumped Pardalote	Pardalotus xanthopygus
Striated Pardalote	Pardalotus striatus
Silvereye	Zosterops lateralis
Brown Honeyeater	Lichmera indistincta
Singing Honeyeater	Meliphaga virescens
Purple-gaped Honeyeater	Meliphaga cratitia
White-naped Honeyeater	Melithreptus lunatus
New Holland Honeyeater	Phylidonyris novaehollandiae
White-cheeked Honeyeater	Phylidonyris nigra
Tawny-crowned Honeyeater	Phylidonyris melanops
Western Spinebill	Acanthorhynchus superciliosus
Little Wattlebird	Anthochaera chrysoptera
Red Wattlebird	Anthochaera carunculata
White-fronted Chat	Epthianura albifrons
Mistletoe Bird	Dicaeum hirundinaceum
Red-eared Firetail (Finch)	Emblema oculatum
Australian Magpie-lark (Mudlark)	Grallina cyanoleuca
Grey Butcherbird	Cracticus torquatus torquatus
Australian Magpie	Cracticus tibicen dorsalis
Grey Currawong	Strepera versicolor
Australian Raven	Corvus coronoides

APPENDIX 2

LIST OF REPTILES

The following reptile species were recorded by A Chapman during a 3-day survey (January 1985).

COMMON NAME	SCIENTIFIC NAME
Marbled Gecko	*Phyllodactylus marmoratus*
Rosenberg's Monitor	*Varanus rosenbergii*
	Cryptoblepharus virgatus
	Ctenotus gemmula
King's Skink	*Egernia kingii*
	Hemiergis initialis
	Hemiergis peronii
	Lerista distinguenda
	Morethia obscura
Bobtail	*Tiliqua rugosa*
Bardick	*Notechis curtus*
Crowned Snake	*Notechis coronatus*