CONSERVATION RESERVES IN WESTERN AUSTRALIA

REPORT OF THE CONSERVATION THROUGH RESERVES COMMITTEE ON SYSTEM 7 TO THE ENVIRONMENTAL PROTECTION AUTHORITY 1977

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W E S T E R N A U S T R A L I A

REPORT OF THE

CONSERVATION THROUGH RESERVES COMMITTEE

TO THE

ENVIRONMENTAL PROTECTION AUTHORITY

1978

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INTRODUCTION

The first Report of the Conservation Through Reserves Committee (CTRC) of the Environmental Protection Authority recommended to the Authority a system of reserves in ten of twelve regions (systems) of Western Australia (Figure 0.0). The present Report concerns one of the remaining systems - No. 7, the Kimberley. The final Report, on the Darling Range system (No.6), will be the subject of a further report to be submitted by a separate body in due course.

Objectives established by the Environmental Protection Authority for CTRC and invoked by the Committee in its first Report, have also been invoked in reaching recommendations for the Kimberley system. The objectives are more clearly enunciated in the Introduction to the first Report, and because of their importance in understanding the reasons for CTRC recommendations, the original Introduction has been added as Appendix I to the present Report. Since the publication of the first Report, important changes in the administration and areas of responsibility of Departments and Authorities responsible for national parks and conservation reserves have occurred.

Legislation has been enacted to establish the National Parks Authority of Western Australia, consisting of a President, nominated by the Minister, the Conservator of Forests, the Director of Fisheries and Wildlife, the Director of the Department of Tourism, the Surveyor General and four persons nominated by the Minister to represent the interests of the public. The Authority employs professional staff, one of whom is the Director, as well as Park Rangers and administrative staff.

Legislation enacted but not yet proclaimed has passed the responsibility for the protection of native flora from the Forests Department to the Department of Fisheries and Wildlife.

Another important legislative change has been made since the publication of the Committee's first Report, and therefore adopted by the Committee for the Kimberley system. Until recently, the term "Nature Reserve" was not used officially in Western Australia. Any reserve vested in the W.A. Wildlife Authority or other reserve set aside wholly or partly for the conservation of Fauna was termed a "Wildlife Sanctuary". In 1975, an amendment to the Fauna Conservation Act, 1950, (now the Wildlife Conservation Act 1950-1975) provided for "Nature Reserve" to mean an area of land reserved under the Land Act, 1933, for the conservation of indigenous flora or fauna. The term "Wildlife Sanctuary" now means an area of land which is the subject of an agreement made between the Minister for Fisheries and Wildlife and the owner of the land for its use as a sanctuary.

In its first Report the Committee noted that the need for aquatic reserves is widely recognised in Australia. In making recommendations for aquatic reserves in Western Australia, the Committee suggested control through the Fisheries Act because there was no clear-cut provision in other legislation. Since that time,

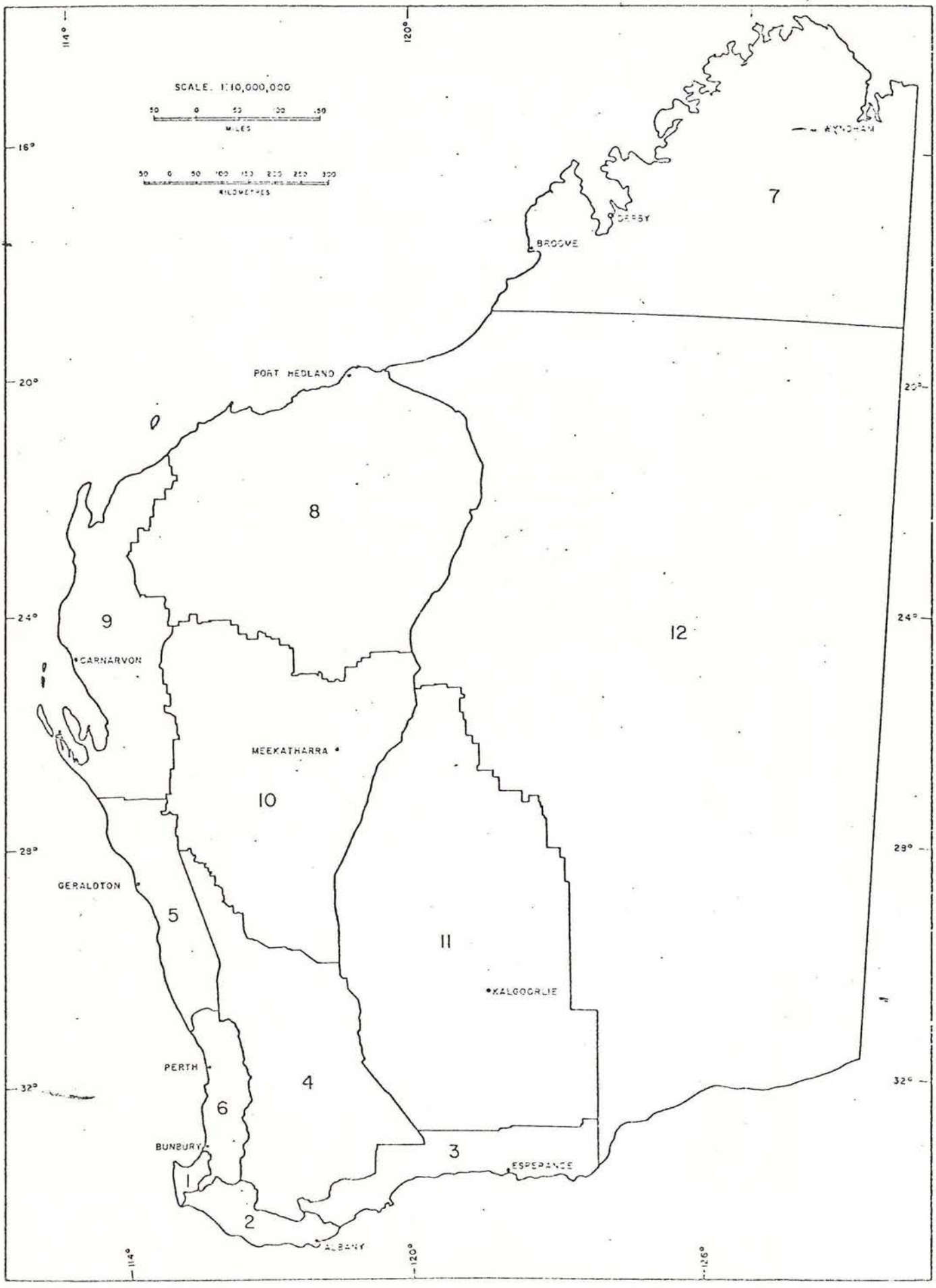

Figure 0.0 Systems

however, the Fisheries Act has been amended to allow for the declaration of aquatic reserves within Western Australian waters in much the same way as reserves are declared under the Land Act above low water mark, i.e. reserves may be made Class A and be made for a variety of purposes and may be vested in a body corporate. As yet, no aquatic reserves have been declared, partly because of the need to establish administrative procedures and partly because of the constitutional problems relating to ownership of the sea. The Committee draws the Authority's attention to special problems created by use of SCUBA equipment in Western Australia and suggests that it consult with the Council for Underwater Activities with a view to obtaining specific recommendations relating to problems arising from the control of skin diving.

Terms of Reference of Committee

The terms of reference of the Committee were :

To recommend an adequate system of Nature Reserves and National Parks for System 7 - which broadly encompasses the Kimberley Division - in accordance with the principles enunciated in the previous Committee Report relative to Systems 1 to 5 and 8 to 12.

Composition of Committee

The Conservation Through Reserves Committee now comprises :

Mr J.F.Morgan (Chairman) Surveyor General for Western Australia
Dr B.E.Balme, Reader in Geology, University of Western Australia
Professor R.T.Appleyard, Professor of Economic History, University of Western Australia.

Technical Sub-committee

R.T.Appleyard, M.A., Ph.D. F.A.S.S.A., Professor of Economic History, University of Western Australia (Convenor)

A.A.Burbidge, B.Sc.(Hons), Ph.D., Senior Research Officer, Wildlife Research Branch, Department of Fisheries and Wildlife

A.S.George, B.A., Western Australian Herbarium, Department of Agriculture

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B.White, B.Sc. (For)., Forests Department

Secretary - Mr L. Goodridge

* Mr Lord was represented at most meetings of the Sub-committee by Mr E. Biggs, a Geologist of the Geological Survey Branch, Mines Department.

In formulating these recommendations we have sought the opinions of the major companies carrying out exploration in the Kimberley - C.R.A. Exploration Pty Ltd and Amax Exploration (Australia) Inc. and also the Chamber of Mines.

Committee Visits

During the preparation of the report, the Technical Sub-committee inspected those areas upon which recommendations were being considered.

In order to ensure that, as far as possible the local populace had preliminary opportunity to comment on initial proposals, the Committee forwarded an invitation to the Shires of Broome, West Kimberley, Wyndham-East Kimberley and Halls Creek to seek local opinion as a preliminary to joint discussion between the Committee and Local Authorities. The Conservation Through Reserves Committee subsequently visited the Kimberley to meet with the local authorities during the period. It is pleasing to record that each of the Shires expressed unanimous agreement with the Committee proposals.

Extent of Reserves

In its first report, CTRC recommended that a further 86 000 km^2 be added to existing conservation reserves. Recommendations in the present Report are for a further 16960km^2, making an aggregate 28440km^2 proposed and existing reserves, or approximately 7.1% of the area of Western Australia so far reported on by the Committee. These figures exclude System 6 which is broadly the area extending from Guilderton and the Moore River in the north to the Blackwood River in the south and extends inland as far as Toodyay, Boddington and Boyup Brook.

SUMMARY OF RECOMMENDATIONS

The Kimberleys

The Committee recommends :

a. that any proposed developments which would affect an area or areas of mangroves on the Kimberley coast be referred to the Environmental Protection Authority for assessment.

b. does not regard Aboriginal reserves as conservation reserves because of their unavailability to the whole population and because of their open options for future use. It believes this aspect should be pursued with appropriate aboriginal interests in the future.

c. an environmental survey should be made in the south-east Kimberley where there are no conservation reserves at present.

1. Oceanic Islands

The Committee recommends :

a. that Reserve No. 7279 comprising the West and Middle Islands of the Lacepede Islands be reclassified to Class B. Should East Island become available for reservation, it should be added to the reserve. The reserve should be extended to low water mark in order to ensure the protection of turtles.

b. that Reserve No. 22697 (Browse Island) be changed from Minerals-Phosphatic Rock to Conservation of Fauna and Flora and that it be declared Class B and vested in the W.A. Wildlife Authority. The reserve should be extended to low water mark in order to ensure the protection of turtles.

c. that the EPA ask the State Government to explore with the Commonwealth Government means of returning Adele Island to State control. Should this eventuate, the Island be declared a Class B Reserve for the Conservation of Fauna and Flora and vested in the W.A. Wildlife Authority. Leases should be issued to protect the lighthouse, radio beacon and automatic weather station.

d. that the EPA ask the State Government to recommend to the Commonwealth Government that the Ashmore Reef Islands and Sandy Island on Scott Reef be managed as though they were Nature Reserves.

2. Inshore Islands

The Committee recommends :

a. that Bat Island, the Coronation Islands and Boongaree Island be added to Reserve No. 27164 - the Prince Regent River Wildlife Sanctuary (see also Area 7.5).

b. that Bigge, Katers and Wollaston Islands, the Maret Islands, and the Montalivet Islands be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority.

c. that the Osborne Islands, comprising Middle, South-West, Carlia, Kidney, Borda and Steep Head Islands be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority.

d. that Low Rocks, in Admiralty Gulf, be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority.

e. that Reserve No. 29541 (Pelican Island, Joseph Bonaparte Gulf) be upgraded to a Class B Reserve.

f. that the EPA bring to the notice of the Aboriginal Lands Trust the conservational value of islands in the Augustus group, at the mouth of the Prince Regent River and in St. George Basin. Should they at any time be no longer required as Aboriginal Reserves, they should be set aside as Nature Reserves.

g. that the Environmental Protection Authority commission a biological survey of the Buccaneer Archipelago to enable a firm decision to be reached regarding the creation of specific reserves.

3. Point Coulomb Nature Reserve

The Committee endorses the status purpose, and vesting of the Pt Coulomb Nature Reserve. It recommends that after compilation of the data collected during the biological surveys coordinated by the Department of Fisheries and Wildlife in conjunction with the W.A. Museum, the W.A Herbarium and C.S.I.R.O., Division of Entomology on :

i. the Pt Coulomb Nature Reserve (April, 1977),

ii. the vacant Crown land between Aboriginal Reserves Nos. 1834 and 20927 (April 1977) and,

iii. the vacant Crown land between Roebuck Plains and Thangoo Stations on the north and west and Dampier Downs and Ardjorie Stations on the east (August 1976),

the EPA decide whether the Pt Coulomb Reserve should be extended or whether the other two areas should be reserved. If the vacant Crown land in south-east Dampier Land is reserved, then the area formerly occupied by Ardjorie Station should be included within the proposed reserve, subject to agreement by the Pastoral Appraisement Board.

4. Walcott Inlet

The Committee recommends :

a. that all vacant Crown land surrounding the Inlet be declared a Class C Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.

b. that once the reserve is gazetted, the National Parks Authority explore with the lessees of Pantijan Station the possibility of joint participation in management of the Park.

5. Prince Regent River Nature Reserve

The Committee endorses the purpose and vesting of Reserve No. 27164. It recommends :

a. that the reserve be upgraded to a Class B Reserve.

b. that Aquatic Reserves be declared to include :

(i) Prince Frederick Harbour seaward to Cape Torrens and the unnamed cape south of the Anderdon Islands,

and

(ii) St. George Basin seaward to Uwins Island and Cape Wellington, including Rothsay and Munster Waters.

c. that the area around Mt. Hann and Mt. Agnes be added to the reserve.

d. that Coronation, Bat and Boongaree Islands be added to the reserve.

e. that Reserve Nos. 8243, 8248 and 8252 be cancelled and their area added to Reserve No. 27164.

f. that the W.A. Wildlife Authority, in consultation with the National Parks Authority, prepare a management plan for the reserve, taking into account increasing public interest in the area.

6. Hunter River Area

The Committee recommends that the area shown in Fig.7.6 be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A. Negotiations should be undertaken with the Aboriginal Lands Trust to include the southern portion of Reserve No. 30643 within the proposed reserve.

7. Mitchell River Area

The Committee recommends that :

a. the leaseholders of Mitchell River Station (who are also the company intending to mine the bauxite) be approached by the EPA with the request that they relinquish the portions of their pastoral lease and mineral tenement as indicated in Fig. .

b. the land mentioned in a. and the vacant Crown land also indicated in Fig.7.7be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.

8. Cape Londonderry Area

The Committee recommends that the area as shown in Fig.7.8 be declared a Class A Reserve for the purpose of National Park and vested in the National Parks Authority of W.A. The reserve should extend to low water mark to ensure preservation of mangroves and should include the adjacent islands. It should also include the islands of mangroves in the estuary of the Drysdale River, down to low water mark.

9. Drysdale River National Park

The Committee endorses the purpose and vesting of Reserve No. 32853. It recommends that those adjacent portions of the existing stock route which are no longer required for that purpose be added to the National Park.

10. Lake Argyle

The Committee recommends that the islands in Lake Argyle and the Carr Boyd Ranges to the west and north-east of Lake Argyle as indicated in Fig.7.10, be declared a Class C Reserve for National Park and vested in the National Parks Authority of W.A.

11. Parry Lagoons

The Committee endorses the status, purpose and vesting of Reserves Nos. 1058, 1059, 30866 and 31636.

12. Ord River Nature Reserves

The Committee endorses the status, purpose and vesting of Reserve No. 31967.

13. Bluff Face Range Area

The Committee recommends that :

a. the Environmental Protection Authority arrange for a biological survey to be carried out in the area shown in Fig. 7.13 to determine its conservational value,

b. the cooperation of the Department of Lands and Surveys be sought to ensure that the views of the Environmental Protection Authority be obtained prior to any land release, pending completion of the survey referred to in a. above.

14. Gardiner Range Area

The Committee recommends that the Department of Lands and Surveys be requested to give consideration to the creation of an appropriate reserve in the Gardiner Range area, should any of the existing pastoral leases be determined.

15. Napier and Oscar Ranges Area

a. The Committee endorses the status, purpose and vesting of the Geikie Gorge National Park. It recommends that in view of the expected large number of future visitors to the Gorge, the National Parks Authority :

   (i) reconsider the boundaries of the existing park,

   (ii) consider whether the existing campsite and facilities are in the most desirable site.

b. The Committee endorses the status, purpose and vesting of the Windjana Gorge National Park.

c. The Committee endorses the status, purpose and vesting of the Tunnel Creek National Park.

d. The Committee recommends that negotiations be undertaken with the lessee of Brooking Springs Station with a view to declaring Brooking Gorge as a Class B Reserve for the purpose of National Park, and vesting it in the National Parks Authority.

e. The Committee recommends that :

   (a) the W.A. Museum be requested to make a survey of caves in the Oscar Range with the objective of proposing a conservation programme for important sites.

   (b) a survey be made of springs with the objectives of;

      (i) designating small reserves, and

      (ii) reconciling conservation requirements and pastoral usage.

16. King Leopold Ranges

The Committee recommends that :

a. the vacant Crown land formerly leased as Bell Creek Station be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.;

b. if a suitable opportunity occurs, land adjacent to the south and west-north-west be purchased and added to the proposed National Park.

17. Geological Sites

The Committee recommends that the following areas be investigated by the proposed Geological Sites Committee to assess their geological importance :

a. Brutens Yard (Cherrabun Station)

b. Bugle Gap (Gogo Station)

c. Fairfield Quarry (West Kimberley Research Station)

d. Gantheaume Point (Broome Townsite)

e. Mount Hardman (Liveringa Station)

f. Mount Wynne (Liveringa Station)

g. Prices Creek (Christmas Creek Station)

THE KIMBERLEY

Area and Geomorphology

The Kimberley System covers 302 580 km^2. On the west and north it is bounded by the Indian Ocean and on the east by the Northern Territory border. Latitude 19°S has been selected arbitrarily as the southern boundary. Cape Londonderry, northernmost point in the System, is 2 300 km by air from Perth and less than 500 km from Timor.

Three broad physiographic subdivisions are recognisable within the System; two large drainage basins and an upland dissected by rivers at a stage of early maturity. Drainage patterns are controlled by regional geological structures and differing lithologies of the country rocks, so that erosion has given rise to broad plains, ranges of rugged hills and flat-topped mesas. Marine inundation of youthful valleys has resulted in a ria coastline of the Atlantic type, characterised by elongate, precipitous, north-westerly trending sounds such as Walcott Inlet. Near Broome and Derby the rising Holocene sea-level has created broad tidal flats.

High tidal ranges give rise to strong tidal currents in some of the narrow, land-locked inlets and a number have been examined as potential sites for tidal power-generating stations. Walcott Inlet, at least, is suitable although such a project would serve no economic purpose today. It is nevertheless likely that tidal energy sources will be developed in the System some time in the future.

Geology and Soils

The oldest rocks in the Kimberley System belong to the Archaean Halls Creek Group and consist of sediments and volcanics, together with their metamorphic products. They are overlain by the Late Proterozoic Kimberley Group which is made up predominantly of arenaceous rocks and includes the extensive King Leopold, Warton and Pentecost Sandstones. Volcanics and minor shale units also occur and the sediments are intruded by basic igneous bodies at widely scattered localities. The great thicknesses of the sandstones and their lithological homogeneity over wide areas, reflect the general tectonic stability of the area of the central Kimberley during the late Precambrian. As in other parts of the world the closing stage of the Proterozoic was characterised by glacial episodes and widespread tillites occur in the upper part of the Kimberley Group.

Plateau basalts, succeeded by marine sediments, mark the beginning of the Cambrian, and strata ranging in age from Cambrian to Quaternary are known within the System. Outcrops of Cambrian and younger rocks are confined to the two major drainage basins that flank the Kimberley Plateau. The principal geological systems represented are the Devonian, Carboniferous, Permian and Triassic. In particular, the spectacular Devonian carbonate succession, exposed in the valleys of the Fitzroy and Lennard Rivers, is famous for its lithological, structural and palaeontological variety.

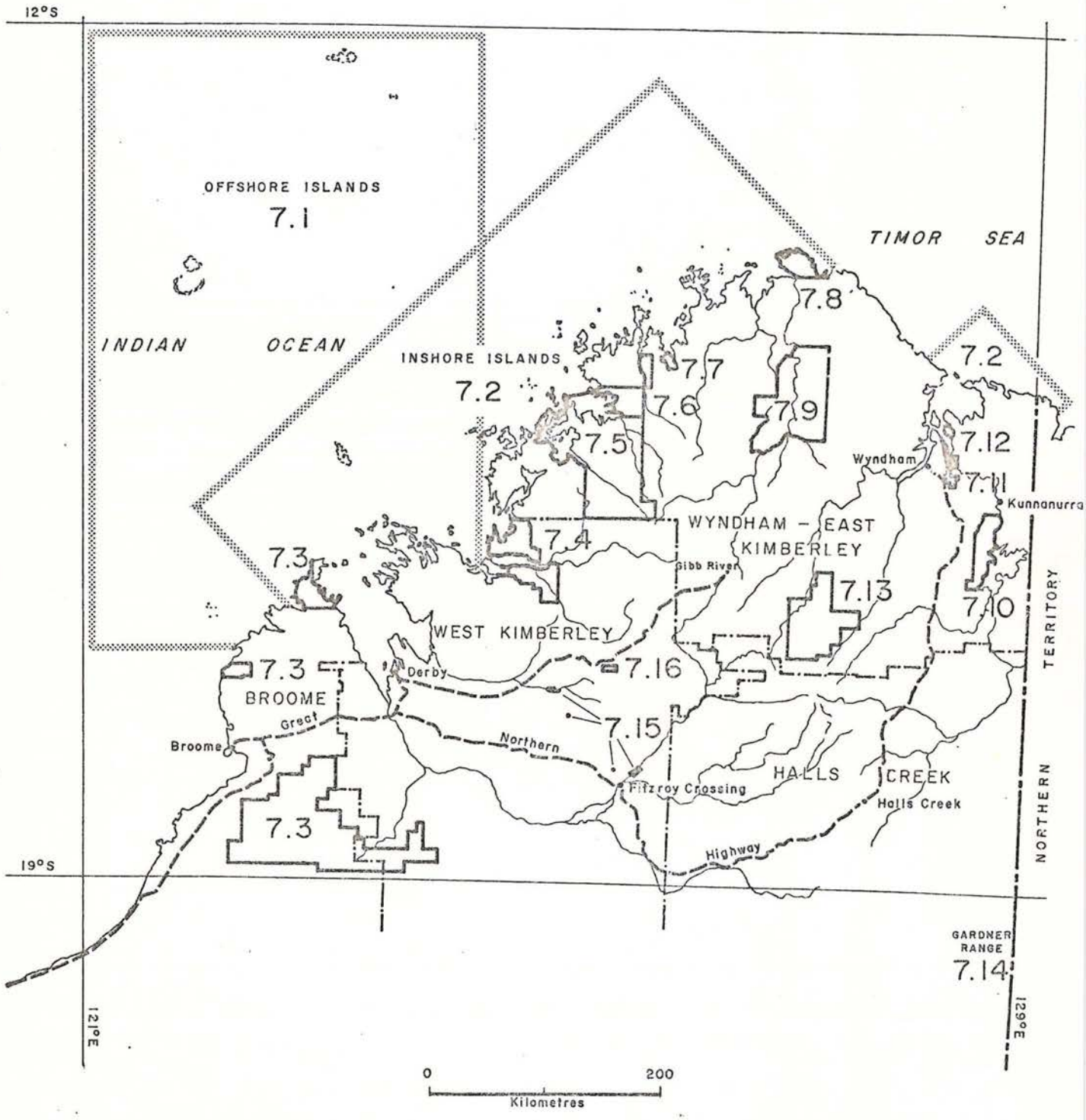

12°S
OFFSHORE ISLANDS
7.1
INDIAN OCEAN
TIMOR SEA
INSHORE ISLANDS
7.2
7.8
7.7
7.6
7.9
7.5
7.2
7.12
Wyndham
7.11
Kunnanurra
WYNDHAM - EAST KIMBERLEY
7.4
7.3
Gibb River
7.13
7.10
WEST KIMBERLEY
7.3
BROOME
Derby
7.16
Great
Northern
Broome
7.15
HALLS CREEK
Fitzroy Crossing
Halls Creek
7.3
Highway
19°S
NORTHERN TERRITORY
GARDNER RANGE
7.14
121°E
129°E
0
200
Kilometres

FIG.7

Soils are mainly controlled by bedrock geology and their associated land forms. Sandy soils predominate in the upland areas with red earths and lateritic gravel residuals sporadically developed. In the drainage basins soil types are more complex and varied. They range from sands and loams through coloured earths to clayey soils and true clays.

Climate

Temperatures are high throughout the year and Wyndham, with a mean maximum of 33.9°C and a mean minimum of 24.3°C, is on average the hottest town in Australia. Virtually all rain falls during the summer months (November-April) and annual precipitation ranges from 350mm in a latitudinal belt along the southern boundary of the System, to over 1 200 mm in the coastal region near the Prince Regent River.

Biology

System 7 forms part of the Northern Botanical Province of Western Australia (Gardner, 1944) and is the western part of the Tropical Zone of Australia (Burbidge, 1960). Climate, geology and geographical position are the main reasons why its vegetation and flora differ markedly from those of the desert and Pilbara and even more so from those of the South West.

The tropical monsoonal climate (a wet summer and a dry winter, both relatively hot) favours plants different from those in southern regions. Likewise, geological substrates are varied and include extensive areas of sandstone and volcanics which are poorly represented in the south. The Kimberley is somewhat isolated biologically from areas to the south by the desert which reaches the coast at the Eighty Mile Beach. There is a gradation to the desert as floristic composition becomes poorer with lower rainfall.

While there is some representation of southern elements, and typical Australian genera such as Eucalyptus and Acacia are widespread, the flora generally has stronger links with the "Top End" of the Northern Territory, north Queensland and the islands to the north of Australia.

Vegetation types range from closed-forest through open-forest, woodland and shrubland to closed and open-herbland. The denser formations occur in wetter areas, i.e. along the coast and major rivers. As in most of the wetter parts of Australia (except the rainforests of Queensland and New South Wales), the formations are generally dominated by Eucalyptus species. However, Acacia species are prominent, and other common tree genera include Buchanania, Brachychiton, Callitris, Terminalia, Planchonia, Melaleuca, Ficus, Owenia and Eugenia. Screw pines (Pandanus species) Fan Palms (Livistona) and Cycads (Cycas) are a feature of some formations. The ground flora shows a predominance of grasses (Poaceae) and contrasts strongly with areas to the south.

Natural grasses are poorly represented in the South-West of Western Australia and are dominated by spinifex (Triodia and Plectrachne species) in the desert and Pilbara. In the Kimberley many genera are present, especially species of Cymbopogon, Eragrostis, Sacciolepis, Sorghum, Themeda, etc., as well as Triodia, and Plectrachne. Ephemeral and perennial herbs are common, notably in swamps.

Herbaceous plants are prevalent, especially after the summer rains, and later in drying swamps. Typical genera include Xyris, Mitrasacme, Drosera, Stylidium, Buchnera, Crotalaria, Utricularia, Blumea, Gomphrena, Eriocaulon and Cyperus.

Due to the summer rainfall many plants are of summer growth and flowering habit, though some species flower in the dry season. A number of trees and shrubs are deciduous during the latter season, including such characteristic species as the Baobab (Adansonia gregorii), Kapok Bush (Cochlospermum fraseri), Kurrajongs (Brachychiton and Sterculia species) (Fig. 7.1) and several Eucalyptus species.

In Dampier Land (south-west Kimberley), large sandy plains carry Pindan, a formation dominated by a number of species of Acacia. It is usually a tall shrubland, but there may be emergent trees such as Eucalyptus miniata. Grass forms most of the ground cover, but many herbs appear after rains (Specht et al., 1964).

Exploration during the 1970s has revealed the occurrence of a rainforest formation known as semi-deciduous microphyll vine thicket on suitable screes in north and north-west Kimberley. No species are dominant in this dense, mixed formation, but lianes and a lack of ground flora are characteristic. Representatives of genera typical of islands to the north are common, e.g. Cassine, Cryptocarya, Wrightia, Paramignya, Ficus, Bombax, Aristolochia, etc. (George and Kenneally, 1975).

Endemism in the Kimberley is much lower than in the South-West of Western Australia due to the close links with the remainder of tropical Australia and the islands to the north. According to Beard (1969), the figure for the region is about 30%. However, the difference between the Kimberley flora and South-West and Eremaean Botanical Provinces is shown by the figure of 77% of the flora of the Northern Province being restricted thereto in Western Australia.

The use of fire in managing the natural environment is a problem in the Kimberley, just as it is in most parts of Australia. It is a wide-spread practice on pastoral leases to burn annually so as to remove old growth of shrubs and grasses, both to encourage regrowth and to reduce the fire hazard at the end of the dry season. This has the unfortunate effect of favouring grasses at the expense of shrubs which become depauperate or

FIG. 1. A kurrajong (Sterculia viscidula), a deciduous tree widespread in the Kimberley. It flowers in winter.

FIG. 2. A Fresh Water Crocodile (Crocodylus johnstoni) in Geikie Gorge

disappear. Fires from pastoral leases often pass into reserves (Miles, 1975) where burning should be much less frequent so as to allow adequate regrowth and prevent the extinction of species.

The Kimberley falls mostly within the Torresian zoogeographic region (Spencer, 1896) and thus the fauna is more closely allied to that of the northern parts of the Northern Territory and Queensland than with the remainder of Western Australia.

To someone familiar with the wildlife of the South-West, the Kimberley presents a striking contrast. A few widespread species, e.g. the Willy Wagtail (Rhipidura leucophrys), common to both, others fall into the same genera, e.g. the Sandy Wallaby (Macropus agilis), but many others are different. Groups not represented in the south include storks, (Jabiru, Xenorhynchus asiaticus), cranes (Brolga Grus rubicunda and Saurus Crane Grus antigone, although the former extends into the Pilbara), Jacanas (Lotus-Bird, Jacana gallinacea), rollers (Dollar Bird, Eurystomus orientali), pittas (Rainbow Pitta, Pitta iris and Blue-winged Pitta, Pitta molluccensis), orioles (Olive-backed Oriole, Oriolus sagittatus, Yellow Oriole, O. flavocinctus and Yellow Figbird, Sphecotheres flaviventris), drongos (Spangled Drongo, Dicrurus bracteatus), crocodiles (Salt-water, Crocodylus porosus and Fresh-water C. johnstoni (Fig.7.2), colubrid snakes (Brown Tree Snake Boiga fusca (Fig.7.3) and Fresh-water Snake Natrix mairii) and horseshoe bats (Hipposideros ater, H. stenotis and Rhinonicterus aurantius).

With groups which are more widespread in Australia their composition in the Kimberley is often quite different in emphasis from the southern two-thirds of the State. Thus among the mammals the number of bats increases and those present show affinities with south-east Asia (e.g. the Flying Foxes, Pteropus alecto and P. scapulatus and the Blossom Bat (Macroglossus lagochilus). Among the birds there are many more species of pigeons and doves (Columbidae) and finches (Estrilidae), and among the reptiles and amphibians there are more species of goannas (Varanidae) Pythons (Boidae) and Tree Frogs (Hylidae). Some common southern genera such as Amphibolurus (Agamidae) and Lerista (Scincidae) are almost absent, being replaced by Diporiphora and Carlia respectively. Fresh-water fish are common and wide-spread and there are many more species than in the South-West. Rainbow fishes (Melanotaenidae), Perches (Teraponidae) and Archerfishes (Toxotidae) are some well-represented groups.

The number of animal species endemic to the Kimberley is lower than in the South-West. Endemics are largely from the sub-humid north-west Kimberley and include the Scaly-tailed Possum (Wyulda squamicaudata), the Black Grass-Wren (Amytornis housei) and Superb Dragon (Diporiphora superba).

FIG. 3. A Brown Tree Snake (Boiga fusca), Drysdale River National Park.

FIG. 4. An unnamed species of Python (Liasis) from the North Kimberley.

The North Kimberley shows many relationships with Arnhem Land and a number of species are found only in these two regions, e.g. the Little Rock-Wallaby, (Peradorcas concinna), Rock-haunting Ringtail (Petropseudes dahli), Woodwards Rock Rat (Zyzomys woodwardii), Brush-tailed Tree-Rat (Conilurus penicillatus), Lavender-flanked Wren (Malurus dulcis), White-lined Honeyeater (Meliphaga albilineata), the dragon-lizards Diporiphora albilabris and D. bennettii and the skink Carlia johnstonei.

One notable difference between the Kimberley fauna and that of the rest of Western Australia is the absence of extinction in the former. In the southern parts of the State many animals, especially mammals, have either disappeared or become very rare following both changes in land-use and the introduction of exotic predators and competitors. In the Kimberley this does not seem to have happened. Although data on mammals, especially from the past, are not plentiful, it appears that almost all species which should be present are still there. Species which have declined are mainly from the south and east Kimberley where land-use has affected the natural environment.

Mangroves

Mangrove communities are a feature of the Kimberley coast, both as extensive low closed-forest on tidal flats and as narrow fringes on rocky shores. Species composition is richer than on more southerly Western Australian coasts, 14 species having been recorded. Distribution is distinctly zonal in some stands but with no apparent pattern in others. Mangroves are an important feature biologically. They support a rich lichen flora (George and Kenneally, 1975). They are also a probable source of many nutrients derived from the coast and supporting the marine life offshore.

There are 16 bird species restricted to mangroves in Western Australia, one of the richer mangrove bird faunas in the world (R.E.Johnstone, pers. comm). They include the Mangrove Golden Whistler (Pachycephala melanura), the Shining Flycatcher (Myiagra alecto) and the Mangrove Kingfisher (Halcyon chloris). Many other species visit mangroves to feed, nest or shelter, e.g. the Bar-shouldered Dove (Geopelia humeralis). Tidal flats provide food for thousands of wintering and resident wading birds such as sandpipers and dotterels.

Mudskippers, crabs and prawns are common among the mud and rocks and around the roots and trunks of mangroves. Oysters and barnacles become attached to prop roots, and marine snails and hermit crabs seek refuge on branches above high tide. In West Kimberley large black mangrove ants build mounds in the mud which are covered with up to 7m. of water at high tide.

There is great variation in the species composition and zonation of mangrove communities, due to differences in soil type and depth, rainfall, tidal range and erosion. Faunal composition is also affected by these factors as well as by the distance between mangrove communities. Large gaps such as occur between the Drysdale River estuary and Cambridge Gulf prevent the movement of some fauna between them. The Eighty Mile Beach between the Kimberley and the Pilbara is a similar barrier.

Because of their great biological and physical importance and their variation, the Committee considers that mangrove communities should be retained and protected wherever practicable. Some areas are already in existing or proposed reserves, but other areas large and small are not.

The Committee therefore RECOMMENDS that any proposed developments which would affect an area or areas of mangroves on the Kimberley coast be referred to the Environmental Protection Authority for assessment.

History

The first Europeans to settle in the Kimberley were pastoralists. They worked the land extensively but often did not plough back sufficient capital in the form of improvements. By the end of the nineteenth century the absentee landlord pattern of ownership had appeared, and thereafter the industry became more stable although growth has been markedly affected by rugged terrain, climatic conditions and isolation from markets. The establishment of an abattoir at Wyndham and the State Shipping Service in the early twentieth century alleviated some of the pastoralists' problems, but distance from other parts of the State, and indeed distance between one pastoral station and another remains a major social and economic problem for white settlers (Kerr,1975).

The immediate post World War I years were difficult for pastoralists. The decline in stock quality due partly to lack of capital improvements, the proliferation of vermin to the extent that it constituted a serious threat to the industry, and droughts had all contributed to the decline of the pastoral industry. The Air Beef Scheme (with an inland abattoir at Glenroy Station) was introduced in 1949 and between 1950 and 1970 important technological changes greatly improved the productivity of the industry: motor transport of cattle replaced the old droving system; small areas of pasture under irrigation were established as were additional seaport abattoirs at Broome and Derby.

Although cattle raising is, and has been, by far the region's major industry, mining has also contributed to its growth. Indeed, the first gold produced in Western Australia was from Halls Creek but finds of this and other metals have not been significant. By 1900 mineral exploration was small scale and mainly by individual prospectors, a pattern which has hardly altered apart from the operations for iron ore mining at Cockatoo and Koolan Islands.

The Kimberley is therefore one of the nation's most undeveloped regions. Past activities have not greatly altered the landscape except for the creation of Lake Argyle; it is essentially the same as when the Europeans settled there, aside from the few outlet ports, inland towns and a very basic road system between them.

Population

In 1971 only 0.82 per cent of the State's white population lived in the Kimberley region. Growth rates since 1961 have been erratic: 6.15% per annum for the period 1961-66 (compared with 2.58% per annum for the State as a whole), but only 0.70% per annum between 71-76 (compared with 2.22% for the State as a whole).

Erratic growth rates are not unusual in large, sparsely populated areas where migration, due perhaps to the establishment of a small new industry or plant, can have a dramatic impact on population growth. Furthermore, the nature of the region and its industrial structure has attracted a predominantly male population: 54% of the total in 1976 compared with 51% for the State as a whole. The census of 1971 recorded 6,305 aborigines in the Kimberley which, when added to the white population there gave a total of 14,602 persons or 1.42% of the State's population and a density of 1 person per 21 km^2.

Pastoral Industry

The pastoral industry, which employs 29% of the working population in the Kimberley and construction (15%) and community services (15%) dominate employment. Distribution of the working population between areas within the Kimberley is, however, very diverse. The Halls Creek area, for example, has 60% of its workforce in the pastoral/agricultural sector, 8% in construction and 5% in mining. On the other hand, the Broome area has only 19% of its workforce in the pastoral/agricultural sector but 22% in community services, 9% in transport, 8% in construction and 10% in manufacturing. While these figures clearly reflect the existence of a main town in the Broome area, the general profile for the total region is dominance by the pastoral sector and the services which support it. The essentially rural character of the Kimberley is conveyed by 1971/72 official statistics showing that there were only 13 manufacturing establishments in the whole region, ten of which were classified "food, beverages, etc."

Mining

Iron ore is extracted from Koolan and Cockatoo Islands in Yampi Sound. During 1974, approximately 3.3. million tonnes of hematite ore were shipped. The only other reported mineral production in recent years is nine tonnes of copper ore mined during 1973 near Mt Dockrell, south-west of Halls Creek. It is considered highly likely that further mines will be established in the Kimberley in the future. In the past, several minerals have been mined from small, often short-lived deposits. The first gold to be worked in Western Australia was discovered in alluvials near Halls Creek. Subsequently, both lode and alluvial gold were won from the Halls Creek - Ruby Creek area and the Mary River Goldfield. Copper, lead, zinc, tin, tungsten and niobium have been worked in various localities in Napier Range near Mt Dockrell, north of Halls Creek and north east of Derby. All these metals plus uranium, rare earth minerals, fluorite, chromium, nickel, silver, diamonds, coal and hydrocarbons have been investigated during recent exploration and could be viably mined in the future.

A large bauxite deposit on the Mitchell Plateau will undoubtedly be exploited in the future. Mining feasibility studies have been completed and the practicability of using Port Warrender in Admiralty Gulf as the main port has been investigated. Similar deposits of bauxite occur adjacent to Mitchell Plateau.

Perhaps the greatest single mineral resource of the Kimberley Region is water. At present some permanent river pools and many

ground-water aquifers are tapped to supply stock and domestic water but utilisation must represent only a small percentage of the potential resources. The use of water for crop irrigation is also expected to increase.

Fisheries

Commercial fisheries in the Kimberley include both well-established and developing ones. Best known is the pearl and pearl shell fishery based in Broome, now a much smaller industry than it was before the war. Today, pearl oysters are collected for sale and also collected live for the pearl culture industry. The large pearl culture farm at Kuri Bay produces some of the biggest and finest pearls in the world (Hancock, 1973). Smaller pearl culture farms are located near Broome.

Considerable research has been conducted into the availability of prawns in commercial quantities and some fishing is now taking place in Joseph Bonaparte Gulf, Admiralty Gulf, Cambridge Gulf and York Sound. Experiments in aquaculture of cherrabin (Macrobrachium sp.) and Barramundi (Lates calcifera) may lead to the establishment of an industry at Kununurra. Barramundi are also fished commercially.

Economic Potential

Power requirements for large-scale industry could possibly be met by either hydro-electric power from the Ord Dam (which included provision for turbines in its construction), or from tidal power at Walcott Inlet or elsewhere. The major question for the Kimberley, however, is to what purpose such power supplies would be put. Reference has already been made (see Mining above) to the possible exploitation of bauxite deposits at Mitchell Plateau, and this appears to be the main prospect for economic development. Agricultural developments will undoubtedly include irrigated crops at various Kimberley locations. With the phasing out of cotton growing on the Ord, alternative crops being grown and under consideration are sugar, peanuts, kenaf and rice.

Infra-structure costs in such a difficult and sparsely populated terrain are, of course, considerable, but the Main Roads Department has plans to complete a sealed road from Port Hedland (the terminus of the sealed road from Perth) to Kununurra.

Conservation Reserves

Three large conservation reserves already exist in the Kimberley - the Drysdale River National Park, the Prince Regent River Nature Reserve and the Point Coulomb Nature Reserve. Several small areas of outstanding scenic, biological, geological or historic interest have also been reserved, e.g.Windjana Gorge and Geikie Gorge National Parks; Parry Lagoons and Ord River Nature Reserves. Some offshore islands are already nature reserves, e.g. the West and Middle Lacepede Islands.

A high proportion of the region is reserved for Aborigines and remains substantially in a natural state. The Committee does not regard Aboriginal reserves as conservation reserves because of their unavailability to the whole population and because of their open options for future use. It believes this aspect should be pursued with appropriate aboriginal interests in the future.

Most of the remainder of the region is leased for pastoral activities.

With the increase in knowledge of the Kimberley, especially in the 1970s, it has become evident that some parts are not represented at all in conservation reserves, and some existing reserves do not fully represent the local environment. Additions to the Prince Regent River Reserve and the Drysdale River National Park are needed. New data support the selection of reserves at Walcott Inlet, Mitchell River, Cape Londonderry the King Leopold Range and some offshore islands. An environmental survey should be made in the south-east Kimberley where there are no conservation reserves at present.

The Fitzroy valley is not represented in reserves except for the spectacular Geikie Gorge. Most of the area has been taken up as pastoral leases and remains in a quasi-natural state. A large area south of the valley and east of La Grange should be examined for Pindan vegetation which at present is poorly represented in the Point Coulomb Reserve. In the Ord Valley a substantial reserve for the purpose of regeneration of eroded areas was set apart to ensure ultimate regeneration of grasses because of siltation dangers to the Ord Dam. Lake Argyle is managed by the Public Works Department, together with a substantial adjacent reserve for Government requirements. The Committee believes that in due course, the National Parks Authority should be involved in managing the area.

The areas reported on by the Committee are as follows :

1. Oceanic islands
2. Inshore islands
3. Point Coulomb Nature Reserve
4. Walcott Inlet
5. Prince Regent River Nature Reserve
6. Hunter River area.
7. Mitchell River area
8. Cape Londonderry area
9. Drysdale River National Park
10. Lake Argyle
11. Parry Lagoons

12. Ord River Nature Reserve
13. Bluff Face Range area
14. Gardiner Range area
15. Napier and Oscar Ranges area
16. King Leopold Range
17. Geological sites

7.1 OCEANIC ISLANDS

Most Kimberley islands are inshore continental islands which were formed by a relative rise in sea level which isolated areas that were once part of the mainland. Distant offshore islands are mostly sandy cays formed on coral reef platforms. These include the Lacepede Islands, Adele Island, Browse Island, Cartier Islet, Ashmore Reef Islands and Sandy Island on Scott Reef. Seringapatam Reef is an atoll but none of it is permanently above water (Teichert and Fairbridge, 1948; Serventy, 1952). Some of these islands are important sea-bird and turtle nesting sites. They are discussed in detail below.

1. Lacepede Islands

The Lacepede Islands lie some 20 km off the coast, 150 km north of Broome. They are an important breeding area for both sea-birds and turtles.

There are three main islands, West, Middle, and East Lacepede and the small Sandy Island. They are surrounded by reefs and shoals which abound in marine life including giant clams and a variety of corals. West and Middle Islands, the larger two, are Class C reserve No. 7279, for the Conservation of Flora and Fauna vested in the W.A. Wildlife Authority. East Island is leased to the Commonwealth Government for a lighthouse site.

Seabirds which nest on the islands include the Brown Booby (Sula leucogaster), Lesser Frigate Bird (Fregata ariel), Australian Pelican (Pelecanus conspicillatus), Pied Cormorant (Phalacrocorax varius), Noddy (Anous stolidus) and Fairy Tern (Sterna nereis).

East Island is an important sea-bird nesting site and is the only island in the group used by the Common Noddy.

The Ship Rat (Rattus rattus) has become established on both West and Middle Islands. Large numbers of Green Turtles (Chelonia mydas) nest on the beaches. Gilbert's Water Dragon (Physignathus gilberti) is known from Middle Island and the Spotted Gecko (Gehyra punctata) has been collected from West Island.

The islands were once mined for guano and signs of the workings remain.

2. Adele Island

Adele Island is situated about 100 km north-north-east of Cape Leveque at 15°31'S, 123°09'E. It is a low, flat, sandy island of about 200 ha.

The vegetation is not diverse and only 11 plant species have been collected (Anon. 1972). Most of the island is covered with a grassland of Spinifex longifolius up to 1m high with scattered creepers and other plants. Parts of the island which are subject to occasional flooding are covered with salt water couch (Sporobolus virginicus).

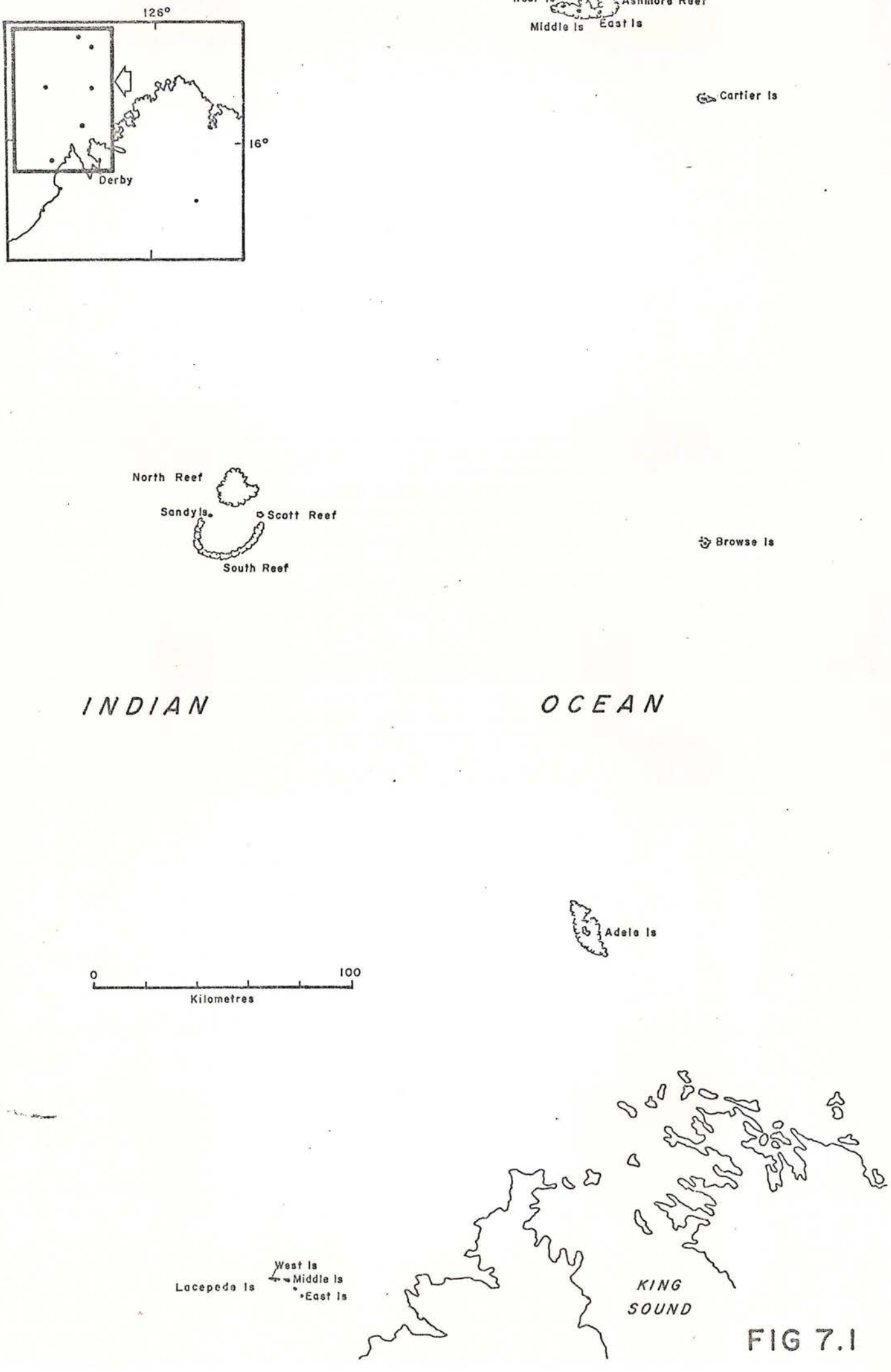

126°
16°
Derby
West Is
Ashmore Reef
Middle Is
East Is
Cartier Is
North Reef
Sandy Is
Scott Reef
South Reef
Browse Is
INDIAN
OCEAN
Adele Is
0
100
Kilometres
West Is
Middle Is
Lacepede Is
East Is
KING
SOUND

FIG 7.1

Sea-bird breeding colonies are the most important wildlife feature. Species that breed there include the Lesser Frigate Bird (Fregata ariel (Fig.7. 5)) which was represented by 2,500 pairs in June 1972; Brown Booby (Sula leucogaster (Fig.7. 6)) 1,500 - 2,000 pairs; Masked Booby (Sula dactylatra) 100 pairs; Pied Cormorant (Phalacrocorax varius) and Lesser Crested Tern (Sterna bengalensis). The Masked Booby is a comparatively rare species in Western Australia and its only other breeding area in the State is Bedout Island near Port Hedland. A small land bird, the Tawny Grassbird (Megalurus timoriensis) also occurs on Adele Island (Serventy, 1952; Anon, 1972).

A variety of marine life, including clams and corals, flourishes in the extensive reefs that surround Adele Island and which are exposed at low tide.

The island has an unmanned lighthouse and radio beacon and the Bureau of Meteorology has erected an automatic weather station.

Adele Island is identified as Meda locations 10 and 13. Both are owned freehold by the Commonwealth of Australia for the protection of the lighthouse and radio beacon.

3. Browse Island

Browse Island has an area of about 60 ha and is situated about 350 km north of Derby at 14°07'S, 123°33'E. It once contained large deposits of guano but these have been mined out (Serventy et al, 1971).

No sea-birds now breed on Browse Island but it is one of the most important turtle nesting sites in Australia. A survey by the Department of Fisheries and Wildlife in June 1972 revealed thousands of turtle nests in the narrow strip of beach above high-water mark. The Green Turtle (Chelonia mydas) certainly breeds there and other species may also use it. The Island is used occasionally as a refuelling stop for helicopters en route from Australia to Indonesia and is the site of a navigation beacon.

Browse Island is Reserve No. 22697 for Minerals-Phosphatic Rock. It is not vested.

4. Ashmore Reef Islands

Ashmore Reef lies in the Timor Sea about 480 km north of Cape Leveque at 12°10' - 12°18'S, 122°50' - 123°10'E. The Reef comprises West, Middle and East Islets which are important sea-bird nesting sites. Breeding species include the Lesser Frigate bird (Fregata ariel), Brown Booby (Sula leucogaster), Red-footed Booby (Sula sula), Crested Tern (Sterna bergii), Sooty Tern (S. fuscata), Common Noddy (Anous stolidus) and Reef Heron (Egretta sacra). Turtles also breed on one island.

FIG. 5. A breeding colony of Lesser Frigate Birds (Fregate ariel) on Adele Island.

FIG. 6. A Brown Booby (Sula leucogaster) with chick on Adele Island.

In the past, Indonesian fishermen have hunted sea-birds on Ashmore Reef for food (Serventy, 1952). Although a recent agreement between Australia and Indonesia restricts these activities, fishermen continue to use the islands as anchorages and the agreement is difficult to police.

The islands of Ashmore Reef are Commonwealth territory and are outside the jurisdiction of the Western Australian Government.

5. Cartier Islet

Cartier Islet, a small unvegetated cay with an area of about 45 ha, lies in the middle of an oval reef platform (12°32'S, 123°33'E). It does not appear to be used by sea-birds (Serventy, 1952) and no data are available on its use by turtles.

6. Sandy Island, Scott Reef

Sandy Island is situated on the north-western extremity of the horseshoe-shaped Scott Reef in 14°03'S, 121°46'E. It is also an unvegetated cay and does not appear to be used by sea birds although it is a turtle breeding site (Serventy, 1952). A potentially important gas discovery has been made in the Scott Reef No. 1 Well drilled in the Scott Reef Atoll.

RECOMMENDATIONS

The Committee recommends :

a. that Reserve No. 7279 comprising the West and Middle Islands of the Lacepede Islands be reclassified to Class B. Should East Island become available for reservation, it should be added to the reserve. The reserve should be extended to low water mark in order to ensure the protection of turtles.

b. that Reserve No. 22697 (Browse Island) be changed from Minerals-Phosphatic Rock to Conservation of Fauna and Flora and that it be declared Class B and vested in the W.A. Wildlife Authority. The reserve should be extended to low water mark in order to ensure the protection of turtles.

c. that the EPA ask the State Government to explore with the Commonwealth Government means of returning Adele Island to State control. Should this eventuate, the Island be declared a Class B Reserve for the Conservation of Fauna and Flora vested in the W.A.Wildlife Authority. Leases should be issued to protect the lighthouse, radio beacon and automatic weather station.

d. that the EPA ask the State Government to recommend to the Commonwealth Government that the Ashmore Reef Islands and Sandy Island on Scott Reef be managed as though they were Nature Reserves. The development of the hydrocarbon resources of Scott Reef need not be incompatible with this recommendation.

7.2 INSHORE ISLANDS

The Kimberley coast south-west of Cape Londonderry is a ria coastline containing many islands near the shore that have been cut off from the mainland by a relative rise in sea level.

The islands vary considerably in size, topography and geology, and although their flora and fauna are generally similar to those of the adjacent mainland there are important differences. Islands are important natural laboratories because their ecosystems have been variously modified, depending on their size and the time at which they were isolated from the mainland. Some islands further south in Western Australia retain animal species that have become extinct on the Australian mainland since the arrival of European man. This does not seem to be true, at present, in the Kimberley, although time and development may change the situation. Domestic cats (Felis catus) are already wide-spread on the mainland and the fox (Vulpes vulpes) is present, although it has not penetrated the whole area. It is interesting that the dingo (Canis familiaris dingo) occurs only on some islands, presumably transported by Aborigines.

Most of the larger Kimberley islands between Collier Bay and Cape Londonderry were examined during 1971, 1972 and 1973 by combined teams from the Department of Fisheries and Wildlife, Western Australian Museum and Western Australian Herbarium.

The data are not yet published and will not be comprehensive because the teams worked from small boats, had to traverse the islands on foot, and could spend only a short time at each place.

For ease of discussion, the islands have been arbitrarily divided into groups.

1. Buccaneer Archipelago

Buccaneer Archipelago lies at the head of King Sound, north of Derby. Geologically it is part of the Yampi Peninsula and consists mostly of Proterozoic sandstone, particularly the King Leopold Sandstone and the Yampi Member of the Pentecost Sandstone.

Koolan and Cockatoo are among the principal islands of the Group and are well known as the site of iron ore mines. Irvine, Bathurst, Hidden, Long and Sunday Islands are also important.

Little information is available on the biology of the Archipelago. The Little Northern Native-Cat (Dasyurus hallucatus), Common Rock Rat (Zyzomys argurus), Ghost Bat (Macroderma gigas), Orange Horseshoe Bat (Rhinonicterus aurantius), Hoary Bat (Chalinolobus rogersi), Little Bat (Eptesicus pumilis) and Black Flying Fox, (Pteropus alecto) are known from Koolan; a rock Wallaby (Petrogale sp.) occurs on Long Island; and Sunday and Swan Islands are used by the Lesser Frigate-Bird (Fregata ariel) for nesting. The Crested Tern (Sterna bergii) also breeds on Sunday Island (Serventy et al., 1971). Sunday Island is a reserve for Aborigines; Koolan and Cockatoo Island are mining leases and the remainder of the Archipelago is vacant Crown land.

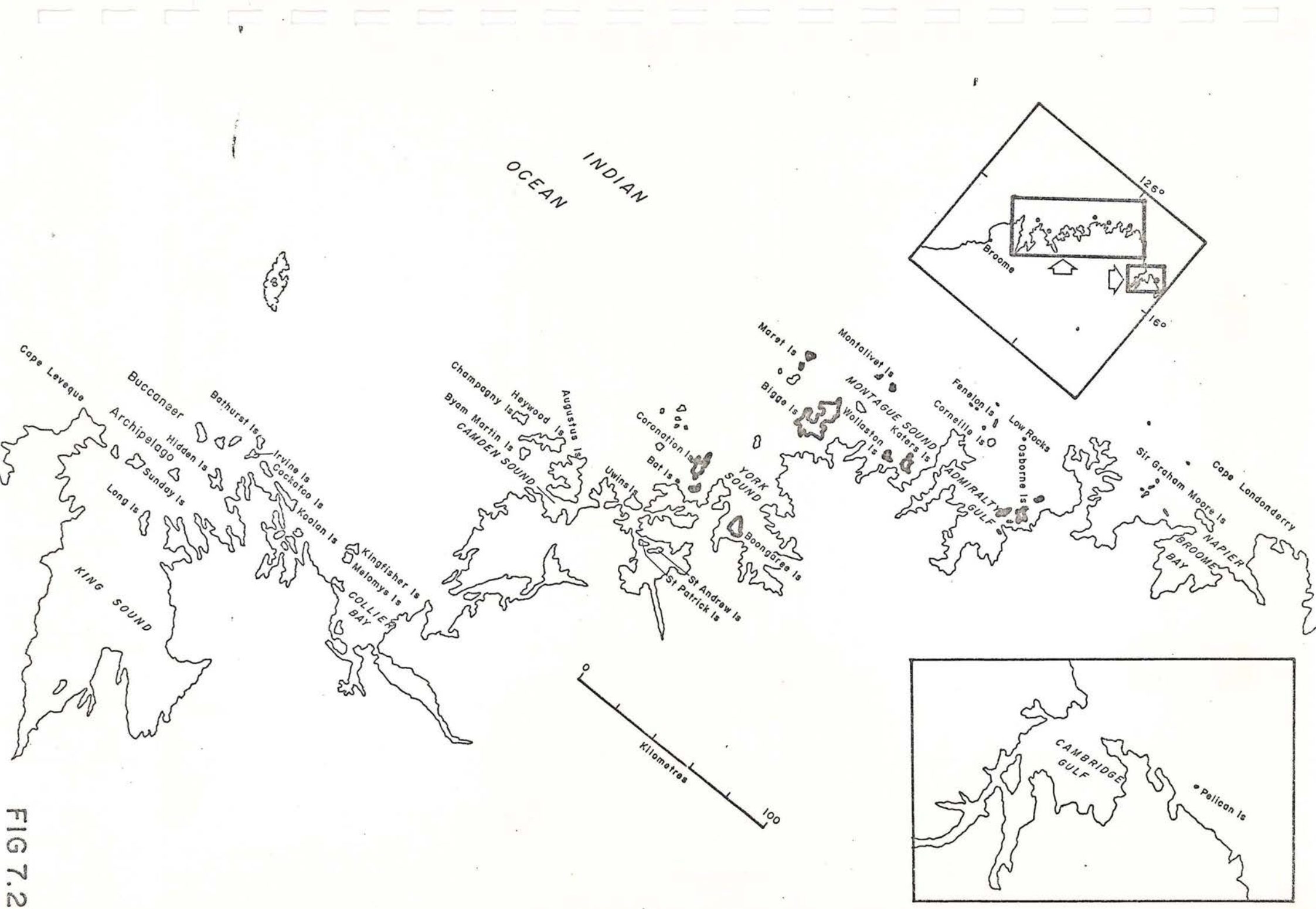

INDIAN OCEAN
125°
Broome
130°
Cape Leveque
Buccaneer Archipelago
Bathurst Is
Irvine Is
Cockatoo Is
Koolan Is
Hidden Is
Sunday Is
Long Is
KING SOUND
Champagny Is
Heywood Is
Augustus Is
Byam Martin Is
CAMDEN SOUND
Kingfisher Is
Melomys Is
COLLIER BAY
Coronation Is
Bat Is
Uwins Is
YORK SOUND
Boongaree Is
St Andrew Is
St Patrick Is
Maret Is
Montalivet Is
Bigge Is
MONTAGUE SOUND
Wollaston Is
Katers Is
Fenelon Is
Cornelle Is
Low Rocks
Osborne Is
ADMIRALTY GULF
Sir Graham Moore Is
Cape Londonderry
BROOME BAY
NAPIER
0
Kilometres
100
CAMBRIDGE GULF
Pelican Is

FIG 7.2

The Committee considers that data are insufficient to justify recommending the creation of specific reserves at present. It recommends that the Environmental Protection Authority commission a biological survey to enable a firm decision to be reached.

2. Kingfisher Islands

These are situated in Collier Bay and consist of two major islands, Kingfisher and Melomys, and some smaller ones. Until recently they were known as the Wood Islands. All are composed of the Yampi Member of Pentecost Sandstone. A brief survey by the Department of Fisheries and Wildlife in 1973 revealed the presence of a Mosaic-tailed Rat (Melomys sp.) on Melomys Island and the Water Rat (Hydromys chrysogaster) on Kingfisher Island. Another interesting record was the Mangrove Kingfisher (Halcyon chloris) as few specimens of this species have been collected in Western Australia.

Kingfisher Island is vegetated by an open-forest of Eucalyptus spp. (Mainly E. perfoliata and E. miniata)with some Terminalia canescens. There is an understorey of Acacia tumida and other shrubs, over a hummock grassland. Melomys Island is covered with Eucalyptus woodland over hummock grassland and scattered shrubs. Both islands are rocky, and fringed with stands of mangroves.

The Kingfisher Islands are vacant Crown Land and the Committee makes no recommendation concerning them.

3. Bonaparte Archipelago

Bonaparte Archipelago includes many inshore islands lying between Camden Sound and Cape Voltaire. They can be divided into three groups :

(a) Augustus Group

Augustus Island has an area of about 17 952 ha and lies opposite Kuri Bay. Further from the mainland are the Heywood Islands, Byam Martin Island, Champagny Island and several smaller islands. They consist mainly of closely jointed, steep and rugged Warton Sandstone.

Augustus Island supports a variety of vegetation formations. Dense stands of mangroves belonging to a number of species (e.g. Rhizophora stylosa, Sonneratia alba, Avicennia marina) occur in the inlets. There are some sandy shores. Most of the island is covered with a mosaic of hummock grassland, shrubland and low open-woodland. Spinifex (Plectrachne) is the dominant grass. The trees include Eucalyptus miniata, Terminalia canescens, Owenia vernicosa, Acacia species and Baobabs (Adansonia gregorii). Screwpines (Pandanus)and cycads (Cycas) occur in some areas.

The island is criss-crossed by shallow valleys in which alluvial soils support an open-forest of Eucalyptus species and Erythrophleum chlorostachys. A large freshwater creek runs southward through the centre of the island and, in its lower reaches, supports a fringing formation of massive cadjeputs (Melaleuca leucadendron, M. viridiflora), screwpines (Pandanus) and dense grass. Many swamp plants also grow along this creek. Cliffs and steep screes are often faced with vine thickets in which Glycosmis pentaphylla occurs. It is a tree related to Boronia and has only recently been discovered in Western Australia.

The Heywood group includes two fairly large islands and a number of smaller ones. The largest is Darcy Island (4 800 ha) which is north-east of Heywood Island (760 ha) and is covered by a low open-forest of Eucalyptus (mostly E. miniata) with a variable, and often dense, shrub layer of Acacia, spp. (including A. delibrata), Grevillea and Dodonaea over hummock grasslands. Like Augustus, the island is criss-crossed with shallow valleys in which the density of these species is greater. At the mouth of a deeper gully is an area of massive cadjeputs (Melaleuca sp.) and in another a cycad (Cycas media) and Native Walnut (Owenia vernicosa) occur. Most of the coast consists of rugged unvegetated sandstone cliffs fringed by a narrow band of mangroves. In sheltered bays and inlets the mangroves form low closed-forests. Attractive sandy beaches, with Spinifex grasslands above the high tide line, occur in several inlets.

Heywood Island itself is much smaller and, although generally similar, has extensive open-scrub of Acacia spp.

Champagny (1 330 ha) is covered mainly with an open-scrub dominated by Acacia plectocarpa and A. tumida over lower shrubs such as Santalum lanceolatum and a dense ground cover of grasses. There is also hummock grassland dominated by Plectrachne. This island has a lower profile than Augustus or the Heywood Islands. Sandy beaches, with areas of Spinifex grassland above the high tide line, are prominent along the coast and areas of mangroves occur in sheltered situations.

On Byam Martin (760 ha) the dominant vegetation is a tall shrubland of Acacia sericata and A. plectocarpa over hummock grassland. Creeks are lined with Pandanus or Melaleuca viridiflora with Terminalia sp. and Baobabs (Adansonia gregorii) away from the water. The creeper Ipomoea brasiliensis is common.

Augustus Island has a rich mammal fauna. It includes the Little Rock Wallaby (Peradorcas concinna), Sugar Glider (Petaurus breviceps), Golden Bandicoot (Isoodon auratus), Little Northern Native-Cat, (Dasyurus hallucatus), an Antechinus (Antechinus cf. bilarni), two species of Rock-Rats (Zyzomys argurus and Z. woodwardii), three species of bats and the dingo.

Antechinus is also known from Heywood Island. Woodward's Rock-Rat occurs on Heywood and Darcy Islands and the Little Rock-Wallaby is also found on the latter island. A large number of birds and reptiles are known from the islands in the Augustus group.

The Committee considers that these islands are worthy of reservation as conservation areas but at present all islands in this group are Aboriginal Reserves. The Committee RECOMMENDS that the Environmental Protection Authority bring to the notice of the Aboriginal Lands Trust the conservational value of islands in the Augustus group, at the mouth of the Prince Regent River and in St George Basin. Should they at any time be no longer required as Aboriginal Reserves, they should be set aside as Nature Reserves.

(b) Prince Regent Group

This group contains islands adjacent to the Prince Regent River Nature Reserve: St Andrew and St Patrick Islands in St George Basin, Uwins Island at the mouth of the Basin, Bat Island off Cape Brewster, the Coronation Islands in York Sound and Boongaree Island in Prince Frederick Harbour.

St Andrew (1,400 ha) and St Patrick Island each consist of a central plateau of Warton Sandstone overlying Carson Volcanics. Only St Andrew Island has been examined biclogically.

The vegetation is similar to that of the adjacent Prince Regent River Nature Reserve (Miles, Kenneally and George, 1975). Small areas of vine thicket occur on steep, moist basaltic soils and on screes below the sandstone cliffs, but much of the slopes is covered with open-woodlands of Eucalyptus miniata and Terminalia ferdinandiana. Mammals include the Brindled Bandicoot (Isoodon macrourus), Tunney's Rat (Rattus tunneyi) and the Black Flying Fox (Pteropus alecto). Both St Andrew and St Patrick Islands are reserved for Aborigines.

Uwins Island (3,300 ha) consists of heavily jointed Warton Sandstone. The vegetation is similar to that of the adjacent mainland in the Prince Regent River Nature Reserve (Miles, Kenneally and George, 1975). It is mainly a woodland with Eucalyptus ferruginea, E. miniata and E. perfoliata predominating. Shrubs of Acacia stipulosa and A. humifusa are common and the ground cover consists principally of hummock grasses and Cenchrus elymoides; the gullies support fan palms (Livistona sp.), screw pines (Pandanus), Santalum and Choretrum. Some of the inlets are lined with mangrove stands in which Rhizophora appears to predominate.

The most notable element of the fauna is the Northern Native-Cat (Dasyurus hallucatus) which is plentiful. The Golden-backed Tree-Rat (Mesembriomys macrurus) also occurs there. Uwins Island is also reserved for Aborigines.

Bat Island is a small island lying off Cape Brewster. The first European to visit it was P.P.King in 1820 (King, 1827) who named the island after visiting a cave containing numerous bats. The island was investigated in 1973 and the cave proved to be a refuge for two species of bats - the Little Bat (Eptesicus pumilis caurinus) and the Common Sheath-tailed Bat (Taphozous georgianus). Some of the plants collected by King's botanist (Alan Cunningham) were subsequently described as new species and the island is therefore an important type locality. It is at present vacant Crown Land.

The Coronations are a group of low basaltic islands to the north of the Prince Regent River Nature Reserve. The main vegetation is a mixed Eucalyptus low woodland with a ground cover of grasses. Patches of low woodland contining Terminalia, Acacia, Pandanus, Hakea and other genera are also found. There are a few areas of mangroves and some sandy beaches.

The fauna is less diverse than on sandstone islands and the only mammals known are the Common Rock-Rat (Zyzomys argurus) and the Black Flying Fox (Pteropus alecto). Z. argurus occurs here as an unusual form which may warrant taxonomic distinction.

Boongaree Island (4 880 ha) lies near the coast in Prince Frederick Harbour. It consists mainly of King Leopold Sandstone although a large mass of Hart Dolerite occurs in the central portion. Vegetation on the sandstone is mainly an open-woodland of Eucalyptus miniata and other eucalypts, with shrubs of Acacia, Calytrix, Dodonaea and Grevillea. Areas of deeper soil contain an open-scrub of Acacia. The doleritic slopes support grasslands with occasional Kapok Bush (Cochlospermum fraseri). There are extensive areas of mangroves.

A stream with a steep valley in the sandstones on the northern side of the island provides a habitat for a dense fern flora. It is also one of the few known localities in Western Australia for a tree of the genus Aglaia.

The fauna is diverse. The most important occurrence is the Scaly-tailed Possum (Wyulda squamicaudata). Other mammals include the Little Rock Wallaby (Peradorcas concinna), Northern Native Cat (Dasyurus hallucatus), Tunney's Rat (Rattus tunneyi) (Fig.7.7) Woodward's Rock-Rat (Zyzomys woodwardii) and three species of bat. Reptiles include the Superb Dragon (Diporiphora superba) and the large gecko Pseudothecadactylus lindneri.

Boongaree Island is at present vacant Crown Land.

The Committee recommends that Bat, Boongaree and the Coronation Island be set apart as a Class B reserve for the Conservation of Flora and Fauna.

FIG. 7. Tunney's Rat (Rattus tunneyi), Drysdale River National Park.

FIG. 8. Wollaston Island.

(c) Bigge Group

This group consists of three large islands and some smaller ones. The largest is Bigge Island itself with an area of about 17 190 ha. Katers and Wollaston Islands, which lie near the mainland in Montague Sound, are also fairly large and there are several smaller islands further offshore including the Maret and Montalivet Islands. The larger islands consist mainly of heavily dissected King Leopold Sandstone with areas of dolerite and sandy soil and the smaller plateaux formed by lateritized basalt.

Most of Bigge Island consists of open, dissected sandstone with deep gullies, and, in some places, broad valleys. They support low open-woodlands and tall open-shrublands of Acacia, Pandanus, Owenia, Eucalyptus spp. Ficus, Strychnos and Gardenia with scattered hummock grasses (Plectrachne). Other shrubs include Hibiscus, Santalum, Calytrix and Canthium. Occasional creeks are fringed with cadjeputs (Melaleuca leucadendron) and screw pines (Pandanus) as well as the fern Acrostichum speciosum.

A wide central vale with basaltic soil contains a woodland of Eucalyptus species (including E. miniata), Acacia and Terminalia. Behind sandy shores there is a hummock grassland of Spinifex longifolius with scattered shrubs of Morinda citrifolia and Scaevola taccada. Muddy shores are fringed with mangroves, especially Avicennia and Rhizophora.

The most interesting faunal element is the presence of a very small rock wallaby probably of the genus Peradorcas. On the mainland this possibly undescribed species is known only from the Mitchell Plateau region. On Bigge Island it is plentiful and occurs wherever there are suitable rock crevices for shelter.

Woodward's Rock Rat (Zyzomys woodwardii), another fairly rare mainland species, is also common on Bigge Island. Other mammals include the Northern Native Cat (Dasyurus hallucatus), the Little Native-Mouse (Pseudomys delicatulus) and the Echidna (Tachyglossus aculeatus).

The Little Rock Wallaby (Peradorcas concinna) occurs on Wollaston (850 ha) and Katers (1 775 ha) Islands, both of which are composed mainly of horizontally bedded sandstones (Fig.7.8). Katers Island has extensive areas of bare rock and areas of little soil with hummock grasslands. Fissures and cracks in the rocks support Ficus sp. and many small trees and shrubs, such as Ervatamia, Gardenia and Strychnos. Tall open-shrublands of Acacia retinervis and A. xylocarpa with occasional Eucalyptus and Erythrophleum occur in larger fissures. A deep valley in the north-west part of the island has a narrow strip of vine thicket in which Tinospora and Aristolochia occur. The latter genus is known from only one other Western Australian locality. There are some fringing sandy areas with Spinifex longifolius, Beach Morning Glory (Ipomoea brasiliensis) and a few mangrove formations.

Wollaston is a steep island with rock terraces. The main vegetation is a hummock grassland. Gyrocarpus americanus, Alstonia and Ficus are common trees in joint fractures in the sandstone.

One deep valley contains a dense thicket of Acacia sp. and Caesalpinia bonduc with the creeper Flagellaria indica, and in seepage areas the ferns Lygodium microphyllum and Stenochlaena palustris. Sandy flats by the sea are covered with Sporobolus virginicus.

In addition to rock-wallabies, Woodward's Rock-Rat (Zyzomys woodwardii) occurs on Kater Island and the Golden-backed Tree-Rat (Mesembriomys macrurus) has been collected on Wollaston.

All islands of the Bigge Group are vacant Crown Land. They are important biologically and the Committee recommends that they be set apart as a Class B Reserve for the Conservation of Flora and Fauna.

4. Admiralty Gulf Islands

Three distinct groups of islands can be recognised in Admiralty Gulf.

(a) Institut, Montesquieu and Kingsmill Islands

These are groups of small islands lying to the north of Cape Voltaire. Fenelon and Corneille are the largest. They consist of laterite plateaux breaking away to a dolerite slope with sandy spits on parts of the shoreline. On Fenelon, the plateau vegetation is a low vine thicket with Ficus, Flagellaria indica, and Gardenia. The slopes support tall shrublands and open-scrub dominated by Acacia species with a ground cover of grasses.

These islands are at present vacant Crown Land. The Committee considers that data are insufficient to justify the recommendations of specific reserves at present.

(b) Osborne Islands

The Osborne Islands lie in the south-eastern part of Admiralty Gulf. There are five main Islands, Middle Osborne, South-West Osborne, Carlia, Borda and Steep Head. The group provides a great variety of geology, flora and fauna and is in many ways a microcosm of the region.

Middle Osborne Island (2 300 ha) consists almost entirely of basalt of the Carson Volcanics. Unlike many basaltic areas it is steep and in places rugged and the major peak resembles a volcanic plug. Much of the island is covered with a mixed low open-forest, with vine thicket on steep screes. Sandy areas on the coast have Baobabs (Adansonia gregorii) and Pandanus over Sorghum and Spinifex. Areas of mangroves occur on muddy shores. The fauna includes Woodward's Rock-Rat (Zyzomys woodwardii) and the dingo (Canis familiaris dingo).

South-West Osborne consists of two central plateaus formed by Warton Sandstone overlying basalt slopes of Carson Volcanics, changing to alluvial soils near the coast (Fig.7. 9). On the plateaus the vegetation is a tall shrubland of Acacia over Plectrachne. Extensive areas of vine thicket with Ficus spp. occur below the cliffs and open-scrub to tall shrubland occurs on the basalt. Species include Baobabs (Adansonia gregorii), Zizyphus, Acacia translucens, Hakea arborescens and the grasses Themeda australis and Sorghum sp. Woodward's Rock-Rat (Zyzomys woodwardii) is the only mammal but the island has an important bird fauna, especially that associated with the vine thickets. Birds recorded include the Red-crowned Pigeon (Ptilinopus regina), Torres Strait Pigeon (Myristicivora spilorrhoa), Green Winged Pigeon (Chalcophys indica), Scrub Fowl (Megapodius freycinet), Rainbow Pitta (Pitta iris), Peregrine Falcon (Falco peregrinus) and Spangled Drongo (Dicrurus bracteatus).

Carlia Island (480 ha) is somewhat similar but the plateau is less conspicuous and there are no vine thickets. An extensive area of mangroves occurs on its eastern shore. The fauna includes the Golden-backed Tree-Rat (Mesembriomys macrurus) and the dingo.

Borda Island (600 ha) contrasts sharply with the remainder of the group as it is composed of rugged King Leopold Sandstones. Its vegetation is mainly a tall shrubland of Acacia, Gyrocarpus americanus, Calytrix and Grevillea with scattered and sometimes dense hummock grassland (Plectrachne pungens and Triodia sp.) A small area of vine thicket contains Albizia and Tinospora, and in one gully a dense stand of cadjeputs (Melaleuca viridiflora) occurs.

Little Rock Wallabies (Peracordas concinna) and Woodward's Rock Rats (Zyzomys woodwardii) are common.

The Osborne Islands are vacant Crown Land. The Committee recommends they be set apart as Class B Reserves for the Conservation of Flora and Fauna.

(c) Low Rocks

The Low Rocks are situated at 14°04'S, 125°52'E in the northern part of Admiralty Gulf. They are important as a breeding site for the Pied Cormorant (Phalacrocorax varius), Bridled Tern (Sterna anaethetus) and Crested Tern (Sterna bergii).

Low Rocks comprise Class C Reserve No. 33832 for the Conservation of Fauna and Flora, vested in the W.A. Wildlife Authority. They have an area of 4 ha.

5. Sir Graham Moore Island

Sir Graham Moore Island lies at the head of Napier Broome Bay north of Kalumburu. It consists mainly of laterite with areas of King Leopold Sandstone exposed on the southern and eastern parts. The vegetation is mainly an open-woodland of Eucalyptus spp., Terminalia, Acacia and Brachychiton. Extensive areas of

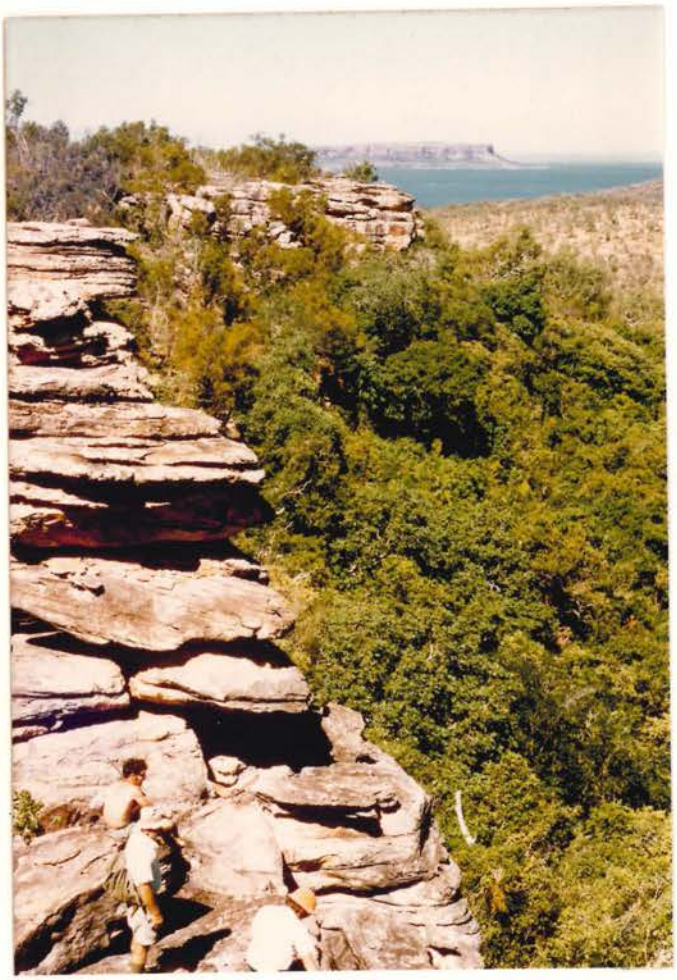


FIG. 9. South-West Osborne Island. Horizontally-bedded sandstone with vine thicket below the cliff. Steep Head Island is in the distance.

closed-sedgeland occur. These support a number of swamp plants and are bordered by cadjeputs (Melaleuca leucadendron). Fan Palms (Livistona sp.) occur in places.

The most interesting faunal element is the Mosaic-tailed Rat (Melomys sp.) Unfortunately pigs have become established and are damaging the vegetation and soils, especially in swamps and creeks. King Brown Snakes (Pseudechis australis) are common.

Sir Graham Moore is vacant Crown Land but the Committee does not consider it worthy of reservation at this time.

6. Pelican Island, Joseph Bonaparte Gulf

Pelican Island lies about 110 km north-east of Wyndham. As the name suggests it is a breeding place for the Australian Pelican (Pelicanus conspicillatus). Only eight other nesting sites for pelicans are known in Western Australia. The island is a Class C Reserve No. 29541. Its purpose is "Wildlife Sanctuary", and it is vested in the W.A. Wildlife Authority. It has an area of about 8 ha.

Synthesis

The most important biological feature of the inshore islands between Derby and Kalumburu is that some contain poulations of animals that are comparatively rare on the mainland. These include the Little Rock Wallaby (Peradorcas concinna), another possibly unnamed Rock Wallaby (Peradorcas sp.) Woodward's Rock Rat (Zyzomys woodwardii), and the Golden-backed Tree Rat (Mesembriomys macrurus). They are also the only places in the Kimberley where plants and animals are so far not in competition with exotic animals that have become wide-spread on the mainland, especially cattle (Bos taurus) and feral cats (Felis catus).

In making its recommendations, the Committee took the following points into consideration :

1. the few data available to it on the biology of the islands;

2. the fact that some islands are reserves for Aborigines. These include all of the Augustus Group, and Uwins, St Andrew and St Patrick Islands;

3. the need to set aside some of the islands as conservation reserves, both to protect their ecosystems and to provide areas representative of this part of the Kimberley;

4. the suggestion that the islands immediately adjacent to the Prince Regent River Nature Reserve are naturally part of the reserve and should be included in it; and

5. the belief that the islands are not suited to intensive recreational use because of their steep, rugged topography and lack of permanent fresh water. They will, however, be interesting places for people to visit.

The Committee believes that data on selected islands are sufficient to warrant their immediate reservation. It does not wish to see all islands in this remote area reserved but is aware that future research may show that additional islands should be conserved.

RECOMMENDATIONS

The Committee recommends :

a. that Bat Island, the Coronation Islands and Boongaree Island be added to Reserve No. 27164 - the Prince Regent River Wildlife Sanctuary (see also Area 7.5)

b. that Bigge, Katers and Wollaston Islands, the Maret Islands, and the Montalivet Islands be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority

c. that the Osborne Islands, comprising Middle, South-West, Carlia, Kidney, Borda and Steep Head Islands be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority

d. that Low Rocks, in Admiralty Gulf, be declared a Class B Reserve for the Conservation of Flora and Fauna and vested in the W.A. Wildlife Authority

e. that Reserve No. 29541 (Pelican Island, Joseph Bonaparte Gulf) be upgraded to a Class B Reserve.

f. that the EPA bring to the notice of the Aboriginal Lands Trust the conservational value of islands in the Augustus group, at the mouth of the Prince Regent River and in St George Basin. Should they at any time be no longer required as Aboriginal Reserves, they should be set aside as Nature Reserves.

g. that the Environmental Protection Authority commission a biological survey of the Buccaneer Archipelago to enable a firm decision to be reached regarding the creation of specific reserves.

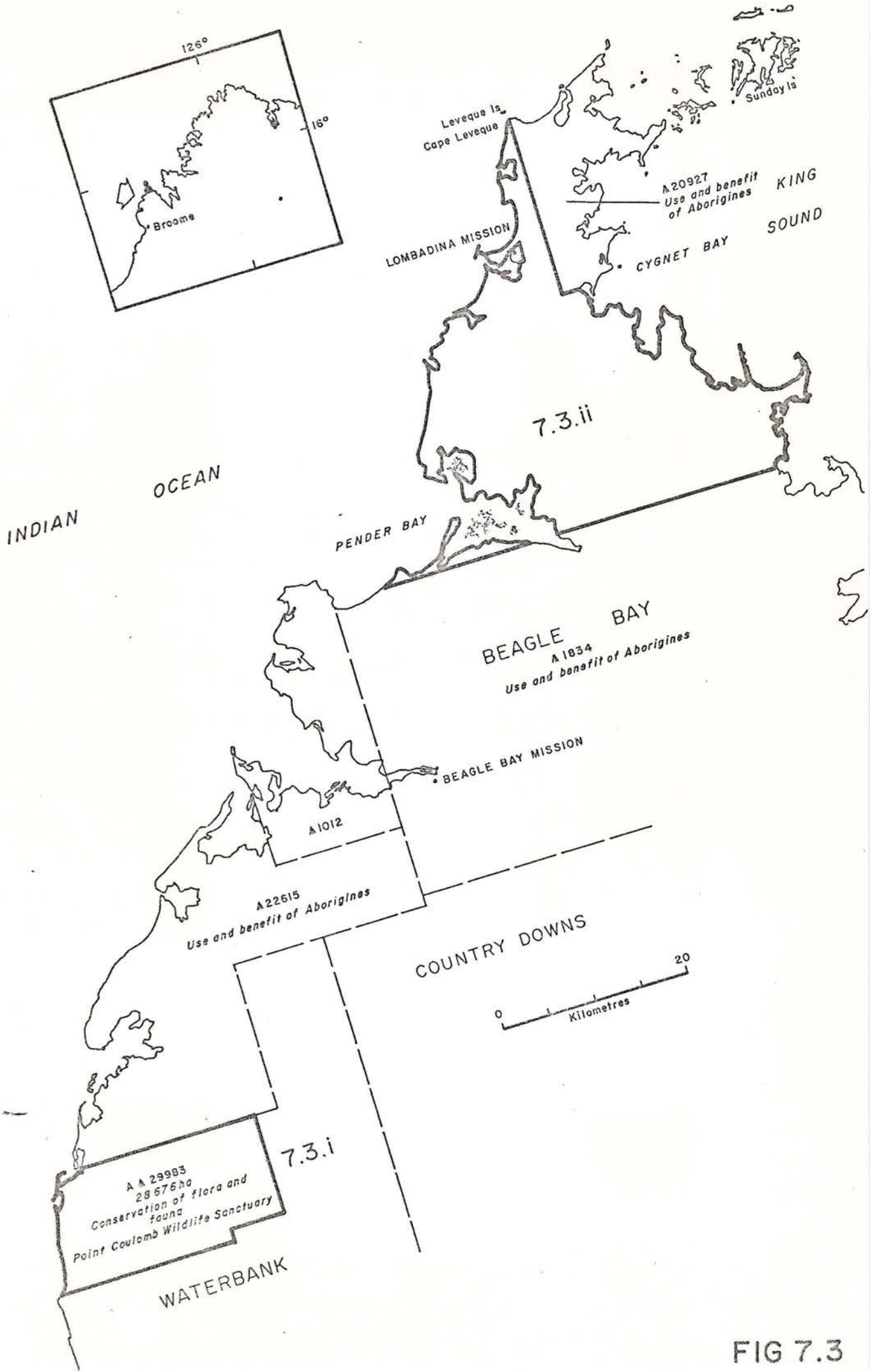
7.3 POINT COULOMB NATURE RESERVE

The Point Coulomb Nature Reserve is Reserve No. A29983 for the Conservation of Flora and Fauna and is vested in the W.A. Wildlife Authority. It has an area of about 28 300 ha and lies about 75 km north of Broome.

The area consists of undulating Quaternary sand plain with many small watercourses and some swamps. The main vegetation is a low open-woodland of Eucalyptus spp., (including bloodwoods and E. miniata) with an understorey of Lysiphyllum cunninghamii, Terminalia sp. and Brachychiton spp. and a ground cover of grasses (Butler, 1971). There is a small area of pindan near the south-east corner where the understorey is dominated by Acacia, especially A. tumida and A. impressa. A coastal strip of dune country is vegetated with typical beach plants (Crotalaria sp., Ipomoea brasiliensis and Spinifex longifolius. A narrow discontinuous strip of closed-forest with Melaleuca leucadendron (Cadjeput), Terminalia sp., Ficus virens and many creepers (e.g. Caesalpinia globulorum) and shrubs (e.g. Celtis sp.) occurs behind the dunes. The epiphytic orchid (Cymbidium canaliculatum also occurs here. Fresh water swamps, found behind the coastal dunes, typically support a low open-woodland of Tristania grandiflora. Two small mangrove blocks occur near Cape Bertholet and include the following species: Avicennia marina, Ceriops tagal, Bruguiera exaristata, Aegiceras corniculatum, Aegialitis annulata, Rhizophora stylosa, Excoecaria agallocha and Osbornia octodonta.

Mammals include the comparatively rare Northern Nail-tailed Wallaby (Onychogalea unguifera) and Dalgyte (Macrotis lagotis) as well as the more common Sandy Wallaby (Macropus agilis). A rich bat fauna has been recorded including Pteropus scapulatus, Taphozous flaviventris, Tadarida jobensis, Nycticeius greyi, Chalinolobus gouldii, C. rogersi, and two species of Nyctophilus. Birds are plentiful and over 100 species have been recorded Some, including the Broad-billed Flycatcher (Myiagra ruficollis), Brown-tailed Flycatcher (Microeca flavigaster tormenti), Black-headed Pardalote (Pardalotus melanocephalus), Red-headed Honeyeater (Myzomela erythrocephala), Rufous-throated honeyeater (Conopophila rufogularis) and Olive-backed Oriole (Oriolus sagittatus) are at the extreme south-western edge of their ranges (Butler, 1973). More than twenty-five species of reptile have been collected including a Lerista (a burrowing skink) known only from the Dampier Peninsula. A rich amphibian fauna is also known from the reserve.

Frequent burning and the presence of wild cattle and donkeys are causing widespread damage throughout the reserve, especially in the areas of deep sandy soils where Dalgyte burrows are located. The Department of Fisheries and Wildlife is endeavouring to have the cattle removed. Feral cats are also common.


126°
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Leveque Is
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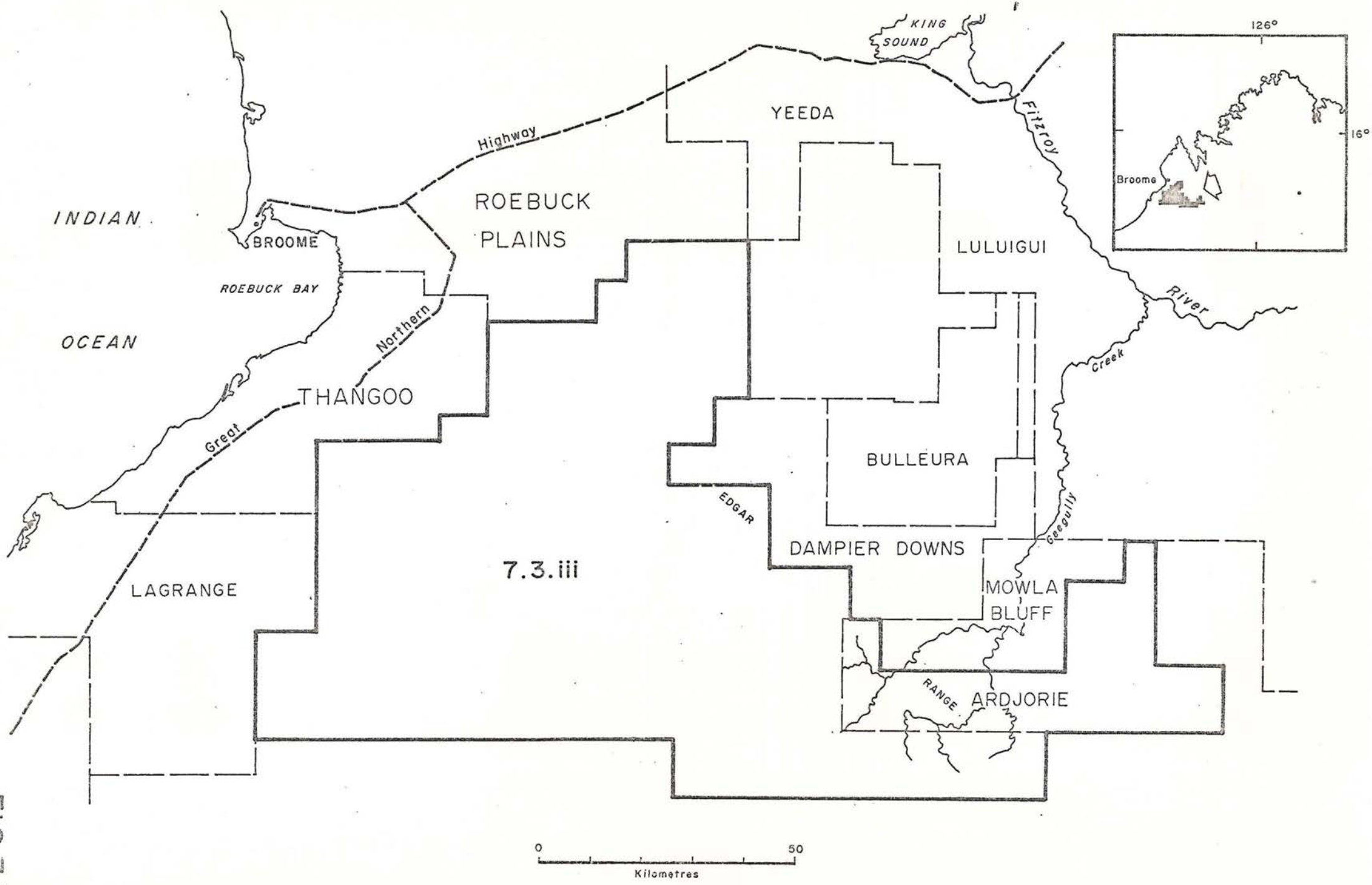
A20927
Use and benefit of Aborigines
KING SOUND
LOMBADINA MISSION
CYGNET BAY
7.3.ii
INDIAN OCEAN
PENDER BAY
BEAGLE BAY
A1834
Use and benefit of Aborigines
BEAGLE BAY MISSION
A1012
A22615
Use and benefit of Aborigines
COUNTRY DOWNS
0
20
Kilometres
7.3.i
AA 29983
28 676 ha
Conservation of flora and fauna
Point Coulomb Wildlife Sanctuary
WATERBANK

FIG 7.3


KING SOUND
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Highway
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126°
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ROEBUCK BAY
ROEBUCK PLAINS
LULUIGUI
River
Creek
Northern
Great
THANGOO
BULLEURA
EDGAR
Geegully
DAMPIER DOWNS
7.3.iii
LAGRANGE
MOWLA BLUFF
RANGE
ARDJORIE
0
50
Kilometres

FIG 7.3

The Point Coulomb Nature Reserve originated as part of a proposed reserve in Dampier Land recommended in the National Parks and Nature Reserve Report, 1962. This recommendation was for an area south and east of the present reserve totalling some 125 000 ha, to preserve an area of pindan and its characteristic fauna. The report also recommended that an area to the north of Point Coulomb, then occupied by Carnot Station, be added to the proposed reserve if it became vacant. This is the area now reserved and the area originally proposed is now part of Waterbank Station.

Pindan is a low woodland or open-scrub with a predominance of Acacia species in its shrub flora (Speck, et al., 1964) (Fig.7.10). It occurs on extensive sand plains and dune fields in the south-west Kimberley. The shrub layer consists especially of Acacia tumida, A. eriopoda, A. sericata and A. holosericea. Other species are Lysiphyllum cunninghamii, Grevillea striata, G. wickhamii, Supplejack (Ventilago viminalis), Konkerberry (Carissa lanceolata) and, in depressions, Melaleuca spp. The ground layer includes a number of grasses, especially Chrysopogon spp., Plectrachne pungens and Aristida browniana. Trees emergent above the shrub layer are sometimes fairly dense. They include Woollybutt (Eucalyptus miniata), Twin-leaf Bloodwood (E. zygophylla), Bloodwood (E. dichromophloia) with Coolabah (E. microtheca) in depressions.

It appears that the existing Point Coulomb Nature Reserve contains only a small area of pindan and correspondingly small populations of both the Nail-tail Wallaby and Dalgyte (Butler, 1971). The Dalgyte is known to occur on parts of Waterbank Station to the east of the reserve but this type of country is highly susceptible to damage by cattle.

The Committee believes that it is important to protect an adequate area of pindan. It also sees a need to protect adequate areas of other features typical of Dampier Land such as coastal sand dunes, mangroves, Melaleuca thickets, and swamps. It sees two possible ways of achieving this :

1. resuming part of Waterbank Station to enlarge the existing reserve, or

2. finding vacant land elsewhere which would serve the purpose.

The Committee favours the latter alternative and believes that resumption of part of a pastoral lease should be recommended only as a last resort.

In 1977 the Department of Fisheries and Wildlife, the W.A. Museum and the W.A. Herbarium undertook a biological survey of a suitable area of land on the Dampier Peninsula. This area of vacant Crown Land had been inspected from the air by the Committee and lies between the Beagle Bay Aboriginal Reserve (No. 1834) and the Aboriginal Reserve to the east and south of Cape Leveque (No. 20927).

FIG. 10. Pindan vegetation. Ground cover of grasses, understory of wattles (Acacia spp.) and emergent gums (Eucalyptus spp.).

The area is similar geologically and floristically to the Point Coulomb Reserve although the dune systems, closed-forests, fresh-water swamps and mangrove blocks are more extensive, more numerous and of better quality. Additional plant species recorded include Sonneratia alba in the mangrove community and the beach (strand) plants Pemphis acidula and Scaevola koenigii. Similarly, Eucalyptus woodland formations of the pindan country in the vacant Crown Land are more prevalent and of greater density and species richness than pindan formations of the Point Coulomb Reserve. In this area the pindan is a low woodland of Eucalyptus dichromophloia, E. miniata, E. zygophylla, E. grandiflora and other trees such as Lysiphyllum cunninghamii, Erythrophleum chlorostachys, Owenia reticulata and Grevillea spp. with a prominent tall shrub layer, often dense, characterised by Acacia holosericea, A.sericata and other Acacia spp., Atalaya hemiglauca, Dolichandrone heterophylla and Persoonia falcata.

The fauna includes all the species known from the Point Coulomb Reserve with a number of notable additions such as the most southern records of the Northern Blossum Bat (Macroglossus lagochilus) and the Rose-crowned Fruit Pigeon (Ptilinopus regina). Both these species are normally found associated with Melaleuca forests, vine thickets and mangrove communities in Western Australia. Although Melaleuca forests and mangrove communities are well represented in this area of vacant Crown land, often occurring adjacent to one another, they are not adequately represented in the Point Coulomb Reserve. The Little Bronze Cuckoo (Chrysococcyx minutillus minutillus), more common in this area than elsewhere in the Kimberley, is also normally associated with these formations.

In summary, this area appears, from a biological viewpoint, to be an ideal reserve to represent the Dampier Peninsula region. Certain parts appear essential for this purpose.

Lombadina Mission is located on the north-west portion of this land and cattle from the settlement graze throughout the area.

Another area of vacant Crown land, situated in the south-east portion of Dampier Land on the edge of the Great Sandy Desert includes a large area of pindan country. It lies between Roebuck Plains and Thangoo Stations on the north and west and Dampier Downs Station and includes the former Ardjorie Station on the east. In August 1976 the Department of Fisheries and Wildlife coordinated a biological survey of the area, in conjunction with the W.A. Museum and the W.A. Herbarium.

The area includes parts of the Edgar Ranges, an interesting topographic feature drained by Geegully Creek, a tributary of the Fitzroy River. The ranges are a series of breakaways, mesas and buttes formed by the southward retreat of a Jurassic plateau. The cap rock is a resistant sandstone which affords some protection to the softer siltstones beneath. Quaternary sands cover both

the plateau and the erosion plain. The difference in height between the two plains is about 150 m (Speck et al., 1964). The Edgar Ranges are of great historical interest to naturalists since they were the site of early collections made by J.P. Rogers in the early 1900s and the Swedish Mojberg Expedition in 1910-13. (Soderburg, 1918). The ranges contain gorges, caves and permanent water and support a variety of vegetation and animals.

The Edgar Ranges and adjacent vacant Crown Land are vegetationally distinct from the areas, previously discussed, on the Dampier Peninsula. The red sandplains of this area support a pindan consisting predominantly of a high open-shrubland to a closed-scrub of Acacia spp. (including Acacia retivenia, A. hilliana, A. ancistrocarpa, A. stipuligera, A. holosericea and A. monticola), Grevillea refracta and G. wickhami over grasses and spinifex. Occasional emergent bloodwoods such as Eucalyptus zygophylla occur. Patches of Eucalyptus odontocarpa (Sturt's Creek Mallee) and Jacksonia sp. form open scrubs in places near the scarp of the ranges.

Extensive dune fields are a feature of the area especially in its southern and south-western portions. These support spinifex hummock grassland formations characteristic of the Great Sandy Desert. Shrubs of the dunes include Cyanostegia cyanocalyx, Cassia sp., Stylobasium sp., Calytrix sp., Acacia drepanocarpa and A. eriopoda.

Gravel surfaces and scree slopes of the ranges support an open-hummock grassland of spinifex with emergent Eucaluptus brevifolia, E. papuana, Acacia monticola, A. hilliana and Solanum beaugleholei. Fringing woodlands of Eucalyptus camald-ulensis, E. confertiflora and E. setosa over Acacia spp. and spinifex line watercourses and narrow valleys running into the scarp. A new variety of screw-pine (Pandanus) is being described from material collected at Logues Spring in the Edgar Ranges (Stone, in press).

Compared with the Dampier Peninsula, the Torresian fauna of this area is depauperate; arid zone species are an important component. Among the 16 native mammal species known from the area, 12 are also known from the Dampier Peninsula. A Rock Wallaby (Petrogale sp.) and the Rabbit-eared Bandicoot (Macrotis lagotis) are particularly notable; Pseudomys hermannsburgensis (the Sandy Inland Mouse) is an arid zone species. During the 1976 survey, 105 bird species were recorded. The Desert Warbler (Gerygone mungi), the Spinifex Bird (Eremiornis carteri), the Black Honeyeater (Certhionyx niger) and the White-fronted Honeyeater (Phylidonyris albifrons) are desert species not known on the Dampier Peninsula. A race of the Plumed Pigeon (Geophaps plumifera mingi) is endemic to the Edgar Ranges. The bird fauna also includes an isolated Kimberley population of the Major Mitchell Cockatoo (Cacatua leadbeateri). More than 30 species of reptiles and amphibia are known and include a similar mixture of Torresian and arid zone elements.

The headwaters of Geegully Creek and the Edgar Ranges mostly lie within Ardjorie, Mowla Bluff and Dampier Downs Stations. In August, 1976 Ardjorie Station was forfeited to the Crown and is now vacant Crown land. This station includes a substantial portion of the Edgar Range.

Recommendations

The Committee endorses the status, purpose and vesting of the Pt Coulomb Nature Reserve. It recommends that after compilation of the data collected during the biological surveys coordinated by the Department of Fisheries and Wildlife in conjunction with the W.A. Museum, the W.A. Herbarium and C.S.I.R.O. Division of Entomology on :

(i) the Pt Coulomb Nature Reserve (April, 1977),

(ii) the vacant Crown land between Aboriginal Reserve Nos. 1834 and 20927 (April 1977) and,

(iii) the vacant Crown land between Roebuck Plains and Thangoo Stations on the north and west and Dampier Downs and Ardjorie Stations on the east (August 1976).

the EPA decide whether the Pt Coulomb Reserve should be extended or whether the other two areas should be reserved. If the vacant Crown land in south-east Dampier Land is reserved, then the area formerly occupied by Ardjorie Station should be included within the proposed reserve, subject to agreement by the Pastoral Appraisement Board.

7.4 WALCOTT INLET

Walcott Inlet is the broad drowned valley of an earlier river which closely followed the contact between the Carson Volcanics, to the north and King Leopold Sandstone to the south. This bisection gives rise to contrasting landforms on either bank of the Inlet: rolling lowlands with gentle slopes and isolated hills and ridges on the Volcanics; rugged hills and ranges, deeply dissected by fault and joint valleys and consequently edged by steep slopes on the King Leopold Sandstone. Near the mouth of Walcott Inlet, the Warton and Pentecost Sandstones overlie the Carson Volcanics and produce a similar topography to that of King Leopold Sandstone.

As its name implies, the King Leopold Sandstone occurs in the north-western portion of the King Leopold Ranges which continue south-easterly out of this area. It also forms the Artesian Range, east of the head of Walcott Inlet, another rugged hill area bordering the Prince Regent Plateau further inland. Dark grey Hart Dolerite intrudes all these rock types and produces a characteristic black bank on many hillsides where scree slopes have been produced by weathering. The sandstones in particular yield an angular, blocky scree when weathered, which provides excellent shelter for many small animals. The Isdell River, which flows south-westwards in its headwaters, is deflected by the King Leopold Ranges to flow north-westerly into Walcott Inlet. Where the river flows through sandstone ridges, particularly in the southern Artesian Range, spectacular gorges have been formed.

Extensive tidal alluvial flats support dense stands of mangroves and at least six species are present. As mentioned in the Introduction to the System, this habitat is an important one biologically, especially for birds.

Rock slopes rise, often steeply, from the mangroves and rocky shores terminating in a plateau which in places is bordered by cliffs. These are spectacular along the promontory leading to Raft Point. A low woodland or open-woodland covers the slopes and plateau, interspersed in places with tall shrubland and hummock grassland. Rocky sandstone outcrops are frequent. On several slopes the vegetation in sheltered areas becomes more dense and heterogeneous, almost equivalent to semi-deciduous vine thicket.

Typical trees include Woollybutt (Eucalyptus miniata), Grey Box (E. tectifica), Bloodwoods (E. polycarpa, E. dichromophloia), Terminalia, spp., Whitewood (Atalaya hemiglauca), Bauhinia (Lysiphyllum cunninghamii), Quinine Tree (Petalostigma pubescens), Buchanania sp., Gardenia spp., Owenia vernicosa, etc. Shrubs include Acacia spp., Grevillea spp., Ficus spp., Cochlospermum fraseri, Dolichandrone, etc. Plectrachne pungens. Spear Grasses (Aristida spp.), Sorghum sp., Chrysopogon fallax and Kangaroo Grass (Themeda australis) are common grasses.

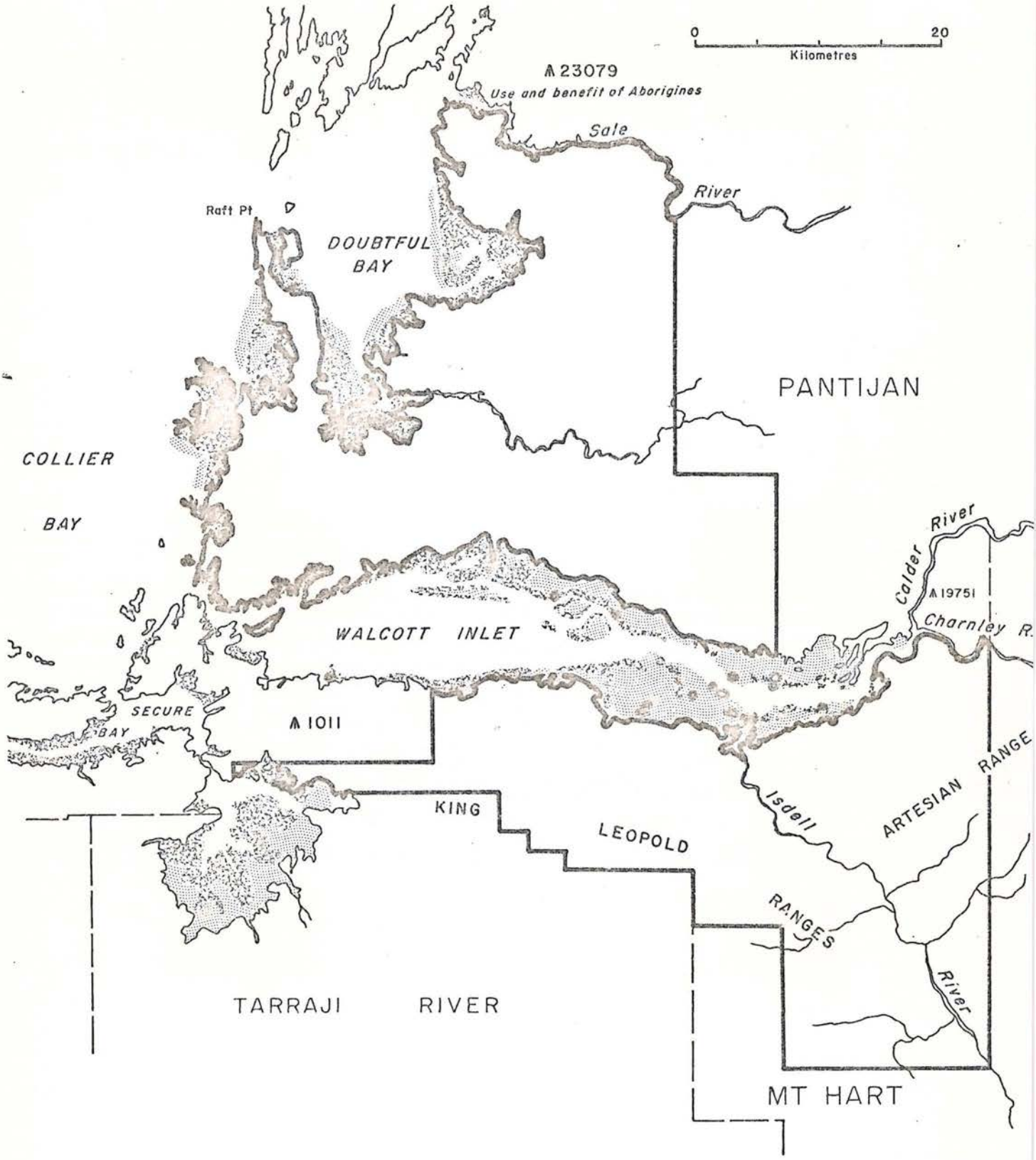

0
20
Kilometres
A 23079
Use and benefit of Aborigines
Sale
River
Raft Pt
DOUBTFUL
BAY
PANTIJAN
COLLIER
BAY
Calder River
A 19751
Charnley R.
WALCOTT INLET
SECURE
BAY
A 1011
ARTESIAN RANGE
Isdell
KING
LEOPOLD
RANGES
River
TARRAJI
RIVER
MT HART
126°
16°
Derby

FIG 7.4

Walcott Inlet extends for about 30 km in an east-west direction from Collier Bay and is up to 11 km wide. Watered by the Charnley, Calder and Isdell Rivers, its rugged grandeur is impressive. Tides of great range (a mean effective tide of 11 metres) characterise the Inlet. At present, the entire Inlet is surrounded by vacant Crown Land except at its eastern end where Pantijan Station is leased by the Federal Government on behalf of the aborigines of the Mowanjum community. The area is inaccessible by vehicle, the road to the south terminating at Mt Hart Station, 60 km away.

Several proposals have been made for the establishment of a tidal power station at the mouth of the Inlet. Although the Committee's terms of reference do not include comment on the viability of these proposals, it believes that any recommendations for a National Park or Conservation reserve in the area should not prejudice future decisions concerning a tidal power station.

Recommendations

The Committee recommends :

a. that all vacant Crown Land surrounding the Inlet (Fig.7.4) be declared a Class C Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.

b. that once the reserve is gazetted, the National Parks Authority explore with the lessees of Pantijan Station the possibility of joint participation in management of the Park.

7.5 THE PRINCE REGENT RIVER NATURE RESERVE

The Prince Regent River Nature Reserve is Class C Reserve No 27164 for Conservation of Flora and Fauna. It covers 633 333 ha and is vested in the W.A. Wildlife Authority. The reserve contains an excellent representation of the flora and fauna of the wettest part of the State. While much of the area has a relatively monotonous, low relief of sandstone and volcanic hills, there are spectacular features such as King Cascade, Pitta Gorge, Mt Trafalgar, Python Cliffs and the Prince Regent River itself, which runs straight for most of its length, often between vertical cliffs.

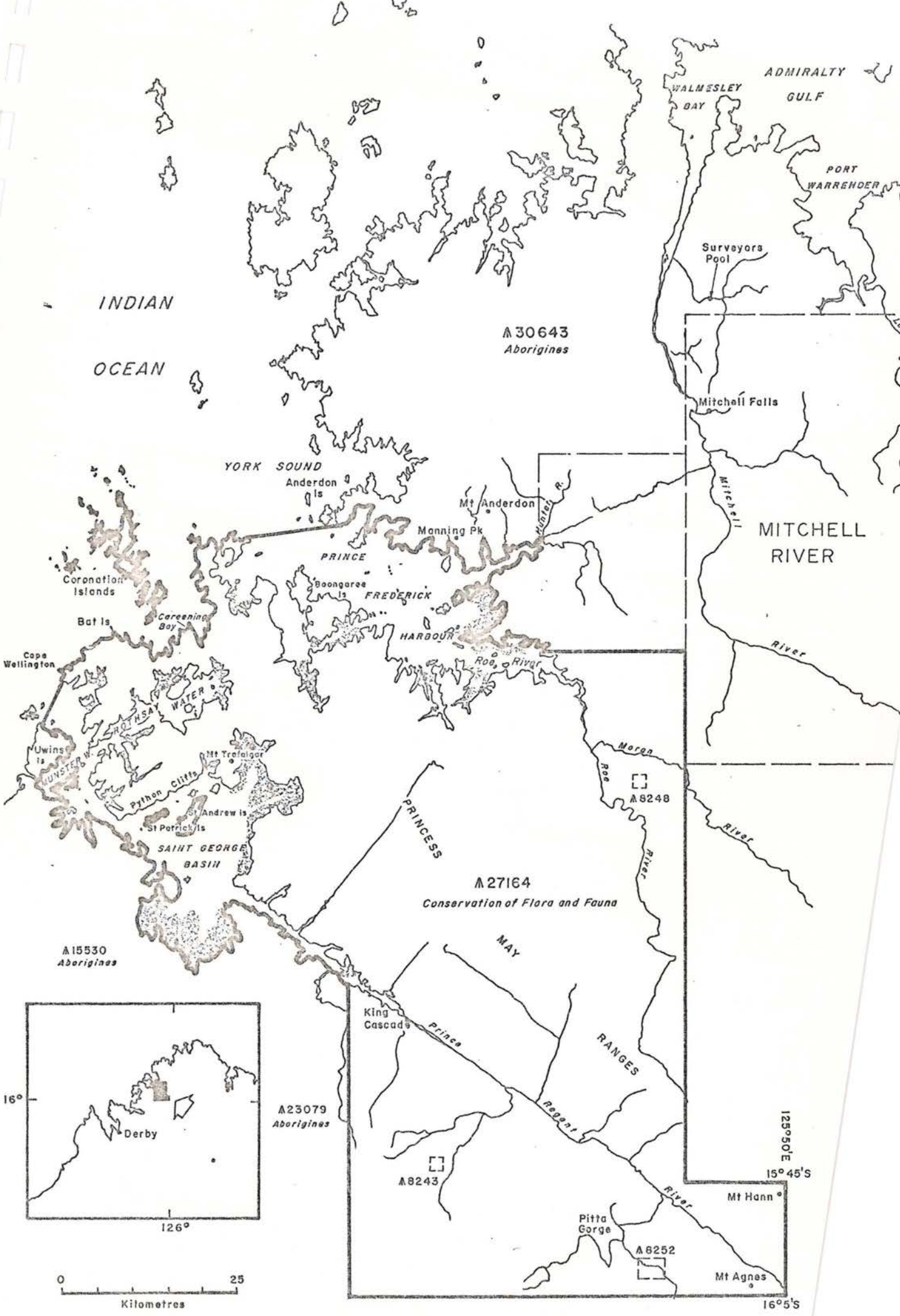
The Reserve lies largely within the Prince Regent Plateau, a sub-province of the Kimberley Plateau Province (Williams and Sofoulis, 1971). The Plateau consists of Carpentarian King Leopold Sandstone, while to the west of St George Basin (the estuary of the Prince Regent River) (Fig.7.11) is Warton Sandstone overlying Carson Volcanics. The Basin itself contains extensive tidal flats of Quaternary alluvium. Quaternary alluvial deposits also occur on erosional plains on the plateau. North-east of the Roe River is a hilly region of Carson Volcanics capped in places with Tertiary laterite.

The vegetation consists mainly of closed-forest, open-forest, woodland,open-woodland, tall shrubland and closed-grassland (George and Kenneally, 1975). Eucalyptus species are generally the dominant trees, often with an admixture of species of Celtis, Canarium, Buchanania, Owenia, Ficus, Erythrophloeum, Gardenia, Planchonia and others. In fringing formations along watercourses, species of Melaleuca, Pandanus and Eucalyptus are common. Grasses are dominant in the ground flora and in some swamps form the principal cover when trees and shrubs are absent. Several small but important pockets of semi-deciduous vine thicket occur on screes around St George Basin and Mt Trafalgar. Mangroves cover extensive areas on tidal flats, especially in St George Basin (Fig.7.12) and Rothsay Water. Over 500 species of plants have been recorded from the reserve, including both common and rare species. Fan Palms (Livistona sp.) are uncommon but several large populations of Cycas basaltica occur on hills behind Careening Bay. Streams and swamps are rich in aquatic and swamp plants.

Thirty-three species of native mammals are known from the reserve (McKenzie, et al., 1975). This is nearly two-thirds of the total number of species recorded for the Kimberley and is particularly high for a single reserve. Macropods, bandicoots and rodents are well represented and there is a diverse assemblage of bats. The mammals include three species of rock-wallaby (Petrogale brachyotis, P.(?) pencillata and Peradorcas concinna) and the Scaly-tailed Possum (Wyulda squamicaudata).

FIG. 11. Rugged, King Leopold Sandstone country near Fern Gully, Prince Regent River Nature Reserve. Trees are mostly Darwin Woollybutt (Eucalyptus miniata).

FIG. 12. Mangroves in the north-western arm of the St. George Basin, Prince Regent River Nature Reserve


INDIAN
OCEAN
A30643
Aborigines
WALMESLEY
BAY
ADMIRALTY
GULF
PORT
WARREHOER
Surveyors
Pool
Mitchell Falls
YORK SOUND
Anderdon
Is
Mt Anderdon
Manning Pk
Hunter R.
Mitchell
MITCHELL
RIVER
PRINCE
FREDERICK
HARBOUR
Boongaree
Is
Coronation
Islands
Bat Is
Careening
Bay
Cape
Wellington
Roe
River
River
Uwins
Is
Mt Trafalgar
Python Cliffs
St Andrew Is
St Patrick Is
SAINT GEORGE
BASIN
Moran
Roe
River
A8248
PRINCESS
River
A27164
Conservation of Flora and Fauna
MAY
A15530
Aborigines
King
Cascade
Prince
RANGES
Regent
River
A8243
125°50'E
15°45'S
Mt Hann
Pitta
Gorge
A6252
Mt Agnes
16°5'S
16°
Derby
126°
A23079
Aborigines
0
25
Kilometres

More than 130 species of birds, one-third of the total recorded from the Kimberley have been recorded here. Most represent the sub-humid avifauna of north-western Kimberley which is also typical of the "Top End" of the Northern Territory (e.g. Scrub Fowl (Megapodius freycinet tumulus) and Torres Strait Pigeon (Ducula spilorrhoa spilorrhoa)) (Storr, et al., 1975). Several dry country birds are known from the inland sandstone plateau (e.g. the Diamond Dove (Geopelia cuneata)). The Black Grass-Wren (Amytornis housei) occurs in various areas of the reserve, and the only record of the King Quail (Coturnix chinensis lineata) from Western Australia is from a single locality in the Prince Regent River Nature Reserve.

The frogs (13 species) and reptiles (54 species) are also typical of the north-west Kimberley and northern Territory (Storr and Smith 1975). Torresian genera are well-represented, but Eremaean are not. Some taxonomic divergence from populations in the Northern Territory appears and Diporiphora bilineata margaretae and Carlia johnstonei johnstonei, for example, are both represented by other sub-species in the Northern Territory. The spectacular green lizard Diporiphora superba occurs in the reserve and is restricted to the north-west Kimberley.

Recent work on the Salt-water Crocodile (Crocodylus porosus) in the north-west Kimberley has shown that the Prince Regent River Nature Reserve has an important role to play in the survival of this species (Messel et al. 1977). Of the rivers surveyed the best populations were found in the Roe River and the Prince Regent River and St George Basin. These areas offered a much better chance for a build up in numbers of Crocodiles than did the Admiralty Gulf area.

C. porosus inhabits both fresh and salt water but is concentrated in the tidal portions of large rivers where mangroves are plentiful. It also occurs in bays and occasionally in the ocean. Most of the time crocodiles are sighted in shallow water. As it exists at present the Prince Regent River Nature Reserve does not protect all the habitat of Salt-water Crocodiles. Such protection could be afforded by declaring aquatic reserves in Prince Frederick Harbour and St George Basin. This would also protect the habitat of other marine organisms occurring adjacent to the existing terrestrial Nature Reserve.

Fourteen species of fish have been recorded in fresh streams and a further twenty-one species in the brackish inlet below King Cascade (Allen, 1975). Most are wide-spread in tropical Australia, some extending to other countries. Two unnamed teraponids are known only from the Reserve, one representing a new genus.

Molluscs are represented by 26 species of land snail, a freshwater snail and 2 species of freshwater mussels (Wilson and Smith, 1975). The snails are predominantly camaenids but two punctid arboreal species have been recorded (Amimopina sp. and Pleuropoma walkeri).

There is a large insect fauna typical of the region but also containing little-known and undescribed species, e.g. of Anax (Odonata) and Simulium (Diptera).

In 1962, the National Parks and Nature Reserves Report recommended that the Prince Regent River Nature Reserve should be "vested in a Statutory Body responsible for the control of other National Parks". Since the creation of the Reserve there has been discussion as to whether it should be transferred to the control of the National Parks Authority. In spite of some areas of outstanding scenery in the Reserve, the Committee considers that it should remain vested in the W.A. Wildlife Authority for the following reasons :

1. the Conservation of its flora and fauna can be best achieved by retaining it as a wilderness area;

2. the area is remote, access is difficult, and the rugged terrain would deter ordinary tourists.

3. tourist requirements in the forseeable future should be adequately served by aerial tours over scenic features ;

4. alternative more accessible areas to cater for tourist needs in the Kimberley have already been designated as National Parks or are recommended as such in this Report.

The Committee considers that, although the Reserve is already large and representative of the region, it should be expanded to include several adjacent features. To the east Mt Hann and Mt Agnes, two isolated mountains reaching over 820 m and 740 m in height respectively, lie in vacant Crown land. Between them, on an upper tributary of the Prince Regent River, is a deep gorge. The addition of this area would have these advantages ;

1. it would protect the complete catchment of the Prince Regent River and greatly reduce the risk of pollution should adjacent areas be utilised. This is important in view of the extensive system of streams and rivers forming the river basin, and the dependence of so many plants and animals on them;

2. it would add an area of unique scenery to the reserve.

Several islands which supplement the Reserve biologically lie off the coast and in the St George Basin. St Andrew and St Patrick Islands in St George Basin, and Uwins and Greville Islands at the entrance to the Basin, are Aboriginal Reserves. However Bat, Boongaree and the Coronation Islands are vacant Crown land. They are described in Section 7.2.

Within the Nature Reserves are three other reserves (Numbers 8243, 8248 and 8252 of 405, 405 and 1215 ha respectively) which were declared prior to the creation of the Prince Regent River Nature Reserve. All are Class C their purpose being Water-Travellers and Stock. There seems to be no reason why they should not be included in the Reserve.

Recommendations

The Committee endorses the purpose and vesting of Reserve No. 27164. It recommends :

a. that the reserve be upgraded to a Class B Reserve.

b. That Aquatic Reserves be declared to include :

   (a) Prince Frederick Harbour seaward to Cape Torrens and the unnamed cape south of the Anderdon Islands, and

   (b) St George Basin seaward to Uwins Island and Cape Wellington, including Rothsay and Munster Waters.

c. That the area around Mt. Hann and Mt Agnes as designated in Fig.7.5 be added to the reserve.

d. That Coronation, Bat and Boongaree Islands be added to the reserve.

e. That Reserves Nos. 8243, 8248 and 8252 be cancelled and their area added to Reserve No. 27164.

f. That the W.A. Wildlife Authority, in consultation with the National Parks Authority, prepare a management plan for the reserve, taking into account increasing public interest in the area.

7.6 HUNTER RIVER AREA

To the north of the Prince Regent River Nature Reserve near the mouth of the Hunter River is the most spectacular scenery of the Western Australian, if not the Australian, coastline.

Along the northern side of Prince Frederick Harbour and on either side of the Hunter River are sheer, orange to red cliffs of Warton Sandstone, sometimes underlain by Carson Volcanic basalts. An unnamed tributary of the Hunter, which enters it from the north near its mouth, is especially scenic (Fig.7.13). Near this tributary is Mt Anderdon (484m), which is only 2 km from tidal waters. Here the cliffs descend in great plunging steps towards the sea. On the other side of the creek is Manning Peak of 326 m which is only a kilometre from Prince Frederick Harbour. At the mouth of the Hunter are two enormous pinnacles of sandstone with overhanging cliffs.

Below the cliffs are areas of semi-deciduous vine forest and semi-deciduous vine thicket. One strip which occurs either side of the north bank of the entrance to the Hunter is probably the largest and best developed vine forest in Western Australia. This forest occurs in an almost unbroken line below cliffs for several kilometres. The botanical explorer Allan Cunningham, who visited this area with Philip King in the "Mermaid" in 1820 collected here and one species of tree, Tristania umbrosa, has not been collected since.

A number of birds which are rare in Western Australia and which are restricted to vine forests and vine thickets are comparatively plentiful here. They include the Scrub Fowl (Megapodius freycinet), Red-crowned Pigeon (Ptilinopus regina), and Green-winged Pigeon (Chalcophaps indica). Other vine thicket species recorded here include the Spangled Drongo (Dicrurus bracteatus), Yellow Oriole (Oriolus flavocinctus), Torres Strait Pigeon (Myristicivora spilorrhoa) and the Little Shrike-Thrush (Collurincinla parvula).

The Salt-Water Crocodile (Crocodylus porosus) is found in the tidal portions of the Hunter and its tributaries.

The western side of Prince Frederick Harbour and the upper part of the Hunter River are at present vacant Crown land. The northern side of the Harbour, including the most scenic areas are included in Reserve No. 30643 for the use and benefit of Aborigines. It is vested in the Aboriginal Lands Trust and has an area of 202 343 ha. At present the reserve is not used by Aboriginal people.

Recommendation

The Committee recommends that the area shown Fig.7.6 be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A. Negotiations should be undertaken with the Aboriginal Lands Trust to include the southern portion of Reserve No. 30643 within the proposed reserve.

FIG. 13. Sandstone cliffs with vine forest and mangroves adjacent to an unnamed tributary of the Hunter River.

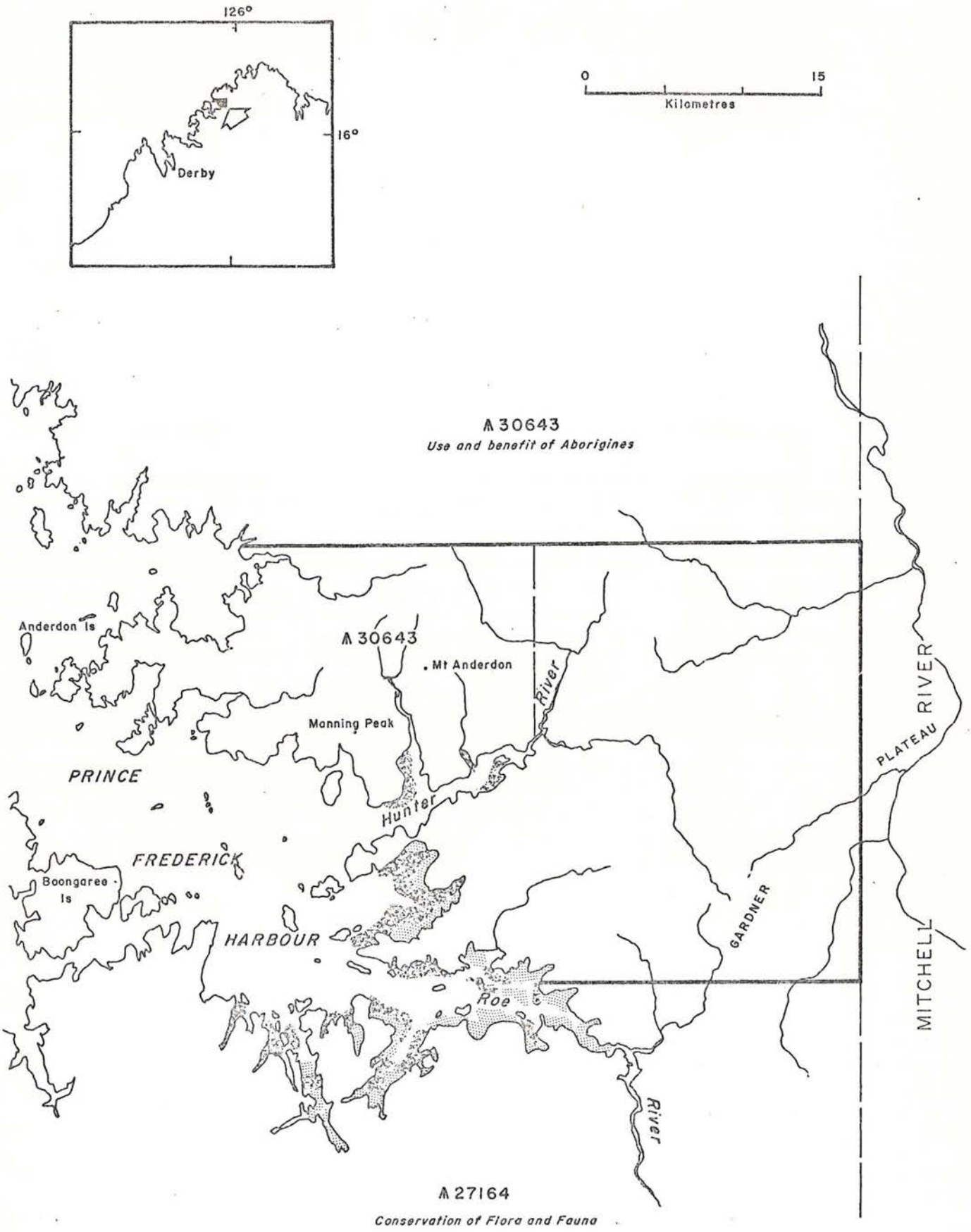

126°
16°
Derby
0
15
Kilometres
A 30643
Use and benefit of Aborigines
Anderdon Is
A 30643
Mt Anderdon
Manning Peak
River
PLATEAU RIVER
PRINCE
Hunter
FREDERICK
Boongaree Is
HARBOUR
GARDNER
Roe
River
MITCHELL
A 27164
Conservation of Flora and Fauna

FIG 7.6

7.7 MITCHELL RIVER AREA

The Mitchell River flows northwards, draining part of the Kimberley Plateau into Admiralty Gulf via Walmsley Bay. It is actively eroding its bed through King Leopold Sandstone, giving rise to gorges and water falls, especially along the margins of the basaltic Mitchell Plateau. Two of the most noteworthy features of this erosion are Mitchell Falls (Fig. 7.14) (14°49'S, 125°42'E) and Surveyors Pool and Falls (Fig.7.15) (14°40'S, 125°43'E), each with a deep gorge downstream.

Near the river courses the sandstone has weathered into a harsh blocky topography with sparse soil in joint cracks and narrow gullies. This in turn has restricted the height and distribution of vegetation, increasing the scenic impact of bare rock gorges.

The Mitchell Plateau is a dissected undulating upland underlain by dark basalt of Proterozoic Carson Volcanics. Leaching has produced a bauxitic laterite profile over large areas of the basalt, although only a few eroded remnants now remain. Much of this bauxitic laterite contains sufficient aluminium to make it a potentially valuable commercial source of that metal.

East of the Plateau two small rivers and the larger Lawley River complete the drainage pattern of the area. These rivers flow into the bay towards Port Warrender through broad mangrove swamps.

The Mining company's main track from the barge landing at Port Warrender follows relatively level ground along the watershed of the Mitchell Plateau, through Mitchell River Station, to join the Kalumburu-Gibb River-Derby road to the east. A few rough tracks made during mineral exploration are the only routes from the Plateau to the hilly sandstone lowlands to the west. The edge of the basaltic plateau is typically precipitous with steep talus slopes beneath vertical cliff faces. These slopes, especially where shaded from westerly sunshine, are heavily vegetated with vine thickets.

The main scenic attraction of the area is the Mitchell River and its tributaries, deeply incised into sub-horizontal sandstone, with waterfalls and permanent pools. The sharp edge of the basaltic Mitchell Plateau forms an impressive backdrop to the east.

In the north-eastern area the area's importance is mainly biological because of the vine thickets and mangroves. Both this and the Mitchell River areas are so far from the bauxite occurrences that no conflict of interests is likely to arise. Port Warrender, the planned port for any mining operations, the probable railway, road and mining plant sites are outside the proposed reserves.

FIG. 14. Mitchell Falls, Mitchell River, in June.

FIG. 15. Surveyor Falls, Mitchell Plateau, in June. Tree is a Cadjeput (Melaleuca leucadendron)

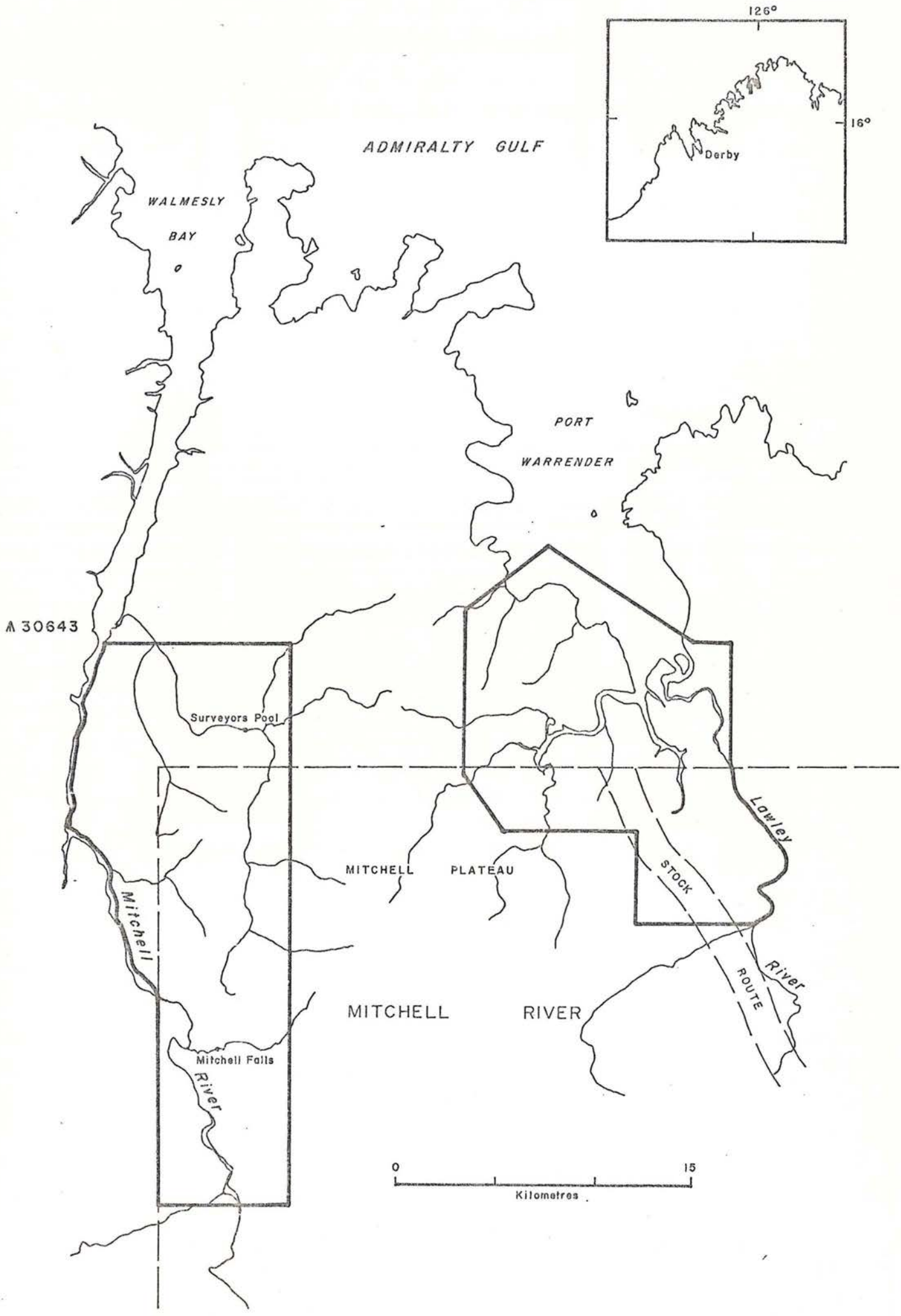

126°
16°
Derby
ADMIRALTY GULF
WALMESLY
BAY
PORT
WARRENDER
A 30643
Surveyors Pool
MITCHELL PLATEAU
Mitchell
River
MITCHELL RIVER
Mitchell Falls
Lawley
STOCK
ROUTE
River
0
15
Kilometres

FIG 7.7

The plateau itself is covered with an open-forest dominated by Eucalyptus tetrodonta, E. miniata and E. nesophila, with some Erythrophleum chlorostachys and Terminalia circumalata. The fan-palm Livistona eastoni is very common in the understorey, and this is the only locality in the State where palms are such a dominant feature (Fig.7.16). Shrubs in the understorey include Cochlospermum, Grevillea spp., Persoonia, Gossypium (Fig 7.17) and Petalostigma, and there is a ground layer of grasses such as Sorghum plumosum, Heteropogon contortus and Chrysopogon latifolius (Beard, 1976).

Patches of vine-thicket (a type of rain forest) occur on rocky basalt slopes around the edge of the plateau. Trees of many genera occur here, including Albizia, Atalaya, Canarium, Micromelum, Vitex, Wrightia and Zizyphus. There are lianes such as Flagellaria, Operculina and Pisonia. The floristic relationships of the formation are Indo-Melanesian rather than Australian.

Similar patches occur at lower levels below the plateau but are somewhat different floristically, containing genera such as Bauhinia, Terminalia, Cassine, Diospyros and Turrala.

Rainforest is of restricted occurrence in Western Australia and the areas at Mitchell Plateau are among the best available for reservation.

Below the plateau, on sandstone, the vegetation changes markedly. It is mostly a woodland or low woodland, with fringing formations along the perennial watercourses. Common trees in the woodland are Eucalyptus, Terminalia, Gardenia, Planchonia, Grevillea, Hakea, Petalostigma and Acacia. Very tall annual grasses are dense in places. Along and near the watercourses Melaleuca viridiflora, Gardenia species, Xanthostemon paradoxus, Ficus, Eugenia and many small herbs such as Stylidium, Utricularia, Eriocaulon are found. On wet cliffs, as at Surveyors Falls, there are ferns, including Nephrolepis and Ceratopteris, and the lycopod Selaginella. At Mitchell Falls is the only known population in the State of Torrenticola queenslandica, an unusual aquatic plant which grows in fast-flowing water.

Following recent surveys, mainly by the W.A. Museum, the fauna of the area is comparatively well known. Within a 20 km radius of Surveyors Pool, 92 non-passerine and 69 passerine species of birds have been recorded (Smith and Johnstone, unpublished). The vine forest is an important habitat for such species as the Rainbow Pitta (Pitta iris), Torres Strait Pigeon (Myristicivora spilorrhoa) Yellow Figbird (Sphecotheres flaviventris) Cicada Bird (Coracina tenvirostris) and Koel (Eudynamys scolopacea). In the mangroves around Port Warrender, 10 species of mangrove birds have been recorded, and 20 species of waders and terns were noted around mangroves and on mudflats. The rugged sandstone areas are

FIG. 16. Open-woodland on laterite, Mitchell Plateau, with fan-palms (Livistona eastonii).

FIG. 17. Gossypium pilosum, a prostrate native cotton common on the Mitchell Plateau.

inhabited by such species as the Black Grass Wren (Amytornis housei), White-quilled Rock Pigeon (Petrophassa albipennis) and Lavender-flanked Wren (Malurus dulcis). The plateau itself is a less important bird habitat, except for the Northern Rosella (Platycercus venustus) which is more common here than anywhere else on the Kimberley mainland.

The reptile and frog fauna is similar to that of the Prince Regent River Nature Reserve, except for the occurrence at Mitchell Plateau of the tree frog Litoria microbelos and the dragon lizard Diporiphora convergens.

Although bauxite occurs extensively on the plateau and adjacent isolated hills, variations in quality of the ore, difficulties of access and the small size of some deposits will ensure that some areas will remain unmined, so that tracts of the unusual palm forest growing on the laterite will be preserved. These tracts, and the fragile vine thickets below the plateau edges, will need to be protected from the possibility of erosional agents arising in adjacent mining areas. The mining company is already considering rehabilitation processes for worked-out areas, including experimentation with regrowth of tree species, and should be encouraged and assisted where necessary.

As access will almost certainly have to be through Mitchell River Station and the probable future mining lease, it is essential that frequent liaison be maintained between the reserve authority and the mining company. It is recognised that some measure of control of tourists' activities may be necessary during certain phases of a mining operation.

Recommendations

The Committee recommends that :

a. the leaseholders of Mitchell River Station (who are also the company intending to mine the bauxite) be approached by the EPA with the request that they relinquish the portions of their pastoral lease and mineral tenement as indicated in Fig.7.7.

b. the land mentioned in a. and the vacant Crown land also indicated in Fig.7.7 be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.

7.8 CAPE LONDONDERRY AREA

Cape Londonderry is the northernmost point of the Western Australian mainland. It lies at the apex of a broad peninsula whose coast is indented with deep bays. The estuary of the Drysdale River lies at the south-west corner of the area, and a number of small rivers flowing only in the wet season, rise on the plateau which forms the core of the peninsula.

The coastline is extremely varied and colourful (Fig. 7.18). Lateritic and sandstone cliffs up to approximately 50 m high are interspersed with low rocky shores, sandy tracts and alluvial tidal flats. Two small rivers enter the sea over 50 m cliffs in an inlet on the east coast, and must be an impressive sight in the wet season.

The plateau consists of a core of Carpentarian Carson Volcanics flanked on the east by Warton Sandstone and on the west by King Leopold Sandstone and Tertiary laterite. Extensive sandy soils cover the north-west of the area, and deposits of Quaternary sand and silt occur in small pockets along the coast.

The vegetation of the plateau is mostly low open-forest and low woodland with areas of tall shrubland. Eucalypts are the predominant trees, especially Messmate (E. tetrodonta), E. latifolia, Woollybutt (E. miniata) and several bloodwoods. Other trees include species of Terminalia, Buchanania, Melaleuca, Grevillea, Persoonia, Brachychiton, Owenia, Xanthostemon and Pandanus. Fan Palms (Livistona sp.) occur in the south-west of the area. Lateritic and some sandstone soils, especially in tall shrubland, support a mixture of shrubs such as Grevillea cunninghamii, Acacia(?)retinervis, Cassia oligoclada and Ficus species while after fires short-lived perennials appear, e.g. Scaevola ovalifolia, Trachymene hemicarpa, Stemodia caerulea, Denisonia ternifolia and Triumfetta sp.

Rocky areas, especially near the east coast, support vine thickets which contain a wide range of species such as Pouteria sericea, Gyrocarpus americanus, Ficus virens, Bridelia tomentosa, Celtis philippensis, Cassine melanocarpa and lianes including Flagellaria indica, Capparis sp., and Malaisia scandens.

Mangroves occur as both narrow and broad stands on tidal silt flats and include Lumnitzera racemosa, Bruguiera exaristata and Scyphiphora hydrophyllacea, the last being known in this State only from this area. The estuary of the Drysdale River is lined with extensive stands of mangroves.

Areas of deep sand on the coast carry a hummock grassland of Spinifex longifolius and Triodia, sp., sometimes with scattered shrubs of Grevillea viscidula, G. refracta and Phyllanthus baccatus.

FIG. 18. Coast south-east of Cape Londonderry, where the lateritic plateau reaches the sea. Low vine thicket is on the scree slopes.

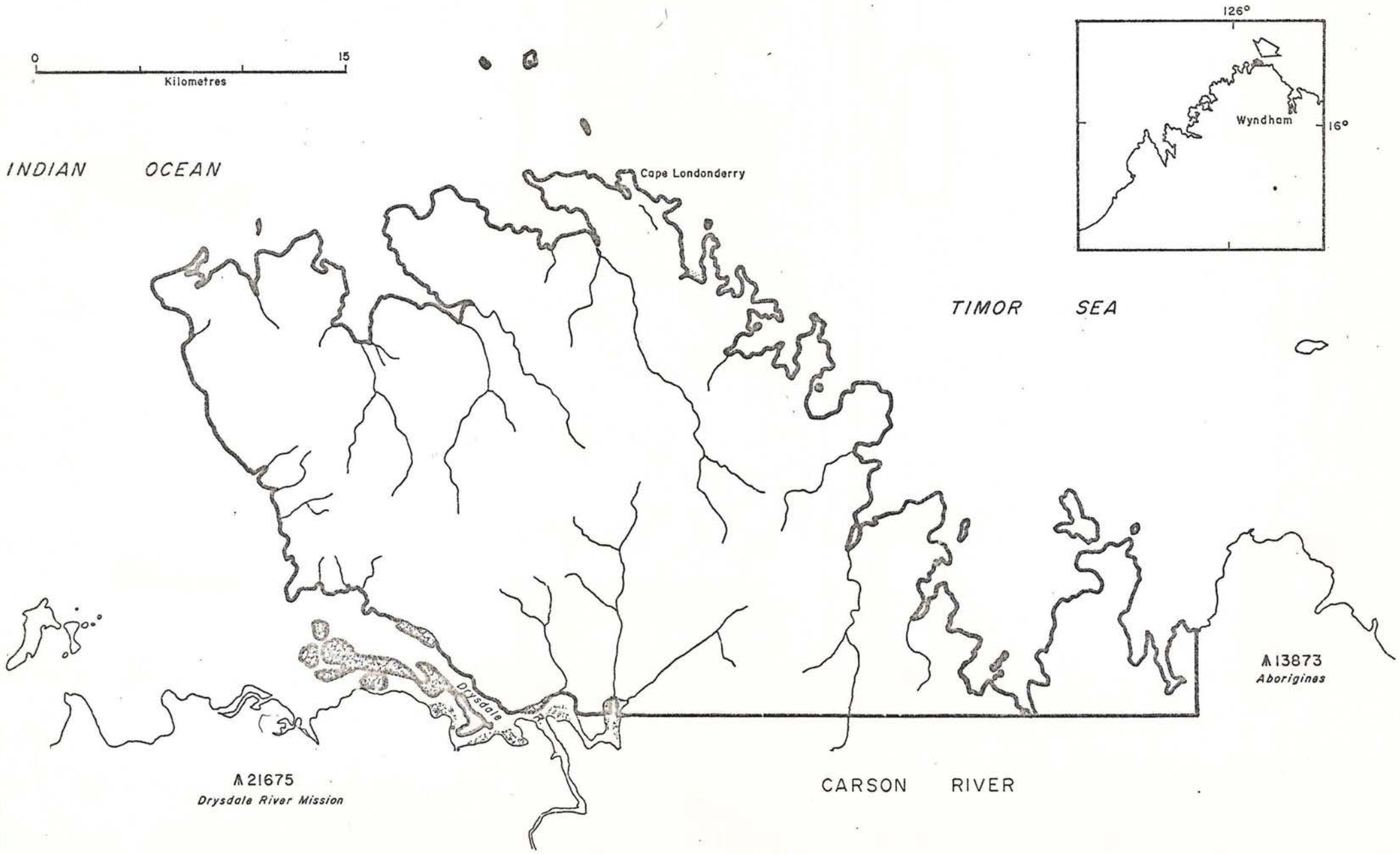

0
15
Kilometres
INDIAN OCEAN
Cape Londonderry
126°
Wyndham
16°
TIMOR SEA
M13873
Aborigines
Drysdale R.
M21675
Drysdale River Mission
CARSON RIVER

FIG 7.8

The fauna of the area has not been studied in detail, but the Spangled Drongo (Dicrurus bracteatus) is known to occur in small vine thickets on the east coast. Other birds recorded include the Brolga (Grus rubicunda), Jabiru (Xenorhynchus asiaticus) and Great Bower Bird (Chlamydera nuchalis).

The Committee considers the area worthy of National Park status, on the basis of its geographical position, and its varied scenery, geology, flora and fauna. Although currently almost inaccessible except from the sea or by helicopter, it has potential for recreation in the future. The reservation of land extremities is traditional because of the romantic appeal that they hold for most people. As examples, Cape Leeuwin and Wilsons Promontory in Australia and Lands End and John O'Groats in England may be cited.

CTRC has already recommended conservation reserves at West Cape Howe (Area 2.9) and West Point on Dirk Hartog Island (Area 9.1) the southern and western extremities of the State.

The area is at present vacant Crown Land and covers about 70,862 ha.

Recommendation.

The Committee recommends that the area as shown in Fig.7.8 be declared a Class A Reserve for the purpose of National Park and vested in the National Parks Authority of W.A. The reserve should extend to low water mark to ensure preservation of mangroves and should include the adjacent islands. It should also include the islands of mangroves in the estuary of the Drysdale River, down to low water mark.

7.9 DRYSDALE RIVER NATIONAL PARK

The Drysdale River National Park is Class B Reserve No. 32853 for the purpose of National Park and is vested in the National Parks Authority of W.A. It has an area of 435 906 ha.

The Park lies astride the Drysdale and Carson Rivers about 150 km west of Wyndham and 100 km south of Kalumburu. This area was first proposed for reservation in 1955 (Morgan, 1955). The Park with its existing boundary was recommended in the National Parks Report, 1962 and finally reserved in 1974 following recommendations made by CTRC shortly after it was established.

A biological survey of the Park was carried out during August 1975 (Kabay and Burbidge, in press). The reserve embraces a cross-section of the country and includes sandstones, basalts and siltstones of the Late Precambrian Kimberley and Bastion Groups together with soils derived from them. Scenically it varies from extensive rather monotonous open-woodlands to the broad waters of the Drysdale River, attractive pools in creeks, and rugged cliffs along the Carson Escarpment, along Johnson Creek and in Worriga Gorge (Fig. 7.19). Major waterfalls occur at Morgan Falls and on the Drysdale River and there are numerous small falls elsewhere.

Biologically the Park contains biota intermediate between those of the sub-humid north-west Kimberley and the semi-arid east Kimberley.

The vegetation is predominantly open-forest or woodland, low open-forest and low woodland (Kabay, George and Kenneally, in press). Fringing formations occur along the major rivers and creeks and pockets of vine thicket and vine forest occur along the Carson Escarpment and in some gorges. There are small areas of open-shrubland and closed-grassland.

The woodlands and forests are mostly dominated by Eucalyptus. On sandstone Eucalyptus miniata, E. tetrodonta, E. latifolia and E. leucophloia predominate and on basalt E. tectifica and E. foelscheana are the common species. Associated with these are species of Gardenia, Owenia, Erythrophleum Callitris, Acacia and Brachychiton. Many shrubs, grasses and herbs make up the understorey, more densely in sand or loam than in rocky areas. Most plants are typical of the region, but some species of special interest include uncommon plants such as Homalocalyx ericaeus, Fenzlia phebalioides, Colochasia antiquorum, Bombax ceiba and Piliostigma malabaricum.

Fringing formations along rivers and creeks are dominated by cadjeputs especially Melaleuca leucadendron, M. argentea and M. viridiflora. Other trees include Sesbania, Ficus, Nauclea, Eugenia, Terminalia and Pandanus.

FIG. 19. Worringa Gorge, Drysdale River National Park: Palmoondoora Creek, fringed with Cadjeput (Melaleuca leucadendron) and screw pine (Pandanus aquaticus). The cliffs are King Leopold sandstone.

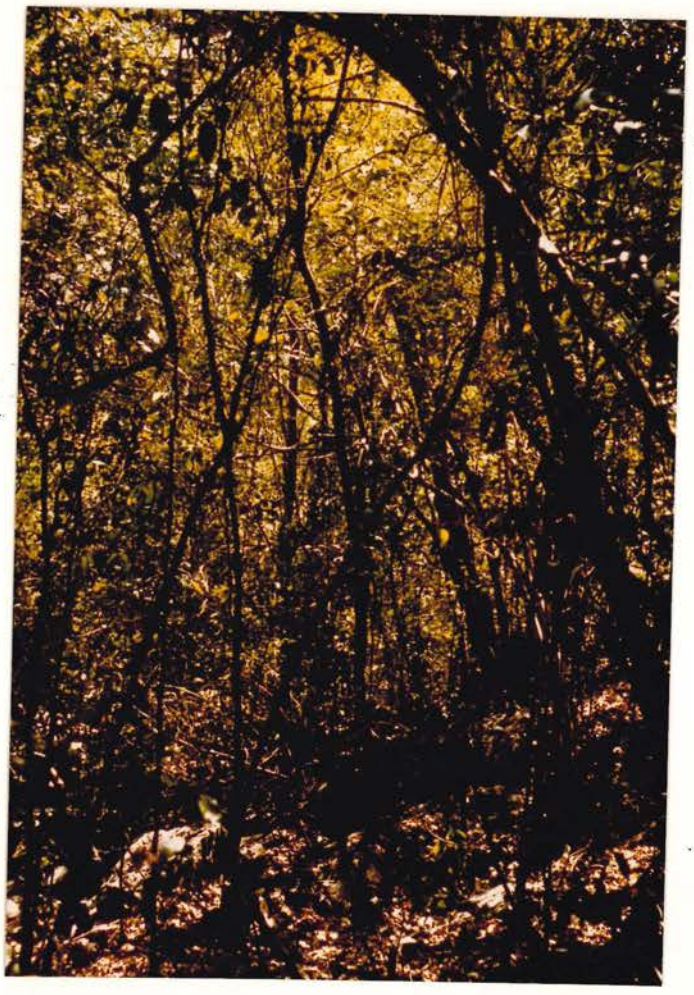


FIG. 20. Worringa Gorge, Drysdale River National Park: inside the semi-deciduous vine forest by Elasmias Creek.

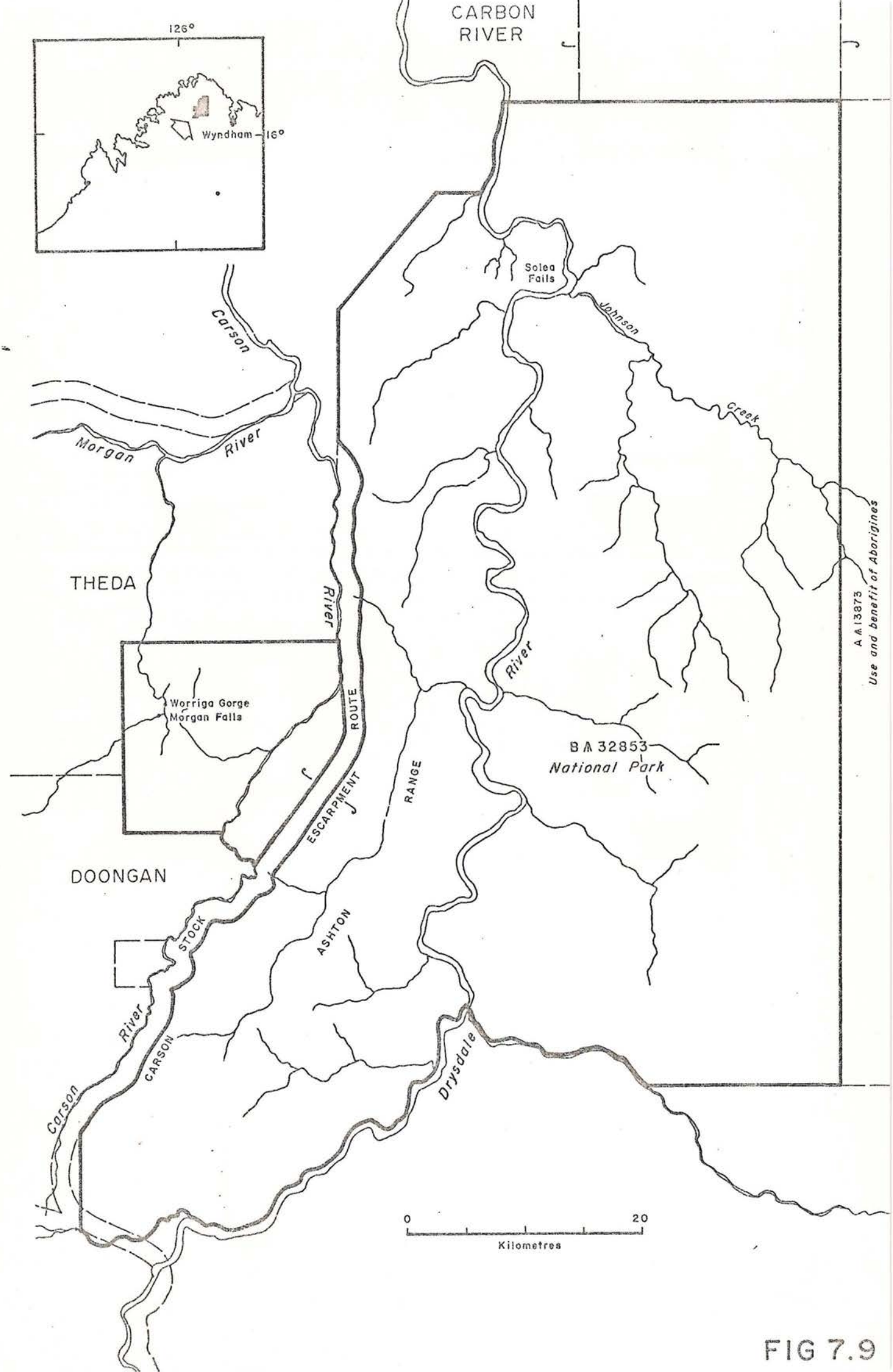

126°
Wyndham
16°
CARBON
RIVER
Solea
Falls
Johnson
Creek
Carson
River
Morgan
River
THEDA
River
Worriga Gorge
Morgan Falls
ROUTE
ESCARPMENT
RANGE
River
A A 13873
Use and benefit of Aborigines
B A 32853
National Park
DOONGAN
STOCK
ASHTON
River
CARSON
Carson
Drysdale
0
20
Kilometres

FIG 7.9

The vine thickets and forests are mostly poorer in species than those of the Mitchell Plateau and lower Prince Regent River, but are a valuable sample of rainforest which occurs only in small areas of the System. An important occurrence is in Worriga Gorge where over 12 tree species are found and robust lianes occur (Fig.7.20).

The epiphytic orchid Dendrobium dicuphum is common in wetter parts of the Drysdale vine thickets.

The Drysdale and Carson Rivers contain permanent pools, while some smaller streams are perennial. In and around the water are many aquatic and swamp plants. About 30 aquatics have been recorded for the Park, including rare or unusual species such as Nymphoides minima, Blyxa echinosperma, Myriophyllum dicoccum, Triglochin procera var. dubia, and Limnophila sp. nov. (George and Kenneally, in press). The swamp plants include a number of bladderworts (Utricularia), trigger plants (Stylidum), Mitrasacme, Xyris, etc.

Twenty-five species of ferns occur in the Park. Of these 13 are known from Worriga Gorge alone and two (Christella dentata and Doryopteris concolor) have not been recorded elsewhere in Western Australia. The recorded flora of the Park totals 594 species, of which only 39 per cent occur also in the Prince Regent River Nature Reserve.

Twenty-six species of native mammals have been collected in the Park (McKenzie, et al, in press). Thirteen of these are bats, including the poorly known Myotis adversus, Tadarida loriae and Nyctophilus arnhemensis; the last is a new record for Western Australia. N. walkeri, a species previously known from only one specimen taken in the Northern Territory in 1892 was also collected. Terrestrial mammals include the Short-eared Rock Wallaby (Petrogale brachyotis), Sugar Glider (Petaurus breviceps), a Planigale (Planigale maculata), the Water Rat (Hydromys chrysogaster) and a species of native mouse (Pseudomys sp.) that may be undescribed.

Birds number 129 species (Johnstone, et al, in press). The avifauna includes sub-humid species at their eastern known limit of distribution such as the Green-winged Pigeon (Cholcophaps indica) and Silver-backed Butcher-bird (Cracticus torquatus), as well as semi-arid species that do not extend further west, e.g. the Crested Pigeon (Ocyphaps lophotes), Brown Songlark (Cinclorhamphus cruralis) and Gouldian Finch (Chloebia gouldiae).

Frogs and reptiles were plentiful during the survey and 13 species of frogs and 47 reptiles were recorded (Storr and Smith, in press). They include undescribed species of goanna (Varanus), gecko (Rhynchoedura) and ground frogs (Limnodymastes and Uperoleia). The goanna is known only from the Park.

A surprisingly high total of 26 species of fresh-water fish was recorded (Hutchins, in press). Nine are undescribed and three of these are known only from the Park.

The land snail fauna is indicative of drier conditions than those prevailing in the Prince Regent River Nature Reserve and other north-west Kimberley coastal localities (Merrifield, et al, in press). The family Camaenidae is less diverse in the Drysdale River National Park, and operculate land snails (prosobranchs) are not represented. More aboreal snails were found in the Park, but these are mainly tiny species which may have been overlooked at the Prince Regent. They are found in dense vine thickets in the deeper, well-watered gorges. Their affinities appear to be mainly with Pacific and Indonesian snails and they may be a relic fauna. Ground-living snails in the Park are found in a wider range of habitats wherever deep leaf litter accumulates. They belong mainly to groups endemic to northern Australia.

Some 2 415 species belonging to 15 insect orders were collected (Common and Upton, in press). They include 14 species of dragon-flies (Odonata), 55 of grasshoppers (Orthoptera), 338 of bugs (Hemiptera), 403 of beetles (Coleoptera), 30 of butterflies (Hesperiidae, Papilionidae, Pieridae, Nymphalidae and Lycaenidae), and 931 of moths (other Lepidoptera).

The Drysdale River National Park is an outstanding conservation reserve. At present it is not readily accessible to visitors but it may become an important tourist attraction in the future.

The Committee believes that the Reserve boundaries need slight modification such as the inclusion within the National Park of those portions of the existing Stock Route which is not required forthat purpose. Its addition to the Park would ration-alise the boundary and facilitate management, particularly in regard to the Carson Escarpment. It should be borne in mind that the original concept of the Stock Route was intended to preserve future public access as well as provide for passage of stock.

In its northern section the Park is at present confined to the east side of the Drysdale River. An area on the west side adjacent to the spectacular Solea Falls warrants inclusion in the Park. It consists partly of rugged sandstone hills on which there is a tall open-shrubland or low open-woodland with a spinifex (Plectrachne) understorey. Fan Palms (Livistona loriphylla) are common here, as is Kalumburu Gum (Eucalyptus herbertiana). The outstanding feature of the area is a permanent stream now named Forest Creek entering the Drysdale some 10 km below the Falls. Along its lower course it is lined with a tall closed-forest of Melaleuca leucadendron, Carallia brachiata, Metrosideros eucalyptoides and an unnamed species. This is the only know occurrence of this formation in the Kimberley. Upstream the creek forks and its two valleys contain

dense vine thickets in which Cassine, Pouteria, Stenocarpus, Ficus, Planchonella, Denhamia and Alstonia occur. A small comb fern (Schizaea digitata) found here is not known elsewhere in Australia. There is also an undescribed species of Ricinocarpos. The shrub Rapanea(?) porosa is known in Western Australia only from this locality. Another rare species is Fenzlia phebalioides.

The proposed addition is at present part of Carson River pastoral lease. It is rugged and has little pastoral value. It would add to the biological representation in the Park, and ensure the protection of Solea Falls on the Drysdale River. At present, only the eastern side of this Fall is within the Park.

Recommendation :

The Committee endorses the purpose and vesting of Reserve No. 32853. It recommends that those adjacent portions of the existing stock route which are no longer required for that purpose be added to the National Park (Fig. 7.9).

7.10 LAKE ARGYLE

The decision to press ahead with the Ord Scheme signified the end of isolation for the lower Ord Valley. Planning, construction and operation of the scheme has meant more people and better access. Tourism has inevitably followed and has been increasing year by year. The need to protect significant features for the benefit of both local residents and visitors has therefore become a matter of urgency. The Public Works Department has been active and responsible in this field, and in the provision of facilities to attract and handle the increasing tourist pressure. Pre-eminent among the attractions is the vast Lake Argyle itself.

The Public Works Department, as the dominant authority in all phases of the Scheme, naturally exerts influence over all activity relating to the Lake. Potential erosion problems, mainly associated with stock use of the occasionally inundated black soil plains, have lead to the vesting of Reserve 31165 on the east and south sides of the Lake in the Minister for Works. Some vacant Crown Land exists between Reserve 31165 and the low water marks, but seasonal inundation restricts its potential use for other than water protection purposes. In the vicinity of the dam and downstream to the irrigation area, particularly on the east side of the Ord River, the requirements of management suggest that the Public Works Department should be involved in all land-use activities, including tourism.

Large areas of the catchment upstream from the dam have been withdrawn from pastoral lease and reserved for the regeneration of eroded areas. Although not vested, the management to achieve the stated purpose of reservation is in the hands of the Department of Agriculture.

The vacant Crown Land west and north-west of Lake Argyle, comprising the Carr Boyd and other ranges, has the attributes of a National Park. The grandeur of the ranges, rising steeply from a large body of navigable water (Fig.7.21) give them an obvious recreational value, particularly within a few kilometres of the waters edge. Their biology was studied by the Western Australian Museum prior to the completion of the main dam. Mammals include the Euro (Macropus robustus), Short-eared Rock Wallaby (Petrogale brachyotis), an Antechinus (Antechinus bilarni), Ingram's Planigale (Planigale ingrami) and the Bushy Horseshoe Bat (Hipposideros ater).

The hinterland consists of rugged ridges of sandstones and siltstones separated and dissected by narrow valleys and gullies, frequently steep-sided and rocky, which severely restrict access other than by foot. Exploration during the past decade has revealed many mineral occurrences within this area, including fluorite, radioactive minerals and base metals, which indicate a potential for economic mining operations in the future. Problems of access, world metal prices and other factors have caused a decrease in recent mineral exploration, but until further detailed work is undertaken exclusion of mining cannot be justified. In order to preserve the wilderness quality of the ranges, it is suggested that plans for specific mining should be submitted to the EPA before any operations begin.

FIG. 21. Lake Argyle and the Carr Boyd Range.

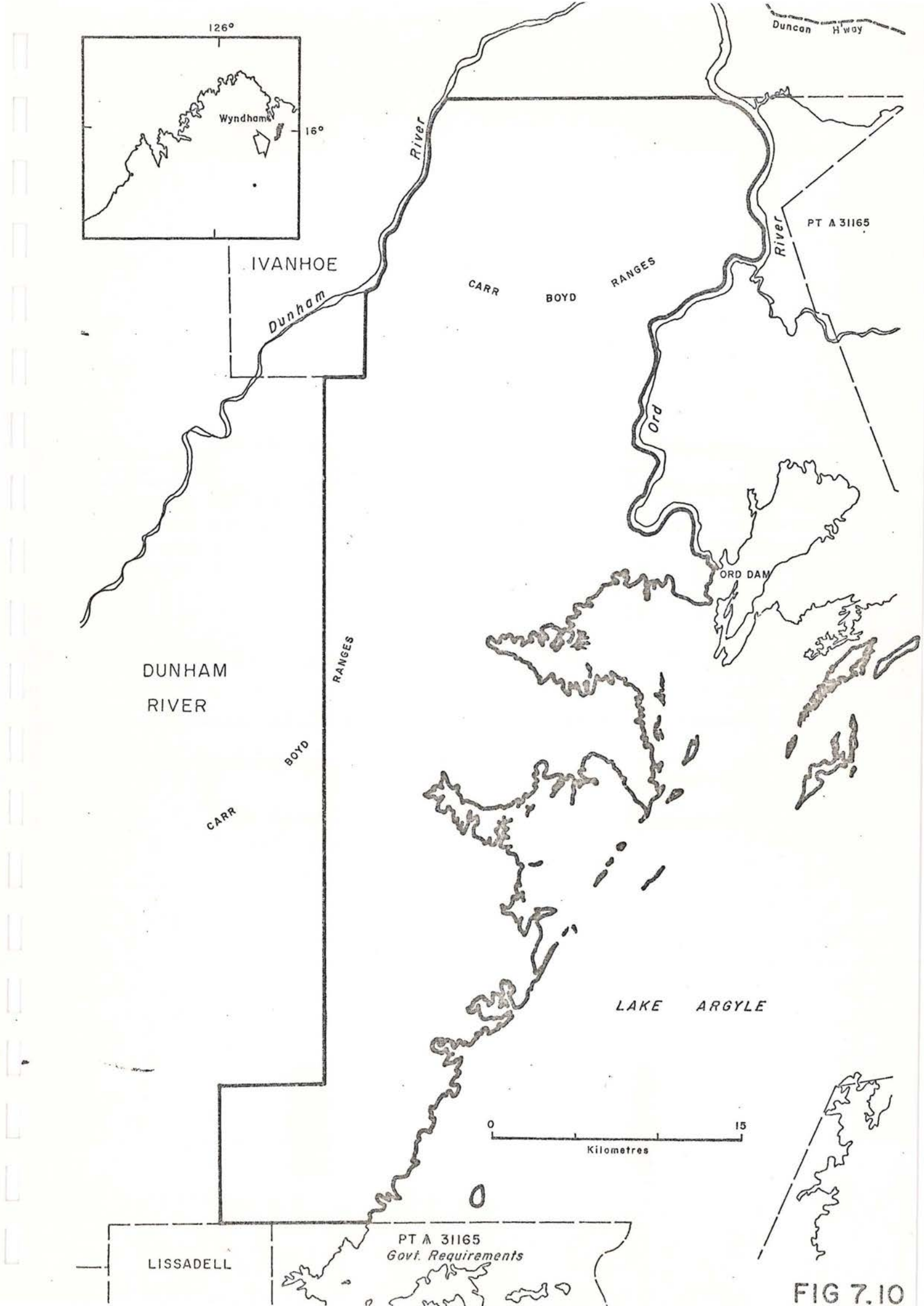

126°
Wyndham
16°
Duncan H'way
River
PT A 31165
IVANHOE
Dunham
CARR
BOYD
RANGES
River
Ord
ORD DAM
DUNHAM
RIVER
RANGES
BOYD
CARR
LAKE ARGYLE
0
15
Kilometres
PT A 31165
Govt. Requirements
LISSADELL

FIG 7.10

The islands created by the damming have obvious recreational potential and some are in use already. Their biological importance as parts of a fragmented ecosystem should not be overlooked. The ability of existing plants and animals to survive without the infusion of new genetic material and their capacity to adapt to a changed habitat are aspects that should be studied over a long period of time. The Short-eared Rock Wallaby (Petrogale brachyotis) and the Northern Nail-tailed Wallaby (Onychogalea unguifera) are both known to have been left on islands following "Operation Noah" which aimed to remove animals from areas destined for inundation. This situation would be expensive to create experimentally and ecologists should take advantage of it. Some form of reservation is desirable for this purpose although it may not be possible to use it immediately. Total exclusion of controlled recreation and other use is not suggested.

There is at present no major conservation reserve in this part of the Kimberley. The Committee favours the creation of a National Park to cover both the islands and the Carr Boyd Ranges west and north-west of Lake Argyle (Fig.7.10). The possibility of future mining precludes a firm recommendation for this purpose and a Class C reservation as National Park is therefore recommended until time and further work clarify the situation.

Recommendations :

The Committee recommends that the islands in Lake Argyle and the Carr Boyd Ranges to the west and north-west of Lake Argyle as indicated in Fig.7.10 be declared a Class C Reserve for the purpose of National Park, and vested in the National Parks Authority of W.A.

7.11 PARRY LAGOONS NATURE RESERVE

An area about 25 km south-east of Wyndham is outstanding for its bird life. It is mostly contained within Class C Reserves Nos. (ca 1 024 ha, Water and the Conservation of Fauna, vested in the Minister for Works), 1059 (ca 2 000 ha Water and the Conservation of Fauna, vested in the Minister for Works), 31636 (12 589 ha, Conservation of Fauna, vested in the W.A. Wildlife Authority) and 30866 (ca 2 129 ha, Protection of Flora and Fauna, vested in the W.A. Wildlife Authority). These reserves include a number of wetlands (Parry Creek, Parry Lagoons, Police Hole, Jogalong Billabong, Palm Spring, Wild Goose Creek and Goose Hill Creek). The Great Northern Highway runs along the western boundary and the old Wyndham-Kununurra Road runs through the area.

The lagoons and billabong attract thousands of water birds, especially during the dry season when fresh water in the region becomes scarce. Common species include the Magpie Goose (Anseranas semi palmata), Straw-necked Ibis (Threskiornis spinicollis), White Ibis (T. molucca), Glossy Ibis (Plegadis falcinellus), Black Duck (Anas superciliosa), Grass Whistle-Duck (Dendrocygna eytoni), Water Whistle-Duck (D. arcuate), Brolga (Grus rubicunda), Jabiru (Xenorhynchus asiaticus and Pelican (Pelicanus conspicillatus). The comparatively rare Burdekin Duck (Tadorna rajah) can also be seen there. The Red-backed Quail (Turnix maculosa) occurs in grasslands around Parry Lagoon. Finches are numerous in the area, species recorded including the Zebra (Taenopygia gullata), Pictorella (Heteromunia pectoralis), Double-bar (Stizoptera bichenovii), Crimson (Neochia phaeton) and Long-tailed (Poephila acuticauda).

Mammals include the Northern Nail-tailed Wallaby (Onychogalea unguifera), Sandy Wallaby (Macropus agilis) and the Long-Haired Rat (Rattus villosissimus), which is not known from any other locality in Western Australia.

The reserves are at present being damaged by cattle and this should be controlled.

Recommendation :

The Committee endorses the status, purpose and vesting of Reserves Nos. 1058, 1059, 30866 and 31636.

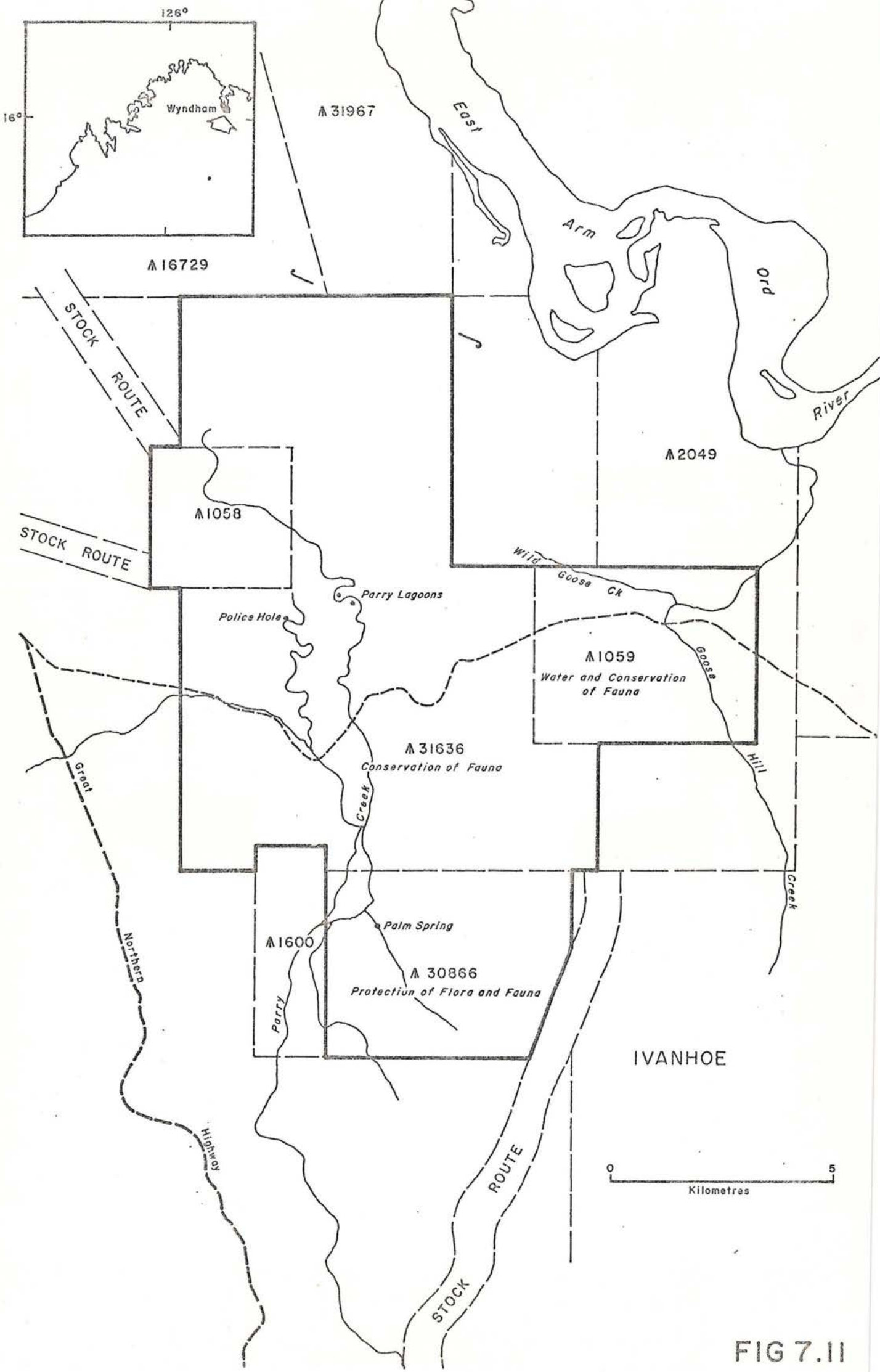

126°
16°
Wyndham
A31967
East
Arm
Ord
River
A16729
STOCK ROUTE
A2049
A1058
STOCK ROUTE
Wild Goose Ck
Parry Lagoons
Police Hole
A1059
Water and Conservation of Fauna
Goose
A31636
Conservation of Fauna
Great Northern Highway
Parry Creek
Hill Creek
Palm Spring
A1600
A 30866
Protection of Flora and Fauna
IVANHOE
STOCK ROUTE
0
5
Kilometres

FIG 7.11

7.12 ORD RIVER NATURE RESERVE

The Ord River Nature Reserve is situated on the tidal portion of the Ord River east of Wyndham. It is set apart as Reserve No. 31967 for the Conservation of Flora and Fauna, vested in the W.A. Wildlife Authority, with an area of about 23,945 ha. The reserve was declared primarily to protect the Salt-water Crocodile (Crocodylus porosus) and resulted from a recommendation by Dr H.R. Bustard who was commissioned by the Department of Fisheries and Wildlife to report on the status of crocodiles in Western Australia (Bustard, 1969). Dr Bustard felt that this area was ideal for a crocodile reserve because it contained excellent habitat, it still held a number of crocodiles which would repopulate the area if rigidly protected, it would be east to patrol and was readily accessible from Wyndham for tourist use.

The reserve contains extensive areas of mangroves. It has not been examined in detail and no information is available on the general flora and fauna.

Recommendation :

The Committee endorses the status, purpose and vesting of this reserve.

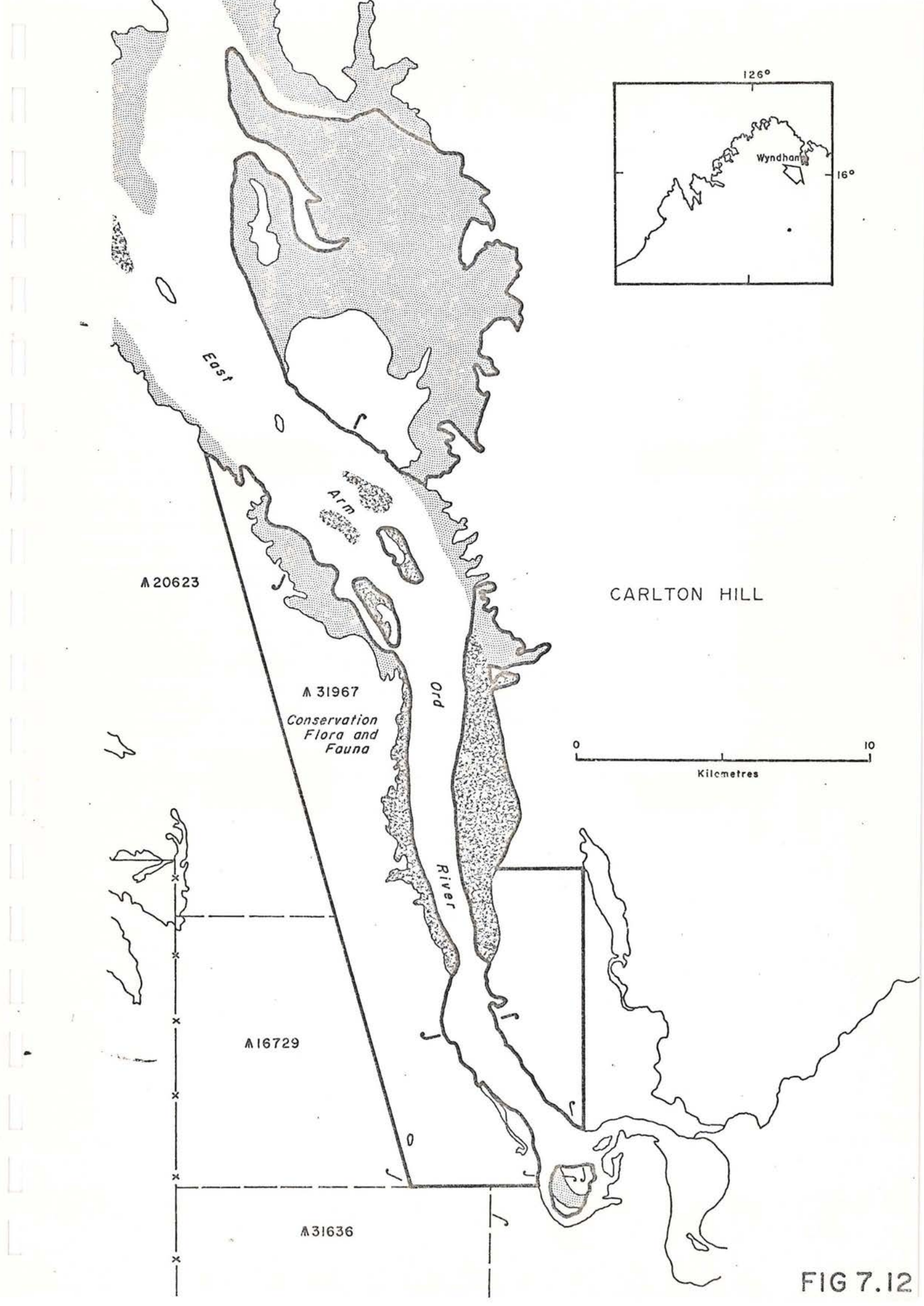

126°
Wyndham
16°
East
Arm
Ord
River
A20623
A31967
Conservation
Flora and
Fauna
A16729
A31636
CARLTON HILL
0
10
Kilometres

FIG 7.12

7.13 BLUFF FACE RANGE AREA

The upper catchment of Durack River lies in a large area of vacant Crown Land, surrounded by pastoral leases. Much of it is a gently undulating and monotonous plateau, but there are many seasonal streams and, along the larger watercourse, permanent pools.

Most of the area is covered by the Late Precambrian Pentecost Sandstone but there are small areas of sandy alluvium. In places the streams have carved out picturesque gorges and the southern end of the Bluff Face Range lies across the area. Average annual rainfall is about 650 mm.

Low woodland with a grassy understorey occupies extensive tracts. Eucalyptus tetrodonta, E. phoenicia, E. dichromophloia and E. miniata are the dominant trees, with Plectrachne pungens common as ground cover.

Along drainage lines the vegetation often increases little in density, though the species composition changes. Orange Grevillea (Grevillea pteridifolia) and Baobab (Adansonia gregorii) are characteristic species. An important occurrence is that of Fan Palms (Livistona sp.) in some gorges. Two species of Livistona occur in the area.

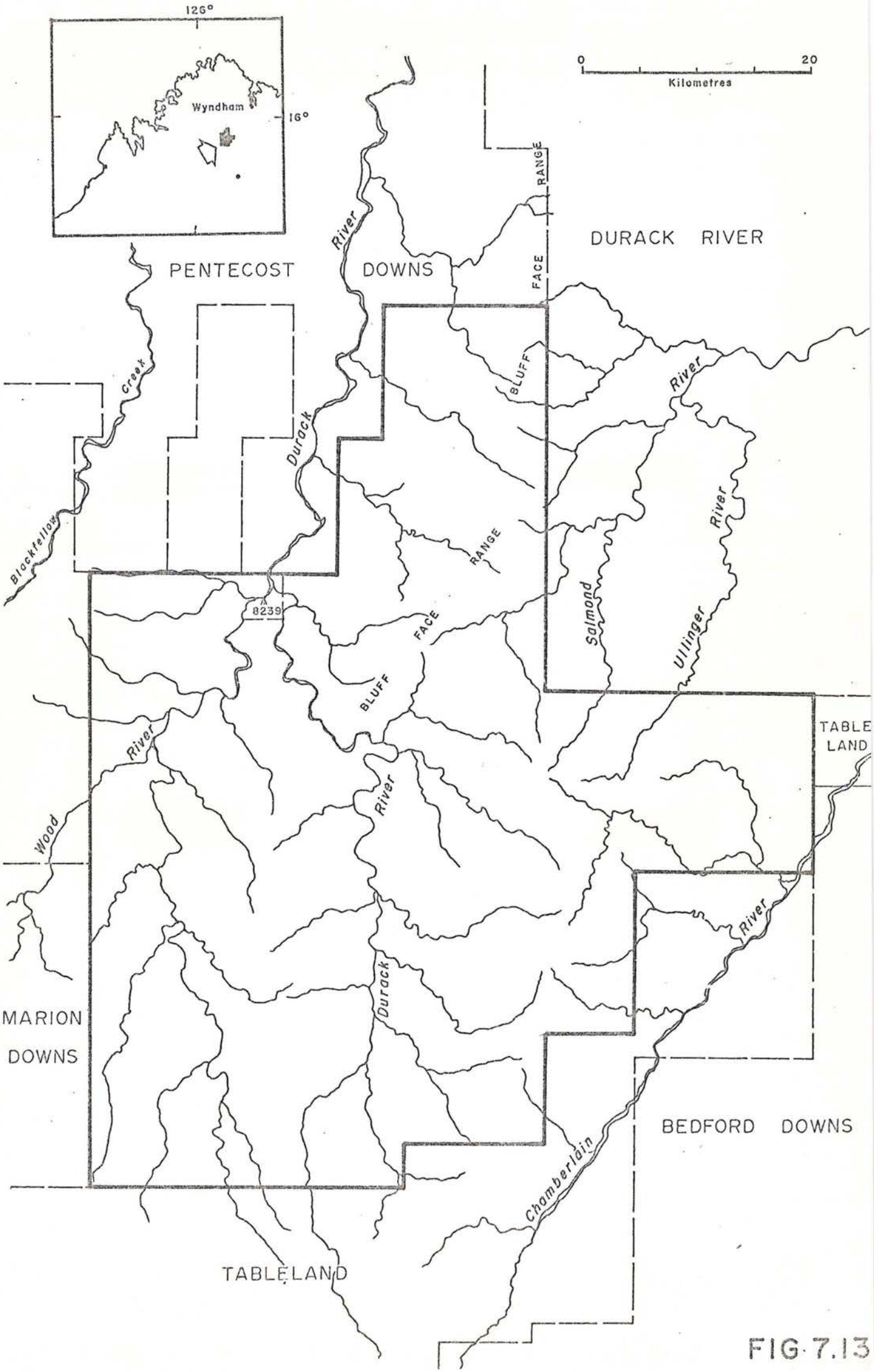
At present there is no conservation reserve in the east-central Kimberley. The area in question lies midway between the wet north-west and the semi-arid south-east Kimberley. A reserve here would increase the conserved representation of Kimberley biota. Information is at present insufficient for a definite recommendation to be made, but no development of the area should be allowed until a biological survey has been carried out.

Recommendations:

The Committee recommends that:

a. the Environmental Protection Authority arrange for a biological survey to be carried out in the area shown in Fig.7.13 to determine its conservational value;

b. the cooperation of the Department of Lands and Surveys be sought to ensure that the views of the Environmental Protection Authority be obtained prior to any land release, pending completion of the survey referred to in a. above.


126°
Wyndham
16°
0
20
Kilometres
PENTECOST
DOWNS
DURACK RIVER
River
RANGE
FACE
BLUFF
River
Durack
Creek
Blackfellow
RANGE
A
8239
FACE
BLUFF
Salmond
River
Ullinger
River
TABLE
LAND
River
Wood
River
River
Durack
River
MARION
DOWNS
BEDFORD DOWNS
Chamberlain
TABLELAND

FIG·7.13

7.14 GARDINER RANGE AREA

In the extreme south-eastern Kimberley and extending southward into System 12 (Deserts) is an area which includes the Gardiner Range. It is in a zone of transition between Kimberley and desert flora, the former mainly occupying moister and sheltered habitats but with progressively fewer representations as the rainfall decreases.

The Gardiner Range is a series of low hills covered by a hummock grassland (Triodia) with scattered shrubs of Grevillea, Hakea and Acacia. The flats around the hills carry grasses and sporadic eucalypts. A small area of mulga is the northernmost locality for this formation in Western Australia. However all of the land concerned is held under pastoral lease conditions, but provision should be made to ensure the creation of an appropriate reserve should any of the existing leases be determined.

The area was examined in June, 1975, by W.H. Butler while under contract to the W.A. Museum (G.M. Storr and W.H. Butler, pers. comm.). Sixty-nine species of birds were recorded, including the Port Lincoln Parrot (Barnardius zonarius) this being its northernmost record in W.A. Most birds observed were Eyrean (arid zone) species, the Torresian (Kimberley) element being in the minority. Mammals observed included a Nail-tailed Wallaby (Onychogalea sp.) and the Dalgyte (Macrotis lagotis). Seven species of reptiles and a frog were collected.

At present there is no significant conservation reserve in the East Kimberley. The proposed National Park in the Carr Boyd Ranges adjacent to Lake Argyle (Area 7.10) would provide some representation of East Kimberley ecosystems but on its own it would not adequately represent the region. Most of the east Kimberley is under pastoral lease and cannot be considered for reservation without good supporting data; such data are not available. In the absence of other reserves, the Gardiner Range area will provide additional representation of the region as well as being of value in its own right, being in an area of biological transition between two floras and faunas.

Recommendation :

The Committee recommends that the Department of Lands and Surveys be requested to give consideration to the creation of an appropriate reserve in the Gardiner Range area, should any of the existing pastoral leases be determined.

7.15 THE NAPIER AND OSCAR RANGES AREA

The National Parks and Nature Reserves Report (1962) gave considerable attention to this area. It expressed the opinion that because the ranges "include some of the most beautiful and striking scenery to be found in Western Australia", it was desirable that parts be set aside as a National Park (p.208). It also expressed the opinion that selected gorges and ranges in the area be set aside as Class A Reserves and that an expert Committee be asked to survey the area and recommend parts for public recreation, aboriginal and archaeological sites, fauna and flora and for geological purposes.

Since the publication of the National Parks and Nature Reserves Report, Geikie Gorge, Windjana Gorge and Tunnel Creek (areas recommended by the Committee) have been declared National Parks and placed under the control of the National Parks Authority, decisions which the present committee fully endorse. While CTRC believes in principle that a larger area of the Napier and Oscar Ranges should be set aside as National Park, it also recognises the difficulty of obtaining suitable land for such a purpose. Unlike the North Kimberley, there are no large tracts of vacant Crown Land in the region, and any proposal for a major park in the area would involve the acquisition of land held under pastoral lease.

Geikie Gorge National Park

Geikie Gorge is Class A Reserve No. 28401 under the control of the National Parks Authority. The gorge was named by Hardman after Sir Archibald Geikie, the British geologist. It is formed where the Fitzroy River cuts through Devonian limestone at the junction between the Oscar and Geikie Ranges, 16 km from Fitzroy Crossing (Fig.7.15). Permanent deep water occurs in the Gorge within the National Park.

It harbours a large population of the Fresh-water Crocodile (*Crocodylus johnstoni*) as well as Leichardt's Sawfish (*Pristiopsis leichhardti*) and Coach-whip Stingray (*Himantura arnak*), species normally marine. Barramundi (*Lates calcifera*) are also found there.

There are a wide variety of water birds including the Darter (*Anhinga rufa*), White Egret (*Egretta alba*) and little Pied Cormorant (*Phalacrocorax melanoleucos*). Two species not often found so far from the sea are the White-breasted Sea-Eagle (*Haliaetus leucogaster*) and Red-backed Sea-Eagle (*Haliastur indus*). In the thick vegetation fringing the gorge the Reed-Warbler (*Acrocephalus stentoreus*), Brush Cuckoo (*Cacomantis variolosus*) and Restless Flycatcher (*Myiagra inquieta*) occur, while along the cliffs the Great Bower-Bird (*Chlamydera nuchalis*) and Brown Breasted Shrike-Thrush (*Colluricincla woodwardii*) are found.

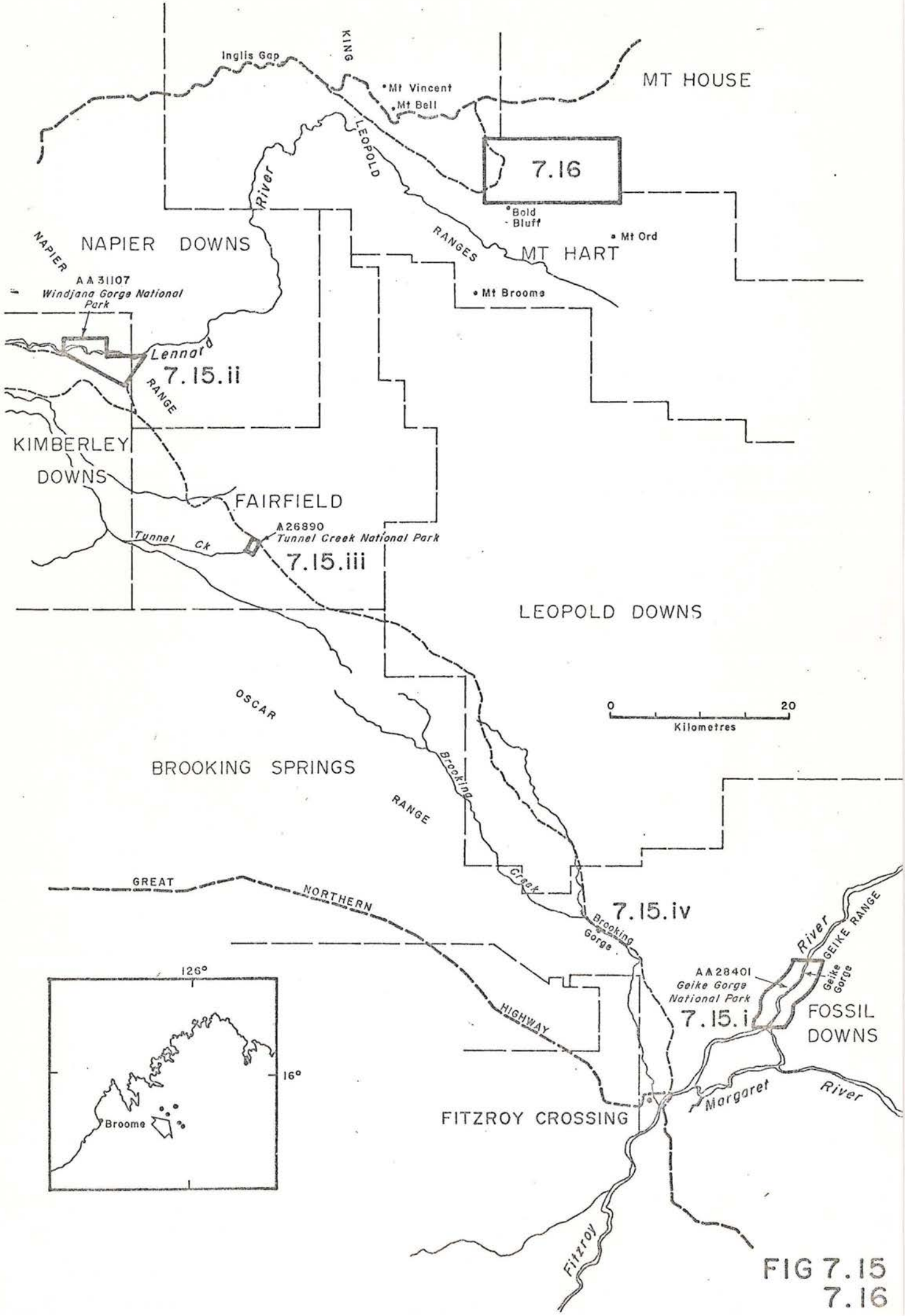

Inglis Gap
KING
Mt Vincent
Mt Bell
MT HOUSE
7.16
LEOPOLD
River
Bold Bluff
RANGES
Mt Ord
MT HART
NAPIER
NAPIER DOWNS
AA 31107
Windjana Gorge National Park
Mt Broome
Lennard
7.15.ii
RANGE
KIMBERLEY DOWNS
FAIRFIELD
Tunnel Ck
A 26890
Tunnel Creek National Park
7.15.iii
LEOPOLD DOWNS
0
20
Kilometres
OSCAR
BROOKING SPRINGS
RANGE
Brooking
Creek
GREAT
NORTHERN
HIGHWAY
7.15.iv
Brooking Gorge
GEIKE RANGE
River
AA 28401
Geike Gorge National Park
Geike Gorge
7.15.i
FOSSIL DOWNS
126°
16°
Broome
FITZROY CROSSING
Margaret River
Fitzroy

FIG 7.15
7.16

The forest fringing the river is dominated by three species of cadjeput, (Melaleuca leucadendron, M. argentea, and M. sp.). There are also River Gums (Eucalyptus camaldulensis), Freshwater Mangroves (Barringtonia acutangula), figs (Ficus) and screw pines (Pandanus). The Tropical Reed (Phragmites karka) forms dense stands on the banks, while native passionfruit (Passiflora foetida) scrambles over trees and shrubs.

As it is close to Fitzroy Crossing and the east-west road through the south Kimberley, the Park has become a popular tourist resort. The National Parks Authority estimates that 13 360 persons entered it between April 1974 and October 1975. The ranger conducts boat tours through the Park (Fig.7.22), and the fees charged contribute to the cost of maintaining the service. Members of the Committee were taken on the trip early one morning and as the first group to make the journey that day sighted more wildlife (especially crocodiles) than would normally be seen. Geikie Gorge is without doubt an important tourist attraction in the Region, and although coach tourists stay for only a few hours, others who come by private vehicle usually camp on the site close to the water edge. The rapidly increasing number of tourists will create management problems in the future.

Recommendation :

The Committee endorses the status, purpose and vesting of the Geikie Gorge National Park. It recommends that in view of the expected large number of future visitors to the Gorge, the National Parks Authority :

(i) reconsider the boundaries of the existing Park,

(ii) consider whether the existing campsite and facilities are in the most desirable site.

Windjana Gorge National Park

Windjana Gorge is Class A Reserve No 31107 vested in the National Parks Authority. It is a picturesque narrow canyon cut through the Napier Range by the Lennard River (Fig. 7.23) The National Parks and Nature Reserves Report (1962) indicated that few people visit the Gorge owing to the poor conditions of existing tracks. This is not so today. As a result of track improvements, Windjana Gorge is now a popular stop-over for many tourists to the Oscar and Napier Ranges. As described in the National Parks and Nature Reserves Report, the gorge is about 5 km long, walled by vertical cliffs of weathered limestone from 30-100 m high. Though the Lennard River runs through the Gorge in wet weather, it contains only pools surrounded by trees and shrubbery during the dry season.

River Gums (Eucalyptus camaldulensis) and Cadjeputs (Melaleuca leucadendron) line the banks together with Terminalia, Nauclea coadnatus and Ficus racemosa. On the slopes of the Gorge White Cedar (Melia dubia) and Baobabs (Adansonia gregorii) occur.

The Gorge is rich in fauna, including Sandy Wallaby (Macropus agilis) and Freshwater Crocodile (Crocodylus johnstoni). Water

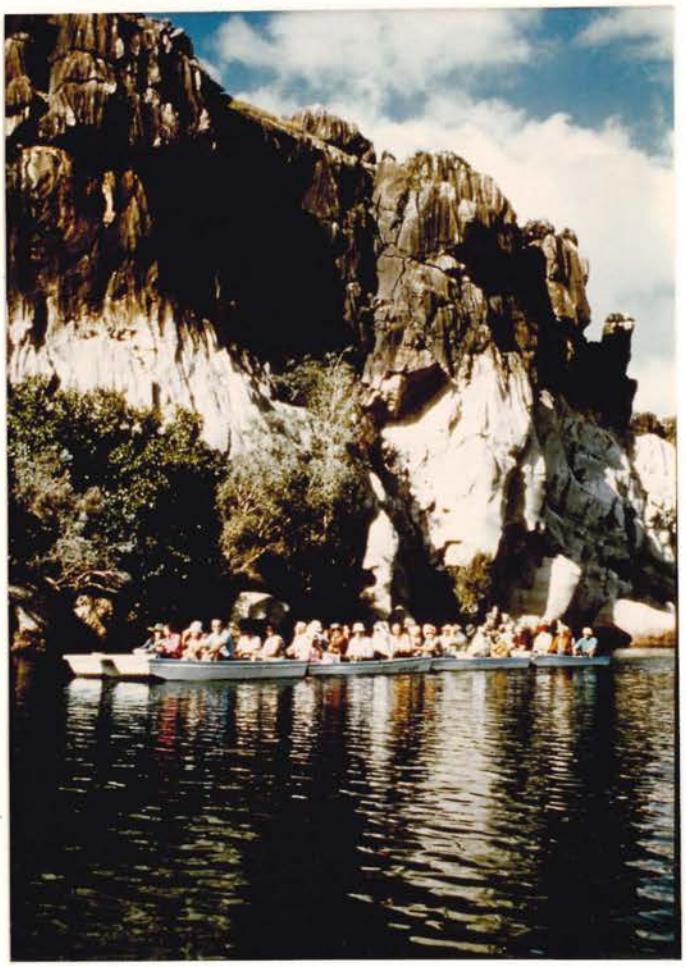


FIG. 22. Tourist party in Geikie Gorge National Park.

FIG. 23. Windjana Gorge National Park.

birds include White Egret (Egretta alba), Black-fronted Dotterel (Charadrius melanops), Darter (Anhinga rufa), Little Pied Cormorant (Phalacrocorax melanoleucos), White-faced Heron (Ardea novaehollandiae), Black Bittern (Dupetor flavicollis) and Nankeen Night-Heron (Nycticorax caledonicus). On the cliffs the Peregrine Falcon (Falco peregrinus) and the Brown-Breasted Shrike-Thrush (Colluricincla woodwardii) are found. Other birds include the Barking Owl (Ninox connivens) and Blue-Winged Kookaburra (Dacelo leachii). The pools contain four species of freshwater fish - an undescribed Rainbow Fish (Nematocentris sp.), Bony Bream (Nematalose erebi), Spangled Perch (Terapon unicolor) and an undescribed Archer Fish (Toxotes sp.).

The Windjana Gorge area is of both aboriginal and historical interest. The large cave near the eastern entrance is decorated by numerous paintings of men and animals, the main figure being an impressive Wandjina. It is also the site of an aboriginal uprising led by the Bunaba tribesman Pigeon (Sandamara). Pigeon's first victim, Constable Richardson, was murdered in October 1894, just 215 m east of the Gorge at Lillimilura Police Station, the remains of which still stand. Later, the stockmen Burke and Gibbs were killed at the entrance to the Gorge.

Recommendation :

The Committee endorses the status, purpose and vesting of the Windjana Gorge National Park.

Tunnel Creek National Park

Tunnel Creek National Park is Class C Reserve No. 26890, under the control of the National Parks Authority. Tunnel Creek flows through the Napier Range in a large natural tunnel eroded through the limestone by the stream itself. This is an unusual physiographic feature, and of interest to geomorphologists and geologists, apart from its tourist appeal.

The tunnel contains five species of bats : the Ghost Bat (Macroderma gigas), Bent-wing Bat (Miniopterus schreibersii), Little Bat (Eptesicus pumilis caurinus), Orange Horseshoe Bat (Rhinonicterus aurantius) and Douglas' Bat (Eptesias douglasi). The creek contains fours species of fish: an undescribed Rainbow Fish (Nematocentrus sp.), the Bony Bream (Nematalosa erebi), Spangled Perch (Terapon unicolor) and Fork-tailed Catfish (Neosilurus glencoensis).

Like Geikie Gorge, Windjana Gorge and other sites in the Oscar-Napier, Tunnel Creek is on a route used increasingly by tourists. Its unusual formation and its historical associations with the notorious aboriginal Pigeon (who hid from his pursuers in the tunnel), have attracted many visitors.

The immediate problem is one of management, especially preservation from damage by visitors or as a result of "improvements".

The Committee is opposed to any improvements, especially lighting, which would disturb the colonies of bats that inhabit the tunnel; the Ghost Bat (Macroderma gigas) in particular requires total darkness for its diurnal refuge.

Recommendation :

The Committee endorses the status, purpose and vesting of the Tunnel Creek National Park.

Brooking Gorge

Brooking Gorge is regarded by some people as even more beautiful than Geikie Gorge (Fig.7.24). A long narrow gorge which has been eroded by Brooking Creek, it contains permanent pools of freshwater bordered by a dense growth of Ficus racemosa, Nauclea coadnatus, Melaleuca leucadendron, Pandanus aquaticus and other trees.

Birds recorded include the Black Duck (Anas superciliosa), Restless Flycatcher (Myiagra inquieta), Bar-shouldered Dove (Geopelia humeralis), Peaceful Dove (Geopelia striata), and Great Bower-bird (Chlamydera nuchalis).

Brooking Gorge lies within Brooking Springs Station and is about 16 km from Fitzroy Crossing. As it is accessible by a good track and close to Geikie Gorge the number of visitors may be expected to increase greatly in the future.

At present, however, it is visited only by an occasional tourist bus and about 3 or 4 cars each day during the dry season. The lessee of Brooking Springs Station does not discourage tourists but is understandably apprehensive about the effects of increasing numbers of visitors on his lease. Brooking Gorge is fenced out of the station and cattle are denied access to it.

The Committee wishes to record its appreciation to the lessee of the Station for his efforts in preserving Brooking Gorge in its present condition.

Recommendation:

The Committee recommends that negotiations be undertaken with the lessee of Brooking Springs Station with a view to declaring Brooking Gorge as a Class B Reserve for the purpose of National Park, and vesting it in the National Parks Authority.

FIG. 24. Brooking Gorge.

Oscar Range

The Oscar Range is one of a series of low elongate ridges that rise abruptly from grassy alluvial plains to the north of the Fitzroy River. The range is composed of a central west-north-west trending ridge of Precambrian schist and gneiss that is flanked to the north and south by narrow belts of Devonian limestone. The topography, particularly in the limestone belts, is rugged, with impressive cliffs rising above the plains, canyons and karst features. Numerous springs in the limestone terrain lined with Pandanus and vines and covered with water lilies are peaceful enclaves in an otherwise harsh environment. Caves are abundant and contain aboriginal paintings.

The Oscar Range lies within the pastoral leases of Brooking Springs, Fairfield and Leopold Downs. Springs in the range are important water resources for the pastoral industry and water is piped to storage on the plains below. However, the range country has low grazing potential and is a terrain in which mustering is difficult and which provides a refuge for vermin such as donkeys.

The main conservation requirements are the preservation of the springs and the aboriginal paintings. This may be best achieved by designation of small reserves around springs with fencing to limit access by stock and by construction of barriers to control access to caves. Water supply requirements of the pastoral industry should be met. Public access is presently limited to the road which cuts across the eastern part of the range between Leopold Downs and Fitzroy Crossing. This is satisfactory and efforts to create a reserve for recreational purposes would be counter to principal aims of conserving springs and cave paintings.

Lead-zinc mineralisation in Devonian limestones was first discovered in the Kimberley region in 1901 at Barker Gorge. In recent years several large exploration companies have sought other comparable deposits and currently (April, 1977) some 74 mineral claims are being investigated in the Oscar Range area, where suitable Devonian host rocks occur and some secondary lead and zinc minerals have been reported. The mineral prospects of the area have not yet been conclusively evaluated.

Recommendations :

It is recommended that :

a. the W.A. Museum be requested to make a survey of caves in the Oscar Range with the objective of proposing a conservation programme for important sites.

b. a survey be made of springs with the objectives of :

   (a) designating small reserves, and

   (b) reconciling conservation requirements and pastoral usage.

7.16 KING LEOPOLD RANGES

The King Leopold Ranges extend for some 300 km from Walcott Inlet in the north-west Kimberley to Margaret River about 100 km west of Halls Creek. They form a high marginal abutment to the Kimberley Plateau Province to the north and overlook lower ranges and the Fitzroy Plains to the south-west. Elevations are up to 950 m above sea level and relief is up to 300 m.

The Ranges consist mainly of white to pale brown cross-bedded quartz sandstone intruded by dark grey dolerite which provides a marked visual contrast on steep hillsides. Both the sandstone and the dolerite have resisted erosion more than adjacent siltstones and feldspathic sandstones and have given rise to a rugged terrain with a characteristic hogback topography. Sides of valleys are generally steep and have only thin soil cover supporting sparse vegetation, or are nearly vertical with precipitous bare rock cliffs. As a result, panoramic views of ranges, valleys and plains are obtained from many scarps.

Access to most of the Ranges is restricted by difficulties in road-building across the trend of the steep ridges. A graded gravel "beef road" from Derby towards Gibb River Station provides good access to the central King Leopold Ranges near Mounts Broome and Ord and a road from Fitzroy Crossing to Lansdowne Station exploits the gap where the Leopold River cuts through the Ranges. A good graded track runs roughly parallel to the Ranges from west of Fitzroy Crossing to join the beef road near Lennard River and this services Tunnel Creek and Windjana Gorge.

The area formerly covered by Bell Creek Station, centred about 17° 14'S, 125° 26'E, is close to the "beef road" mentioned above and is now vacant Crown Land. This block, of about 10 500 ha, would serve as a useful nucleus for a National Park encompassing some spectacular scenery in the mid-section of King Leopold Ranges. If adjacent land on Mt Hart Station to the west-north-west becomes available it should be investigated with a view to possible acquisition and addition to the proposed Park so as to include Mts Bell and Vincent, perhaps as far as Inglis Gap. South-east of Mt Bell the road makes an abrupt turn beneath a cliff more than 50 m high in which intensely folded and overthrust beds of massive sandstone are exposed. These provide a spectacular example of the effects of mountain building movements and rock-deformation.

Immediately south of the former Bell Creek Station, a massive sandstone outcrop 844 m above sea level forms Bold Bluff (Fig.7.25), an impressive land mark within the Ranges and, if possible, this area should be included in the proposed Park.

The hills in this area support a low open-woodland with Eucalypt species dominant, especially Woollybutt (*E. miniata*) and *E. tectifica*. Other trees include Baobab (*Adansonia gregorii*), *Lysiphyllum cunninghamii*, *Erythrophleum chlorostachys*, *Terminalia*, *Buchanania*, *Hakea arborescens*, *Grevillea mimosoides*, etc. In sheltered or watered valleys and along creeks the open-forest vegetation becomes more diverse, including *Eucalyptus* sp., screw pine (*Pandanus* sp.) fan palm (*Livistona* sp.), *Albizia lebbek*, etc. Bold Bluff is the only known locality for the cycad *Cyas furfuracea* and is the type locality for two species of restricted distribution, viz. *Acacia gracillima* and *Solanum leopoldensis*. Mt Bell is the only known locality for

FIG. 25. Bold Bluff, King Leopold Range.

Pityrodia obliqua, the only species of the genus in the Kimberley.

The fauna of the area is diverse. Mammals include the rare Rock-haunting Ringtail (Petropseudes dahli), Sugar Glider (Petaurus breviceps), a rock-wallaby (Petrogale sp.), Antelope Kangaroo (Macropus antilopinus), Euro (Macropus robustus), Water Rat (Hydromys chrysogaster) (Bannister, 1969) and the Brindled Bandicoot (Isoodon macrourus) (J. Nelson, pers. comm).

Recommendations :

The Committee recommends that :

a. the vacant Crown Land formerly leased as Bell Creek Station be declared a Class B Reserve for the purpose of National Park and vested in the National Parks Authority of W.A.,

b. if a suitable opportunity occurs, land adjacent to the south and west-north-west be acquired and added to the proposed National Park.

7.17 GEOLOGICAL SITES

The Committee recommends that the following areas be investigated by the proposed Geological Sites Committee to assess their geological importance :

Brutens Yard (Cherrabun Station - 18°43'S, 125°37'E)

Sixty km south of Fitzroy Crossing this area includes the type section of the Permian Noonkanbah Formation, a sequence of shale, siltstone, limestone and intraformational conglomerate.

Bugle Gap (Gogo Station - 18°40'S, 126°05'E)

This site is scenically attractive as well as containing exposures of a Devonian reef complex, including the richly fossiliferous basin facies. The Gap is about 11 km west of Old Bohemia Downs Homestead.

Fairfield Quarry (West Kimberley Research Station - 18°04'S, 125°25'E)

This quarry, 20 km west of Fitzroy Crossing, is reported to be a key fossil locality in the Upper Devonian Fairfield Formation, a complex of limestone breccia, calcarenite, sandy and silty limestone, marl and sandstone.

Gantheaume Point (Broome Townsite - 17°59'S, 122°11E)

The point below Broome Lighthouse is formed of continental and marine Cretaceous sandstones and siltstones, some bedding planes of which exhibit well-defined dinosaur footprints. Marine erosion will destroy some fossils but may be expected to expose others and provide material for continuing studies.

Mount Hardman (Liveringa Station, 18°18'S, 124°39'E)

About 28 km north-west of Noonkanbah Homestead in the Fitzroy Valley this area contains the type locality of the Hardman Member of the Liveringa Formation from which important fossil collections have been made.

Mount Wynne (Liveringa Station, 18°02'S, 124°31'E)

Twenty-seven km east of Liveringa Homestead this locality contains type sections of Lower Permian formations, including exposures of the fossiliferous Nura Nura Member of the Poole Sandstone.

Prices Creek (Christmas Creek Station, 18°39'S, 125°55'E)

This area, situated 23 km north of Christmas Creek Station, includes the type sections of the only undoubted Ordovician strata known to be exposed in Western Australia. Rich fossil collections have been described from the locality.

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INTRODUCTION

In this Report the Conservation Through Reserves Committee of the Environmental Protection Authority recommends to the Authority a system of reserves which, if suitably managed, will conserve examples of the principal environmental and scenic variety in Western Australia, thus providing for public enjoyment, education, and relaxation among the many facets of the natural landscape. These reserves are chosen to provide an integrated pattern of national parks and reserves of equivalent status, so that the needs of a growing and active population will be met in the latter part of this century and beyond.

In presenting its Report, the Committee is confident that if its proposals are adopted, Western Australia will possess a planned system of conservation reserves adequately representing the variety of nature in a manner unsurpassed in Australia. Environmental planning in Western Australia has come early enough, by comparison with the selection of land for other uses, to enable the conservation of a representative selection of environmental types. Development is nevertheless accelerating so rapidly that the Committee finds it necessary to advise that early action must be taken on its proposals if this aim is to be achieved.

As a result of its considerations, the Committee makes recommendations that a further 86,000 km^2 be added to existing conservation reserves. These recommendations do not include consideration of the Darling and Kimberley Systems which are to be the subjects of separate reports.

The aggregate of the areas of both proposed and existing reserves described in the Report represents approximately 6.8% of the area so far reported on by the Committee, but this percentage is not distributed evenly throughout the State. For example, the relatively high percentage of the State's land recommended as conservation reserves in the South West and South Coast regions (see table on page 0- 7) reflects not only the scientific importance of these areas but also their potential for recreational use in the near future. On the other hand, the relatively low percentage of land recommended for new conservation reserves in the wheat belt is the result of the scarcity of uncommitted bushland in this area due to clearing for agriculture.

To provide a frame-work for assessment the Committee divided the State into 12 Systems (see Figure 0.0), each representing a natural and demographic entity. Each proposal for the creation of a reserve was appraised on the following bases:

1. The area's recreational and scientific values;

2. whether it is needed to augment the present pattern of conservation reserves within or adjoining the System that contains it;

3. whether it is representative of the natural features of the System;

4. the presence within it of unique or spectacular natural features;

5. its location in terms of current and future likely use based on projected population growth and distribution;

6. any conflict of potential use (e.g.. whether the area proposed has mineral, agricultural/pastoral, or urban potential and how this should be evaluated against its conservation value); and

7. its status (e.g. whether it is an existing reserve, a reserve recommended by an earlier committee, a new proposal or whether vacant Crown land, leasehold, or freehold).

Conservation Reserves: National Parks and Nature Reserves (Wildlife Sanctuaries)

The International Union for the Conservation of Nature and Natural Resources (IUCN) has defined a National Park as:

"..... a relatively large area

1. where one or more ecosystems are not materially altered by human exploitation and occupation, where plant and animal species, geomorphological sites and habitats are of special scientific, educative and recreative interest or which contains a natural landscape of great beauty; and

2. where the highest competent authority of the country has taken steps to prevent or to eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment; and

3. where visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreative purposes."

The IUCN describes similar areas from which the public is excluded as National Nature Reserves.

These definitions do not differ in essence from those adopted by the Western Australian Sub-Committee of the Committee on National Parks and Native Reserves of the Australian Academy of Science in its report (see National Parks Report, 1962), which may be regarded as the starting point of the work of the Conservation Through Reserves Committee (see p. 0-6), although practice and existing legislation in Western Australia have somewhat modified the concepts. Thus in Western Australia the term "National Park" has been applied to some areas which do not meet all the above criteria, especially in terms of size. The official definition now employed is provided by the National Parks Board of WA in terms of the following criteria:

1. National Parks should be spacious land and water areas so outstandingly superior in natural qualities and beauty as to make imperative their preservation by Government for the enjoyment, education and inspiration of all people.

2. National Parks should be sufficiently large to permit public use and enjoyment together with the continuous effective management of their plant and animal communities.

3. National Parks should be adaptable to the type of management that can provide a wide range of opportunities for enjoyment, such as camping, picnicking, hiking, horse-riding and sight-seeing in a natural setting; such activities always to be consistant with the preservation of the characteristics or features that merited the establishment of a National Park.

4. National Parks will usually contain a diversity of natural resources, including fine scenery and features of scientific interest.

The term 'Nature Reserve' is not used officially in Western Australia. Any reserve vested in the WA Wild Life Authority or other reserve set aside wholly or partly for the Conservation of Fauna is termed a 'Wildlife Sanctuary'. The Wild Life Authority also controls reserves where hunting of declared game species (mostly ducks) is permitted in season. Such an area is known as a 'Game Reserve'. The WA Wild Life Authority has power to prohibit public access to its reserves but has exercised this power in only a very few cases (e.g. Dorre Island) and the public is permitted access to most wildlife sanctuaries.

Under the Land Act, reserves may be set aside for the Conservation of Fauna, the Conservation of Flora or for a combination of both purposes. No statutory authority or board is automatically responsible for reserves set aside solely for flora conservation.

In this report most areas are recommended for control by either the National Parks Board of WA or the WA Wild Life Authority. In each case we have assumed that management will provide both for plants and animals as interdependent parts of natural ecosystems. In general we have recommended areas for control by the National Parks Board of WA where, in addition to wildlife, the land contains features of outstanding attraction to the general public. If wildlife conservation is the primary purpose of the reserve, the Committee has recommended control by the WA Wild Life Authority.

In this Report the term 'Conservation Reserve' includes National Parks, Wildlife Sanctuaries and other areas with similar functions.

We support the views expressed in the National Parks Report, 1962, that the needs of the general public and the scientific worker and naturalist will only be achieved when there is a planned system of parks and reserves combined with efficient management. Without planning and proper control, parks and nature reserves soon degenerate by losing their natural charm and their value is lost both to the tourist and the naturalist.

Summary of Recommendations

Appraisals of, and recommendations on, Systems 1 to 5 and 8 to 12 are presented in Sections bearing individual System numbers. System 6 (Darling) and System 7 (Kimberley) are not included here. In the case of System 6, the complexity of conflicting demands for land use required a broader range of expertise and greater time

for appraisal than has been available to the Committee so far. System 7 has been left in abeyance because of inadequate data. Recommendations on these two Systems will be presented at a later date.

The figures in the table 0.7 show the available vacant Crown land in each System and indicate the pattern of land commitment in this State. It follows from the small percentages for conservation reserves in Systems 4 and 10, and the low figures for vacant Crown land in these Systems, that human use has already so modified most of the natural ecosystems in them that it is now too late to establish additional viable conservation reserves without major acquisition of freehold or leasehold land and prolonged restoration programmes. This is not the situation in most other Systems where greater areas of vacant Crown land are available.

The high percentage of land recommended for conservation reserves in Systems 2 and 3 (western and eastern south coast) expresses the projected recreational needs of the growing population. It is probable that these areas, together with Systems 1 and 6, will be the main recreational zones, but there is also a need for additional recreational facilities in parts of Systems 5, 8 and 9. The Committee also sees a need for further reserves in System 11 (Goldfields) but it has been unable to recommend exact areas because of lack of data.

Historical Background

In 1958 the Australian Academy of Science appointed a Committee on National Parks and Nature Reserves to provide information that might lead to the establishment of a comprehensive system of reserves for the Australian continent. The Committee, in turn, established State sub-committees to determine what had already been done, what was being done and what should be done to have adequate land set aside for National Parks and Nature Reserves. The Western Australian sub-committee presented a report to the Academy in 1962 (National Parks Report, 1962) which contained a historical survey of nature reserves in Western Australia, a list of existing nature reserves and an interpretation of the legal position in relation to security of reserves. But, most important, the sub-committee saw the need for a pattern of reserves to be representative of 'all major communities of natural wildlife and scenery types in Western Australia' and selected new areas towards this end. (This report was published in Western Australia as "National Parks and Nature Reserves in Western Australia", 1965.)

The Academy sub-committee recognised that likely future expansion of pastoral and agricultural interest would place many animal and plant communities in danger of extinction, and would also greatly change the scenic landscape. They also anticipated that patches of original bush would one day be 'things to remark upon', and that families would need more natural areas for recreation in the future.

SYSTEM NO.	SYSTEM NAME	TOTAL LAND AREA (km^2)	VACANT CROWN LAND (km^2)	EXISTING RESERVES (km^2)	PROPORTION OF SYSTEM IN EXISTING RESERVES (% Total Area)	PROPOSED ADDITIONAL RESERVES	TOTAL EXISTING AND PROPOSED RESERVES (km^2)	PROPORTION TOTAL AREA IN EXISTING AND PROPOSED RESERVES (% Total Area)
1	South-west	3970	96	232	5.8	40	272	6.9
2	Western South Coast	18460	1469	2098	11.6	220	2318+	12.6
3	Eastern South Coast	49690	14320	6628	13.3	891	7519	15.1
4	Wheatbelt	134809	3436	1459	1.1	533	1992	1.5
5	Northern Sandplains	44520	6178	3553	8.0	420	3973	8.9
6	Darling	25470	411	-	-	-	-	-
7	Kimberley	302580	37129	-	-	-	-	-
8	Pilbara	271750	59172	9736	3.6	4690	14426	5.3
9	Central West Coast	94910	4133	238	0.3	8088	8326	8.8
10	Murchison	208370	5409	0	-	4000	4000	1.9
11	Coldfields	295100	79114	3284	1.1	3925	7209	2.4
12	Desert	947280	704345	26583	2.8	63450	90033	9.5
Western Australia		2,396,900	915,212	53,811*	2.6*	86,257*	140,068*	6.8*

* 1. Excluding Systems 6 and 7.
2. Existing Reserves includes reserves of various purposes, classes and vestings and also includes State Forest areas included in recommendations.
3. Proposed Reserves includes vacant Crown land, leasehold and freehold land, Figures for existing reserves are accurate. Figures for proposed reserves include a number of estimates, e.g. In System 10 two reserves of at present unknown size are recommended and it has been assumed that each will be 2,000 km^2

\+ Does not include an area of about 250 km^2 foreshadowed in a proposal to establish a National Park for conservation of wet sclerophyll forest.

In selecting areas for reserves the sub-committee declared that it had not been influenced solely by the needs of scientific workers. 'The wild life and scenery of some of these areas', they wrote, 'is so remarkable that they clearly form part of the heritage of ordinary people and, no matter what is scientifically desirable entry will ultimately be demanded to them'. In consequence, the sub-committee noted the danger inherent in uncontrolled public use and made recommendations for the protection and management of reserves in order that public use could be balanced against the purpose for which the reserve was to be set apart.

The Western Australian sub-committee's primary objective was to select reserves which would preserve biological communities for all time. In many respects, the National Parks Report was a landmark in the history of conservation in Western Australia, not only through the establishment of some new reserves but also because it recognised the need for a pattern of reserves representing all natural ecosystems and scenic types. Although a number of its recommendations were acted upon by the Minister for Lands, conflicting interests impeded the implementation of others.

In 1969 the State Government appointed a committee - The Reserves Advisory Council - with terms of reference to:

1. consider ways and means of protecting natural scenery in Western Australia;

2. consider all matters relating to National Parks and relative reserves;

3. consider existing legislation in Australia for the protection of natural scenery; and

4. recommend appropriate action in relation to the foregoing and legislation, if necessary, to achieve desired objectives.

During 1969 and 1970 the Reserves Advisory Council recommended the creation of a number of reserves, resulting in the establishment of such areas as the Victoria Desert Wildlife Sanctuary and the Chichester Range National Park. Recommendations for the reservation of other areas, such as the Drysdale River region, were not implemented.

In December 1971 the Environmental Protection Authority (EPA) was established to, among other things, 'consider and initiate the means of enhancing the quality of the environment' (Environmental Protection Act, 1971, Section 29(a)). The Authority recognised that the establishment of an adequate conservation reserves system would be an important mechanism for achieving this objective. Accordingly, it established a Conservation Through Reserves Committee (CTRC), which met for the first time on February 15 1972.

The Committee comprises:

Dr W.D.L. Ride (Chairman), Director, Western Australian Museum
Mr J.F. Morgan, Surveyor General of Western Australia
Dr B.E. Balme, Reader in Geology, University of Western Australia; and

Professor R.T. Appleyard, Professor of Economic History, University of Western Australia.*

A full time Secretary was appointed.**

The terms of reference of the Committee are:

1. to review and update firm recommendations of the Western Australian Sub-Committee of the Australian Academy of Science Committee on National Parks in respect of National Parks and Nature Reserves;

2. to review National Parks and other significant reserves controlled by the National Parks Board of WA and the Pemberton National Parks Board, and large wildlife sanctuaries controlled by the WA Wild Life Authority.

3. to review areas recommended to the Minister for Lands by the Reserves Advisory Council;

4. to consider proposals for reserves submitted to it in writing by interested members of the public and organisations and by Local Authorities and State and Commonwealth Government instrumentalities.

PROCEDURE

The Committee established two main guidelines:

a) to recommend adequate reserves to secure the conservation of representative biological and geomorphic types occurring in Western Australia, as well as other features of special scientific significance, and

b) to recommend adequate areas of National Parks (additional to those in (a) above, where necessary) to meet project population growth, distribution and mobility.

The Committee's review function has been found to be indivisible from its initiating function, an indivisibility which is represented in the Recommendations made in this Report. In addition, public participation was not only necessary but essential. Accordingly written submissions were sought through advertisements in the Government Gazette and in the press. Organisations known to be interested in conservation were invited to make submissions and 103 submissions were received. Many dealt with more than one area and the Committee found itself assessing over

* Added to the Committee at a later date in his capacity as Convenor of the Technical Sub-committee.

** Mr G. Rundle was seconded from the Main Roads Department on January 24 1972 and on April 17 1974 was succeeded by Mr L. Goodridge.

200 separate areas additional to those previously reviewed by the earlier committees.

The Committee took the view that specialised technical knowledge was necessary to assess these areas. Accordingly, it established a technical sub-committee to consider all proposals in detail. The Committee comprised:

R.T. Appleyard, M.A., Ph.D., F.A.S.S.A., Professor of Economic History, University of Western Australia (Convenor)
A.A. Burbidge, B.Sc.(Hons.), Ph.D., Senior Research Officer, Fauna Research Branch, Department of Fisheries and Fauna
A.S. George, B.A., Western Australian Herbarium, Department of Agriculture
B.W. Logan, B.Sc.(Hons.), Ph.D., Reader in Geology, University of Western Australia; and
J.H. Lord, B.Sc., F.G.S., M.Aus. I.M.M., Director, Geological Surveys Branch, Mines Department.*

Although the technical sub-committee met frequently between August 1972 and June 1973, its members soon realised that the magnitude of the task demanded sustained effort. Agreement was therefore reached between EPA and relevant Government departments and the University of Western Australia, for members of the technical sub-committee to be seconded to the Department of Environmental Protection for up to three days each week between August and November, 1973, when they assessed all proposals. Since November 1973 the technical sub-committee has met frequently to prepare drafts for the Committee. Extensive travel was necessary to investigate submissions received. The advice and opinions of persons with special knowledge of the areas under consideration were also sought.

As mentioned above the State was divided into twelve Systems (see Figure 0.0) each representing, as nearly as possible, a natural and demographic entity. Existing conservation reserves in each System were drawn on maps, together with the additional areas under review as well as all new proposals. Each area was appraised on the basis of the seven criteria listed on page 0-3.

During the compilation of drafts the technical sub-committee has worked in close liaison with the Conservation Through Reserves Committee. Professor Appleyard was a member of both the technical sub-committee and the CTRC and he and the Secretary attended all meetings of the technical sub-committee. In addition, many of the recommendations contained in this Report were made only after full discussion at joint meetings of the CTRC and its sub-committee. However, the text of the final report and the recommendations that it contains are the responsibility solely of the CTRC and represent the unanimous views of that Committee.

* Mr Lord was represented at most meetings of the sub-committee by Mr R. Connolly, a Geologist of the Geological Surveys Branch, Mines Department.

Considerations

The Committee recognised the growing awareness in Western Australia, and throughout the world, of the pressures that man has imposed, and continues to impose, upon his environment, and of his recent determination to strike a balance between legitimate exploitation and preservation of resources. This awareness has been epitomised in the report of the United Nations Conference on the Human Environment held at Stockholm in 1972, some principles of which express the Committee's view of the importance of its task:

> Principle 2
>
> The natural resources of the earth including the air, water, land, flora and fauna and especially representative samples of the natural ecosystems must be safeguarded for the benefit of the present and future generations through careful planning or management, as appropriate.
>
> Principle 4
>
> Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitats which are now gravely imperilled by a combination of adverse factors. Nature conservation including wildlife must therefore receive importance in planning for economic development.

In supporting the ideals expressed by the United Nations Conference, the Committee has been deeply conscious of the need to provide adequate reserves to cater for the recreational requirements of present and future generations. Though many of the areas it has recommended for reservation may not be utilised for years to come, they must be reserved now before further inroads are made into their primitive state.

Throughout its work the Committee has been especially concerned that sufficient areas of native habitat be preserved and managed both for the preservation of animals and plants and for the enjoyment and education of the population. People gain inspiration from contact with nature, whether through recreation or study, and this can only be secured for the future people of this State by well-managed conservation reserves containing healthy natural ecosystems of sufficient size to withstand extensive human use.

The task of securing this land against other pressures is urgent and the Committee hopes that none will be misled, by the quantity of vacant Crown land which is indicated in Table 0-7, into thinking that there will still be opportunity for yet another round of assessment and recommendations. Whilst the Committee is sure that large areas of vacant land may be available in some remote parts of the State for some years, it finds from the experience of those of its members who had served on all three Committees over the last decade that, although a large number of hectares may remain available, they are not representative of much variety so that the opportunity for choice is not likely to remain for long.

A salient feature of the Western Australian economy is its reliance upon primary resources that require the use of land. Exports comprise mainly natural materials (ores and timber) or agricultural products (wheat and wool), and are the basis of the State's very favourable external balance of payments. Relative lack of industrial infrastructure is the main reason why the State has a very unfavourable balance of payments with other Australian States. This reliance on primary products, and especially growth in income from this source since 1962, when the National Parks Report was submitted, has led to the alienation of millions of hectares of virgin land for agriculture.

The main basis of growth, however, has been the exploitation of mineral deposits which occurred during the same period. Aside from investment of $1,600 million in infrastructure and mining equipment in the Pilbara alone, to pay for a complex of mines, railways, ports and towns, the mineral 'boom' has led to widespread exploration of the State. As a result, areas which hitherto had been untouched were surveyed and explored and, although only a minute fraction of the mineral leases was developed, the teams left widespread evidence of their activities in the form of cleared tracks, seismic lines, grids and campsites. But of equal environmental importance, they demonstrated that previously inaccessible areas were accessible and today an ever increasing number of people are moving in their tracks.

More recently, too, has come the impact of intensive timber industries on the forests of the south-west. In a single agreement (between the WA Chip and Pulp Co. and the State of Western Australia) a major part of the total area of the unique karri-marri forests of Western Australia will be harvested in a manner that will drastically alter their present character.

In summary then, despite its isolation from the main-stream of world industrial development, Western Australia has experienced a decade of rapid economic growth initiated and sustained primarily by the exploitation of land for mineral and other natural resources. This has produced a marked effect on its physical environment - a process that in other parts of the world has led to widespread concern for the preservation and efficient management of natural resources.

Despite enormous direct investment in mining activities in the Pilbara, Eastern Goldfields and elsewhere, the major employment and investment multipliers have been felt in the Perth metropolitan area, whose population is the main potential user of National Parks. Even though population growth in the Pilbara quadrupled between 1966 and 1971, this represented an increase of only 21,602 persons. The population of the Perth area, on the other hand, increased by 144,378 during the same period. Whereas population growth in the State as a whole averaged only 2.5% during the early 1960's, it rose to 3.7% in 1965/66 and remained around this level until 1970/71. In one year, 1968/69, it was 4.3%, which was double the Australian average. Economic development associated with these rates has led to a steady increase in per capita income which, in turn, has meant more motor cars, more leisure (especially longer annual holidays), and better roads (e.g. a sealed highway from Perth to the Pilbara). Holiday makers are therefore ranging much more widely than was possible 15 years ago. In addition, the proliferation of four-wheel drive and "all-terrain" vehicles has opened up many areas still inaccessible to conventional vehicles.

The Committee is certain that uncoordinated and unplanned use will have permanently adverse effects on previously untouched areas. Furthermore the State's continuing development will inevitably impose further pressures on existing conservation reserves, if only because of increases in population and per capita income.

LAND USE

Agricultural, pastoral and silvicultural pursuits, mining, secondary industries and urban development are all contenders for land that may have conservational significance, and clear-cut criteria seldom exist for allocating land to competing industries. If the competitors are commercial, then relative profitability may be the decisive factor, but where a commerical venture is opposed to a conservational need there is no obvious common factor available for direct comparison.

There is, however, an increasing community acknowledgement that unique, beautiful or scientifically important features have a real value which, although difficult to quantify, must be recognised when there are conflicting demands for land use.

Providing that equally satisfactory areas can be found elsewhere, the Committee has sought to avoid recommending areas as conservation reserves which will lead to conflict with commercial interests. Where solutions of this kind have not always been possible the Committee has exercised its judgement.

Many submissions received by the Committee expressed concern at the possible environmental damage resulting from exploration and mining on present and future reserves. Some sought to ban mining on all reserves but most regarded only the Class A reserve as inviolate. In a similar manner much evidence presented to the 1971 Committee of Enquiry into the Mining Act related to the issue of mining and conservation.

While many other types of development are more generally devastating to the natural environment, mineral exploration and mining are often singled out as the prime destructive agents. By contrast agricultural development largely escapes public censure because it replaces bushland with an alternative man-made landscape of comparable attraction.

The question of mining on reserves has been a continual preoccupation of committees concerned with conservation and has been no less so with this Committee. At the present time, the dependence of the State's economy on mineral production demands the encouragement of mineral exploration. Such encouragement can only be real when the conditions attaching to the exploitation of a commercial deposit are known, in general, by private companies, before they begin the expensive and often unrewarding exploration phase of their activities. Some areas recommended as conservation reserves in this report have not been exhaustively explored for minerals. Recommendations in this report concerning them must therefore be viewed with knowledge of the attitude of the Committee in regard to exploration and mining in reserves.

The Committee is not currently opposed to mining in all conservation reserves. While mining may be disruptive, the disruption it

causes will depend on many factors, including the type of mine, the distribution of physical and chemical by-products of mining activitiy, the size and purpose of the reserve, its distance from populous centres and the concentrations of population necessary to support the mining operation. The decision to allow mining in a reserve is one for the community as a whole, which must assess its current priorities. Such priorities may change from time to time and no ad hoc committee can hand down irrevocable standards.

The Committee agrees with the Committee of Enquiry into the Mining Act (1971) to the extent that within the South Western Area (as defined in their recommendation No.8), prospecting and mining on existing and proposed A class reserves and National Parks should require Parliamentary approval. Unless explicitly excluded in the Committee's recommendations, these recommendations are made in the knowledge that elsewhere in the State exploration and mining are permissable in A class reserves as provided for under the existing Mining Act 1904-1968. Such exploration and any subsequent mining activity should be subject to safeguards provided under other legislation such as the Environmental Protection Act (1971). Such safeguards should as far as is practicable, be determined and made clear to all applicants before tenements are approved.

Where the Committee considers that mining or other forms of exploitation should not take place on a proposed reserve, it has made this clear in its recommendations.

Apart from mining other land uses within reserves that have been considered include agriculture, grazing, forestry, fishing, game shooting and private development. Thus, the proposed excision of the Shannon River drainage basin from the area to be harvested initially under the Woodchipping Agreement, and the establishment of Reserves in the Whicher Ranger and the Wonnerup-Ludlow area, were recommended only after discussing the likely effects on the timber industry with officials from the Forests Department. Similarly, recommendations concerning the future use of Dampier Archipelago take into account likely industrial and recreational activities accompanying development in the expanded Pilbara. Recommendations concerning the Abrolhos Islands and Shark Bay also took into account the needs of the fishing industry.

But the fact that discussions were held with various authorities does not imply that the personnel involved in them necessarily agree with the conclusions reached by the Committee.

Vesting and Management

As an integral part of each recommendation concerning the reservation of land, the Committee has included recommendations on vesting and management on the basis of existing legislation and currently responsible authorities. In addition, where certain preliminary tasks such as biological surveys were considered necessary, the Committee also nominated the appropriate existing body to be responsible.

The Committee's terms of reference did not permit recommendations on the creation of new or modified management authorities. This function was that of a Committee known as the National Parks Review Committee which met during 1972/73 and reported separately to the Minister for Lands.

So that the Committee's recommendations may be better understood, it is necessary that details be provided concerning the three principal management authorities to which the Committee has accorded roles:

The National Parks Board of Western Australia: This Board is constituted under the provisions of the Parks and Reserves Act, 1895-1963. It consists of six persons appointed by the Minister for Lands and currently employs one professional officer (the Director), the administrative staff and park rangers. In addition, the salary of a botanist attached to the Western Australian Herbarium is provided by the Board; he works on botanical problems associated with national parks. The Board also employs the Western Australian Museum to conduct biological surveys on its behalf.

The Western Australian Wild Life Authority: The Authority is constituted under the provisions of the Fauna Conservation Act, 1950-1970. It has eleven members, four of whom are ex officio; of the remainder, at least three are required by the Act to be biologists. The Chairman is the Director of Fisheries and Fauna. The Authority has no direct allocation of staff or finance, but its needs, including those of biological survey and reserve management, are met (and its decisions implemented) by the Department of Fisheries and Fauna. This Department has a staff of professional officers and fauna wardens as well as administrative staff. Like the National Parks Board, the Western Australian Wild Life Authority also contracts for biological surveys with the Western Australian Museum.

The Forests Department: This Department is responsible for the management of State forests which are located, in particular, in Systems 1, 2, 4 and 6. It has an active Wildlife Research Unit which is currently engaged in studying the relationship between forest management procedures and forest fauna. The Conservator of Forests is responsible for the administration of the Native Flora Protection Act, 1935-1938.

As well as the above bodies, there are a number of others which control land set aside as conservation reserves. These include the Pemberton National Parks Board and various Shire Councils.

The National Parks Report of 1962 expressed the view that the system of management at that time would be inadequate to meet the objectives it had set for the future. Apart from the great increase in numbers of professional staff working for the Western Australian Wild Life Authority since that time and the considerable strengthening of the means of administrative control of national parks (including control by rangers), the position today is much as it was then. In 1962 the Academy Sub-Committee wrote: "It appears that what is needed now is the development of a new policy towards obtaining for Western Australia a carefully planned reserve system, perhaps under the control of a single authority .... The duty of the controlling authority should be to protect and administer the reserves to

the best advantage both of the reserves themselves as natural areas, and for the public who may wish to visit and enjoy them" (National Parks Report, 1962).

When looked at in retrospect, this request for consolidation was obviously premature. In a mendicant state within a climate of general environmental unconcern, it was understandable that responsibility for conservation of reserves should continue to be delegated to understaffed departments whose personnel had other utilitarian functions and who, together with the National Parks Board, relied for professional knowledge of reserve management upon the expertise of voluntary members of committees.

Since 1962, however, the Western Australian Wild Life Authority and Department of Fisheries and Fauna have developed wildlife management to a level unsurpassed in Australia. Further, staff of the Wildlife Research Unit of the Forests Department has conducted detailed studies in forest management. The National Parks Board has advanced considerably its ability to control the public within its parks. Biological knowledge of parks and reserves has also greatly increased as a result of studies made by these bodies and the University of Western Australia, and as the result of surveys carried out by them and by the Western Australian Museum and the Western Australian Herbarium.

Reservation and management are insparable components in the process of conservation through reservation. The Committee's purpose is to recommend reserves, but if these recommendations are to achieve the ends of conservation in the public interest it is inescapable that the Committee must also state the need for management of the resource by a staff trained to high levels in the various fields of park administration and education, including natural and environmental science. The effort which the State must make should be commensurate with the fact that the National Parks and conservation reserves of Western Australia together constitute a land holding for a specific purpose larger than any other in the State apart from land set aside for use by aborigines.

In this regard, the Committee believes that reorganisation and rationalisation of the management of the State's conservation reserves is urgently necessary. Whether or not they are placed under control of a single authority is immaterial providing the responsibility for the outcome is accepted by the Government of the day as a public necessity and is delegated to an agency (or agencies) equipped for the task. Conservational management today is a sophisticated procedure that demands a dynamic attitude to the problems of constantly changing environmental pressures. It can only be effectively accomplished if, whatever managing bodies are set up, they are, themselves, responsible for the gathering, collation and interpretation of scientific data relating to the management of areas that they control, and are accountable for the outcome. In this they must be well equipped to cater for all appropriate aspects of human usage. In providing for popular use, management must be able to work towards creating an educated public enthusiasm and respect for the land and its wildlife.

Special Matters Considered by the Committee

In addition to ensuring that conservation reserves are planned and that, through them, adequate provision has been made for the establishment of recreational facilities commensurate with public demand, the Committee has had to consider other special aspects of conservation relating to the use of land. These were:

(i) the need for environmental control in some areas, even when these are not reserves;

(ii) the need for special safeguards over coastal lands and islands;

(iii) the need for legislative provision in the Forests Act, 1918 and amendments, to permit areas to be set aside within State forests to be Forest Parks having the same environmental security as National Parks but controlled and managed by the Conservator of Forests;

(iv) the need for new legislation to permit aquatic reserves to be set aside;

(v) the special problem of wetlands;

(vi) the problem of reserving sites of geological importance;

(vii) the special problem of road reserves and small reserves along roads;

(viii) remaining vacant Crown land;

(ix) future reviews.

Environmentally Controlled Areas: During its study of agricultural districts the Committee has become convinced of the great recreational value of the man-made rural environment. It believes that development in some outstanding areas of the rural environment should be controlled in the public interest as what might be called "scenic reserves". Although the Committee has not made specific recommendations giving boundaries to such "reserves", it takes the view in its report of the Naturaliste-Leeuwin Ridge (System 1, Area 1.4) that this is an area that must be treated in this manner. It is a landscape of great beauty in which the intermingling of reserves, forests and rural land provides an outstanding public asset. This asset is vulnerable to destruction through indiscriminate piecemeal development when it is permitted to proceed without regard to its total effect.

The Committee RECOMMENDS that the Environmental Protection Authority implement planning procedures to enable the Crown to:

(i) designate specific areas as "scenic reserves" irrespective of the ownership and nature of development of the contained lands; and

(ii) enable control of these by an authority to preserve the character and value of such areas.

The Protection of Islands and Coastal Lands:

(a) Islands: A large number of islands are found around the Western Australian mainland. Few are reserved and, when

the Committee came to consider the reservation of islands, it reached the conclusion that, while there is overwhelming argument for the reservation of some of them for the purposes of wildlife conservation, others will be of considerable importance for other public uses including recreation. But all islands are especially vulnerable and are very liable to misuse. Therefore, while the Committee has been unwilling to recommend that all islands be set aside as wildlife sanctuaries or National Parks, it is nevertheless convinced that islands require protection.

The problem is of considerable magnitude because of the many islands concerned. The list of official names of islands records some 320, but the actual number far exceeds this figure; these range in size from a few square metres at one extreme to Dirk Hartog Island of 62,000 ha and Barrow Island of 20,000 ha at the other. They occur off most stretches of the coast except in the Great Australian Bight.

South sea islands are, by reputation, idyllic but most Western Australian islands are very different from such imaginings. These offshore islands are small fragments of the mainland which have been isolated by rising sea levels during the past 8,000 years. They are mostly windswept and desolate, cold in winter and sun-baked in summer. The island faunas and floras are fragments of mainland biotas modified by island size, geology, soil and climate; they represent modified fragments of the fauna and flora of the adjacent mainland as it was at the time of its isolation. Thus, the surviving species on these islands give a valuable indication of the ecology and faunal composition of the adjacent mainland at the time of separation. They give insight into past climate and, most importantly, they give a clear indication as to what may happen in mainland reserves when these are limited in size by artificial boundaries and are deprived from direct contact with adjacent natural bush by altered and alien agricultural fields, or by similar man-made environments.

As well as being valuable natural laboratories, some islands contain unique species, subspecies, or varieties which are not found elsewhere. Some of the best known examples of island forms in Australian mammalogy are known to occur on Western Australian islands.

In addition, unlike the mainland, many Western Australian islands have not been directly altered by man through pastoral and agricultural activity or other development. In addition, few islands have had non-native animals introduced to them such as predators (e.g. dingo, fox and cat), herbivores (e.g. rabbits, goats and sheep) and rodents (such as the house mouse and ship rat). As a result of the lack of terrestrial predators on some islands, a number of mammals now extinct, or very rare, on the mainland, survive. In addition, ground-nesting seabirds have remained unmolested. Also vegetation has not suffered from mechanical damage or from browsing.

In Western Australia almost all islands still remain Crown land. Because islands are much in demand for public recreation, private homebuilding, sites of fishing clubs and tourist centres, or port sites, etc., the Committee anticipates that pressure to release

them for such purposes will become very great and for various environmental reasons it is clear that they are liable to degradation unless their use is carefully planned. The Committee takes the view that some form of overall protection should be applied to all islands so that any request to alienate an island, or to reserve it for some public purpose is carefully examined in the light of all environmental factors.

The Committee considers that this may be achieved through Section 54 of the Environmental Protection Act, although if it were considered desirable to avoid using that provision, it might be possible to gain adequate protection for islands through their creation as Class B Reserves under the Land Act for the purpose of the Conservation of Flora. Any request to the Minister to alienate such a reserve would, if the Minister agreed to permit the action, be reported to both Houses of Parliament and subject to disallowal. The Committee prefers the former alternative and therefore RECOMMENDS that all islands, presently Crown land, be protected under Section 54 of the Environmental Protection Act, 1971.

(b) Coastal Land: Coastal lands are also particularly vulnerable to environmental degradation and, because the coastline is one of the most attractive recreational parts of our environment, and the greater part of the population lives close to the coast, these lands are under heavy environmental pressure.

The seriousness with which the problem of conserving the coastal environment is regarded has led, in recent years, to official concern being expressed and some progress is being made towards its overall conservation. The Committee takes the view that coastal lands in the south-western portion of the State require urgent and special attention.

Today, increasing mobility of sand dunes, as well as the multiplicity of vehicle tracks and the presence of squatters, provides evidence of deterioration of many coastal lands. Though the causes of dune erosion are complex, there is no doubt that the construction of tracks to beaches and fishing spots, the use of all-terrain vehicles, grazing by domestic stock, and frequent burning have contributed to the present condition.

In addition, the siting of works, such as groynes and retaining walls, even with careful overall environmental planning and understanding of the physical factors which control coastal movement, can produce serious effects such as those which appear to have resulted at Mandurah and Busselton. The coastal movements in these areas have caused concern to owners whose properties have been endangered. Similar movement with less serious consequences has been observed in many other places along the coast.

In addition to the publicly owned foreshores and beaches, many areas, such as those between Leeuwin and Cape Arid, for example, contain reserves for such purposes as "common", "recreation and camping", and "excepted from sale". The Committee takes the view that all of these, together with the general health of the coastal environment are a priceless asset worthy of great public concern.

The Committee supports the view expressed by the Committee of Inquiry into the Mining Act (1971) which recommended that all prospecting and mining be prohibited, except with the consent of Parliament, in the lands and waters on the sea frontage from a point on the coastline marking the northern boundary of the Shire of Northampton (System 5) around the coastline to the eastern boundary of the Shire of Esperance (System 3), extending inland for forty chains from high water mark on the foreshore and, subject to constitutional limitations, extending seaward to the fifteen fathom contour line and also including the waters, the beds, and the beaches of all rivers and estuaries which flow through this coastal strip.

The Committee also supports the general conclusions of policy on this coastal strip which have been reached by the Environmental Protection Authority and the Environmental Protection Council. In particular, it draws attention to the statement by the Authority that:

> "The Authority considers that adequate management of the coastal strip not only as pertains to mining, but also to residential development, recreational use and the like, is of very great importance in total environmental planning in the State. It is expected that coastal developments will continue to dominate the residential needs and desires of the population. It is therefore apparent that the coastal strip must be adequately managed in order that, for example, recreational usage should not be so heavy or concentrated as to be self-defeating and destructive of the natural ecology. The Authority notes with pleasure the establishment by the Town Planning Department of a sub-committee which includes a representative of the Department of Environmental Protection, to investigate such problems further (Sand Drift and Sea Erosion Committee)."
> (Environmental Protection Authority, 1972)

The Committee welcomes the decision which the Environmental Protection Authority has taken towards making the coastline subject to Environmental Protection Policy under Section 39 of the Environmental Protection Act and hopes that the investigation which it is conducting towards this end, and which was initiated early in 1972, will receive all possible support to enable them to reach their conclusions.

In considering the details of coastal Crown lands in Systems 2, 3 and 5 the Committee has been impressed by the complex management problem which they present both concerning the control of human use and of the environment generally. The Committee has taken the view that even before the broader requirements of stated Environmental Protection Policy are formulated, there is need for immediate coordination and restraint at a local level. Accordingly, in respect of these Systems it has recommended that authorities be established (following study by a working group to define their terms of reference). These authorities would combine experience from both State and Local Government and would provide for local public involvement. As in the case of "scenic reserves" (see Environmental Controlled Areas above) the Committee RECOMMENDS that the Environmental Protection Authority implement planning

procedures to enable any authority, appointed as a result of these recommendations, to control the coastal strip and associated Crown lands allocated to it as a unit in order to preserve their character and value.

Forest Parks: In its consideration of forest areas in the South-West the Committee has been made aware of the special problems of managing reserves set aside to preserve forests and of the fact that the Forests Act regards forests as places set aside for the productionof timber. It makes no special provision for certain forests (or portions of forests) to be managed by the Conservator as reserves as though they were National Parks and set aside with the same degree of environmental protection and security of purpose as Class A Reserves for the protection of flora and fauna under the Land Act, or National Parks.

It is clear that the environmental health of such forests requires great expertise in all aspects of forest management and, while it is clearly desirable that, in due course, such expertise should also be available in all management authorities of reserves the expertise today rests exclusively with the staff of the Forests Department and the State should be able to take advantage of it. In reading this report, where it concerns forested areas, it should be remembered that its recommendations are constrained by what is possible under current legislation. The Committee has no doubt that the statutory powers of the Conservator should be broadened to enable him to manage forests set aside for recreational and reservational purposes other than the production of timber. The Act should also be broadended to secure areas within State Forests for this purpose. Accordingly the Committee RECOMMENDS that the Forests Act be amended to make provision for areas to be set aside within State Forests for the purpose of the conservation of fauna, flora and/or public recreation to be managed by the Conservator of Forests for these purposes; and to provide that the purposes of such areas, once designated, be only set aside by Act of Parliament in the same manner as is required for the emendation of purpose of a Class A Reserve under the Land Act.

Where, in this report, recommendations are made that an area of State Forest should be managed as if it were a National Park (see Shannon River Catchment, and State Forest 45 in the Leeuwin-Naturaliste Ridge) it is understood by us that these areas would be designated Forest Parks should the Forest Act be amended as is recommended here.

The above recommendation is made with the intention that areas which are currently State Forest can be taken out of production and dedicated for the conservation of flora and fauna and/or public recreation but still remain managed by the authority responsible for managing the adjacent or surrounding forest as a single unit. It is not the intention of the Committee that the Forests Department should become an authority to manage National Parks or Reserves containing forest where this is not State Forest, or where it is desirable for other reasons to exclude them from State Forest. It is expected that in due course, the authority responsible for National Parks would be equipped to manage such areas.

Aquatic Reserves: The need for aquatic reserves is widely recognised in Australia today. The argument for them is summarised in a statement by Dr. D.F. McMichael in the Report of the Australian Academy of Science on National Parks and Reserves in Australia (1968). The Conservation Through Reserves Committee has recommended in this report that a number of aquatic reserves be established. It has also recommended their control through the Fisheries Act because there is no other statutory provision which can be used for this purpose despite the fact that the Fisheries Act was intended to provide for the conservation and exploitation of commercially important marine life. The Committee is convinced that new legislation will be required to ensure protection of marine life generally, but the question must be asked whether control should be exercised in a manner similar to the Land Act - namely by vesting a defined marine area in a body and empowering it to regulate the use of the area, or whether control should be exercised in the manner of the Maritime Archaeology Act, 1973, which sets out to control the activity of persons within defined areas without vesting them. In view of the current constitutional problems concerning the control of the sea bed, the Committee has taken legal advice and concurs with the view that the second alternative is preferable. It believes that there is no need for the State to delay in preparing such legislation on the grounds that the sea bed question has not yet been determined.

Meanwhile the Committee has no doubt that partial control should be exercised through the Fisheries Act.

In cases where aquatic reserves are adjacent to coastal zones which are also reserves, control of the coastline may be obtained through the Land Act (for examples, see recommendation on Areas 9.1, Shark Bay, and 9.3 Ningaloo Reef Tract).

Control of marine areas requires special skills and the Committee takes the view that, initially at least, the State should make use of the skills, equipment and personnel of the Fisheries Department. It also draws attention to special problems created by the extensive use of SCUBA equipment in Western Australia. The Committee believes that the Environmental Protection Authority should consult the Council of Underwater Activities with a view to obtaining specific recommendations relating to problems arising out of the control of skin diving.

The Committee RECOMMENDS that the Environmental Protection Authority:

(i) obtains legislation to enable the proper control of aquatic reserves; and

(ii) seeks the cooperation of the Minister for Fisheries to obtain such control as is possible under the Fisheries Act for all aquatic areas recommended for conservation through reservation in this Report.

Wetlands: Wetlands (lakes, swamps, river and estuaries) are one of the scarcest resources in Western Australia and the conservation of waterfowl is dependent upon their preservation and maintenance. The conservation of wetlands is a matter of great importance. Special reference is made to wetlands in the reports on Systems 1-5.

The descriptions of the wetlands of the south-west refer particularly to their value to waterfowl and other water birds but it should not be forgotten that wetlands support a wide range of aquatic organisms. The Committee's recommendations on wetlands have been greatly influence by a report prepared by Dr. T.L. Riggert, of the Department of Fisheries and Fauna, which embodies the results of studies he has made over the past ten years.

Special problems arising out of the consideration of wetlands and their use result from:

(i) the need to maintain populations of waterbirds which move widely over a series of wetlands as these change due to weather conditions;

(ii) different species of waterfowl requiring different conditions for breeding so that a wide range of wetland is necessary;

(iii) the human use of adjacent lands which has caused an increase in the salinity of many waters in the south-west and consequent reduction of their ability to support species requiring fresh water;

(iv) the fact that wetlands are conserved for purposes which include recreational shooting. This activity is foreign to national parks and most reserves.

Western Australia's climate requires a general pattern of movement among south-western waterfowl. They disperse throughout the agricultural districts and goldfields to breed in the winter and spring and concentrate mainly in the coastal wetlands in summer where they are cropped by duck shooters. The result is that wetlands along the coast are of prime importance. It is in precisely these areas that wetlands are most affected today by drainage operations, sanitary landfill, reclamation and alteration.

The Committee concludes that, in addition to their importance as native species, waterfowl are an important recreational resource which require special conservation measures. Because of the mobility of the resource, these cannot be provided for by the maintenance of populations within special reserves. Provision must be made for waterfowl throughout their range by the special protection of bodies of water irrespective of the purpose of the land surrounding them. The use of this land may jeopardise the permanence and nature of wetlands and the Committee concludes that special provisions must be made to prevent further destruction of wetlands and to enable activities on land adjacent to them to be controlled.

The Committee RECOMMENDS that the Environmental Protection Authority -

(i) set up a special committee to examine legislative requirements for the special control of wetlands;

(ii) require all applications for Crown land surrounding wetlands to be referred to it.

Geological Sites: In 1962 the National Parks Report contained recommendations that 24 sites containing important geological features should be protected. These were the type-sections of geological formations, important features which are used for teaching purposes in the study of geology, and unique geological features of special scientific interest. It is clear that the number of sites known to the Sub-Committee could now be increased many times but the Conservation Through Reserves Committee does not have this information at present.

Moreover, the preservation of geological sites presents special problems of reservation and management. Some sites have deteriorated and, in a State with important geological resources, the preservation of principal reference features is urgent.

Sites such as fossil localities are particularly vulnerable to over-collection and the Conservation Through Reserves Committee takes the view that the Environmental Protection Authority should obtain information from a special committee to enable action to be taken.

In particular, the Committee RECOMMENDS that the Environmental Protection Authority seek the approval of the Hon. Minister for Mines for a committee to be set up with representatives from the Mines Department, tertiary educational institutions, learned geological societies, the Western Australian Museum, and commercial mining interests. The Committee should have the task to report and recommend as stipulated below. The Director of the Geological Survey Branch, Department of Mines, would be an appropriate Convenor.

It is RECOMMEDED that the Committee be asked to:

(i) prepare an inventory of geological sites in Western Australia which merit protection;

(ii) allocate priorities for the preservation of the sites;

(iii) review legislative provisions and recommend new legislation if necessary;

(iv) advise on management technique and the appropriate authority to control geological reserves where these are not already contained within national parks and reserves and protected thereby.

Reserves Along Roads: While the Committee has, in the main, been concerned with the reservation of areas of land large enough to preserve representative faunas and floras, it has also directed its attention to small uncleared areas of land,

and roadside reserves, which clearly play an important part in the preservation of the countryside. Such reserves are of considerable importance in the preservation of some species, especially those (such as some birds) which use the continuity provided by roadside vegetation and small reserves to permit them to move across what would otherwise be a hostile environment. Such areas also provide important stopping and picnic places for travellers.

Following the expression of considerable public concern about the need to preserve road verges, and especially their flora, the Government set up a Road Verge Committee which submitted its report to the Government in November, 1970. Two of the recommendations made in this report, which were subsequently accepted by Cabinet, are that:

(i) roadside flora areas should be provided at intervals along existing narrow road reserves; these areas should be selected in Crown land where possible, but the resumption of suitable areas of private land should be considered where necessary; and

(ii) a specialist committee consisting of a highway engineer, a botanist and a forester should be constituted to select and recommend suitable sites for these flora areas.

Subsequently, a sub-committee of the Road Verge Committee examined the State road system, allocated priorities for overall examination, and then selected the Newton-Augusta Road for a detailed pilot inspection in order to determine the feasibility of implementing the recommendations. This pilot inspection showed that there are three broad types of areas which influence not only road verge conservation, but the general landscape as seen by the road user. These are broad acre reserves, small roadside flora areas, and highway landscape features.

It was clear to the Sub-Committee that there are many problems relating to the manner in which such areas can be obtained and controlled, the main variables being size and the nature of tenure of desirable areas. For example, selected areas may be private property, Crown grant, conditional purchase lease, existing reserves vested in various authorities or vacant Crown land.

Taking into account the need to provide for such matters as flora diversity, floral vigour, uniqueness, value as shade and shelter, water features, and the contribution which areas make to the overall landscape, it became apparent to the Sub-Committee that, in many cases, resumption will be required. On classified main roads limited areas could be obtained by the Commissioner of Main Roads for purposes of road reserve widening or provision of roadside stopping places. However, as roads controlled by the Commissioner of Main Roads represent only approximately 8% of the State's total road system, the contribution from this source to effective roadside reserves of the State, whilst worthwhile, would be quite small.

There are many uncleared areas in alienated lands which contribute to an overall pleasant landscape. Typical examples are uncleared hilltop areas surrounded by totally cleared farmland. At present, there is no guarantee that these areas will remain uncleared. Therefore, provision must be made for some form of tree preservation order. Whilst such a provision would not deny the use of the land for grazing and shelter of stock, it would result in the preservation of the major vegetation contributing to the general appearance of the landscape. Apart from considerations of landscape and vegetation conservation, sensibly applied tree conservation orders could lessen potential for soil erosion.

One disturbing feature remarked upon by the Sub-Committee during its inspection of the Newton-Augusta Road was the extent of clearing which has occurred in recent years. Many uncleared areas shown on 1968 aerial photos, and considered as potentially suitable for protection, no longer existed when inspected early in 1974.

Work by the Sub-Committee to date indicates that to implement sound but realistic conservation measures could require many departures from long standing customs and procedures. Particularly in view of the decreasing availability of suitable areas, there is a need to establish as a matter of urgency firm Government policies with subsequent development of acquisition and funding procedures. The Conservation Through Reserves Committee RECOMMENDS urgent consideration be given to the report of the Road Verge Committee and to the implications arising out of the study of the Newton-Augusta Road by the Environmental Protection Authority.

Remaining Vacant Crown Land: Today, outside the Goldfields, Kimberley, Pilbara, and Desert Systems, only 2% of the State's land is vacant Crown land and this must be regarded as one of the State's most precious resources. If the Government accepts the view expressed in this Report, that reservation for conservation is an important form of land use for the benefit of the community as a whole, it should be a part of public policy to assess the conservational potential of any major area of Crown land when an application for its alienation is being considered.

The Committee RECOMMENDS that, in view of the statutory responsibilities of the Environmental Protection Authority, any application for the alienation of major areas of vacant Crown land should be referred to the Authority to enable it to assess its conservation potential, including recreation.

Future Review

The Conservation Through Reserves Committee was charged with the task of assessing for the Environmental Protection Authority the needs of Western Australia for conservation reserves. With the completion of its Report the Committee's work may be said to be ended. . However, it is clear from its work, and the work of the two committees that preceded it (one unofficial and

one official), that community needs are constantly changing in this area. Moreover, as data upon which needs are assessed continually accumulate, a more rigorous scrutiny of the problem is required. It is also our experience that the existence of more than one management body can lead to undesirable competition for land for a single public purpose and to conflicting advice.

The Committee RECOMMENDS that the task of advising the Government on its needs for further land for conservation through reservation should be the continuing responsibility of the Environmental Protection Authority, rather than any management authority, and that a permanent bureau be set up under the jurisdiction of the Environmental Protection Authority to monitor and assemble data for constant review.