IMPLICATIONS OF THE SHARK BAY REGION PLAN FOR CONSERVATION IN SYSTEM 9

Report and Recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
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SUMMARY

Shark Bay is an environment of State, National and International significance and conservation should be the major priority.

The environment at Shark Bay is so outstanding as to be worthy of listing for World Heritage on three separate criteria.

The Environmental Protection Authority is aware that the Government has followed the recommendations of the Draft Region Plan, and has established a committee to investigate and advise on the merits of having Shark Bay or parts of the 'Region' placed on the World Heritage List. The Authority supports this approach, and is prepared to offer appropriate assistance.

Shark Bay has natural environments and cultural features of extraordinary quality: the world's most extensive seagrass banks, rare stromatolites, hypersaline embayments, offshore island, spectacular cliffs, special plant communities, rare animals, one of the world's largest populations of dugongs, and the dolphins of Monkey Mia. Cultural heritage is outstanding and includes the site of the first landing of a European at Dirk Hartog Island, and sites associated with Vlaming, Dampier, St Allouarn, Baudin, Hamelin and de Freycinet. The ecological, scientific, recreational and cultural qualities lead the Environmental Protection Authority to reiterate its view that Shark Bay's specific environmental attributes deserve conservation and management as collectively they constitute a superb suite of cultural and natural phenomena.

The land and the sea in the centre of the Shark Bay region has long been recognised by the EPA - and endorsed by the Government - as a critical part of the System 9 proposed conservation reserves.

Land use in Western Australia is in three separate classes. There are reserves for conservation on one hand, heavily modified land for development on the other, and this leaves the majority of land still available for multiple use on the basis of sustained productivity.

. Reserves for Conservation

Those parts of the environment with highest conservation value are 'reserved' or set aside from development. Some of this is achieved in the Shark Bay Plan, and stromatolites, dugong areas etc. are likely to be protected. But the Plan does not allow for enough Reserves for Conservation. Only the northern parts of Edel Land and Peron Peninsula are reserved, and important and fragile land areas at Dirk Hartog Island and central and southern Edel Land are not conserved from grazing. They should be reserved.

In the Conservation Through reserves System in Western Australia other parts of the environment are reserved not because of their high conservation value, but because they are 'representative' of the natural ecosystems of that particular region. The Shark Bay Plan places insufficient emphasis on the need for this class of reserve. It proposes an addition to Cooloomia Nature Reserve but otherwise advocates ongoing pastoral use. Other representative areas should be reserved.

. Multiple Use

Most land in Western Australia is available for multiple use.

In those areas the land is changed or developed, but conservation values still take some priority. For example, oceans can be fished if fishermen do not permanently deplete fish stocks, or forests can be selectively logged if logging does not exceed the rate that new trees grow.

The Shark Bay Plan proposes that pastoralism, a form of land use which should maintain a stable though changed vegetation, be dominant virtually throughout the whole region. This is appropriate on a State-wide basis, but not in an area selected for conservation reserves. There must be a clear division between land that is 'reserved' and land that is available for multiple use including conservation. Conservation reserves and pastoralism are not compatible. But (other) land that has conservation value can be grazed under good management.

. Heavily modified land

The conservation value takes low priority to make way for development of towns, mines, roads etc. This is catered for in the Shark Bay Plan.

This balance between conservation reserves, heavily modified land, and multiple use is being implemented in the south-west of Western Australia, but there are outstanding conservation issues in the pastoral zone.

The Authority recognises that the Shark Bay Region supports a significant commercial fishery, salt harvesting and gypsum mining operations, and that the environment also attracts growing numbers of tourists drawn by the recreational fishing, the dolphins of Monkey Mia, and the remote coastal scenery. Under appropriate management most of these industries are compatible with the conservation of the Region's environment. The Authority also recognises the importance of involvement and commitment of the local community in planning and development of the Region.

Appropriate conservation measures could give a boost to the local economy, through the influx of visitors.

Pastoralism does support a number of families in the Region but the grazing pressure exerted by stock and feral goats has been a cause of environmental degradation. Substantial portions of four leases are unsuitable for pastoral use.

The Environmental Protection Authority concludes that the effect of continuing stock grazing of sensitive and valuable areas is not compatible with long term conservation.

The proposals for marine conservation in the Region Plan are compatible with the intent of Conservation Through Reserves. The Environmental Protection Authority has interpreted the Plan as indicating the need for a large marine park, with various zones of management. This approach has proven successful at the Great Barrier Reef Marine Park.

The Environmental Protection Authority commends the initiative of the regional plan, but at present the plan falls short of the conservation recommendations of the EPA. More land areas should be reserved for conservation, and some unsuitable pastoral lands protected from grazing.

The Authority recommends that the Shark Bay Region Plan be amended to clearly specify positive steps that will be taken to realise the primary objective of conservation of the important land environments in the region, and the intent of the previously endorsed framework of Conservation Through Reserves.

1. INTRODUCTION

The Environmental Protection Authority (EPA) has a long standing involvement in the establishment of a system of national parks and nature reserves in Western Australia through the Conservation Through Reserves Committee (CTRC) 'Green Book', and EPA 'Red Book' recommendations. These proposals form the basis for the conservation reserves of the State.

Shark Bay is recognised as having high significance for scientific, conservation, recreation, commercial and cultural reasons. It is the subject of EPA Red Book Recommendation 9.1 (see Appendix 1).

The Shark Bay Region Plan, prepared by the State Planning Commission and the Department of Conservation and Land Management is an endeavour to prepare a Planning Strategy which identifies and provides for the development, community and conservation needs of a region around Shark Bay (See Map 1).

This objective might be expected to achieve a fair balance for conservation, however, as the subject area was concentrated around the land and sea already recommended for reservation, rather than the broader area of System 9, the 'balance' was likely to lead to a de-emphasis on conservation reserves.

The Authority has taken the opportunity of the review of the Shark Bay Region Plan to consider the extent to which the proposals reflect the intent of the 'Red Book' Recommendation. Though prepared in the knowledge of public comments on the draft Shark Bay Region Plan, this report does not attempt to review public comments.

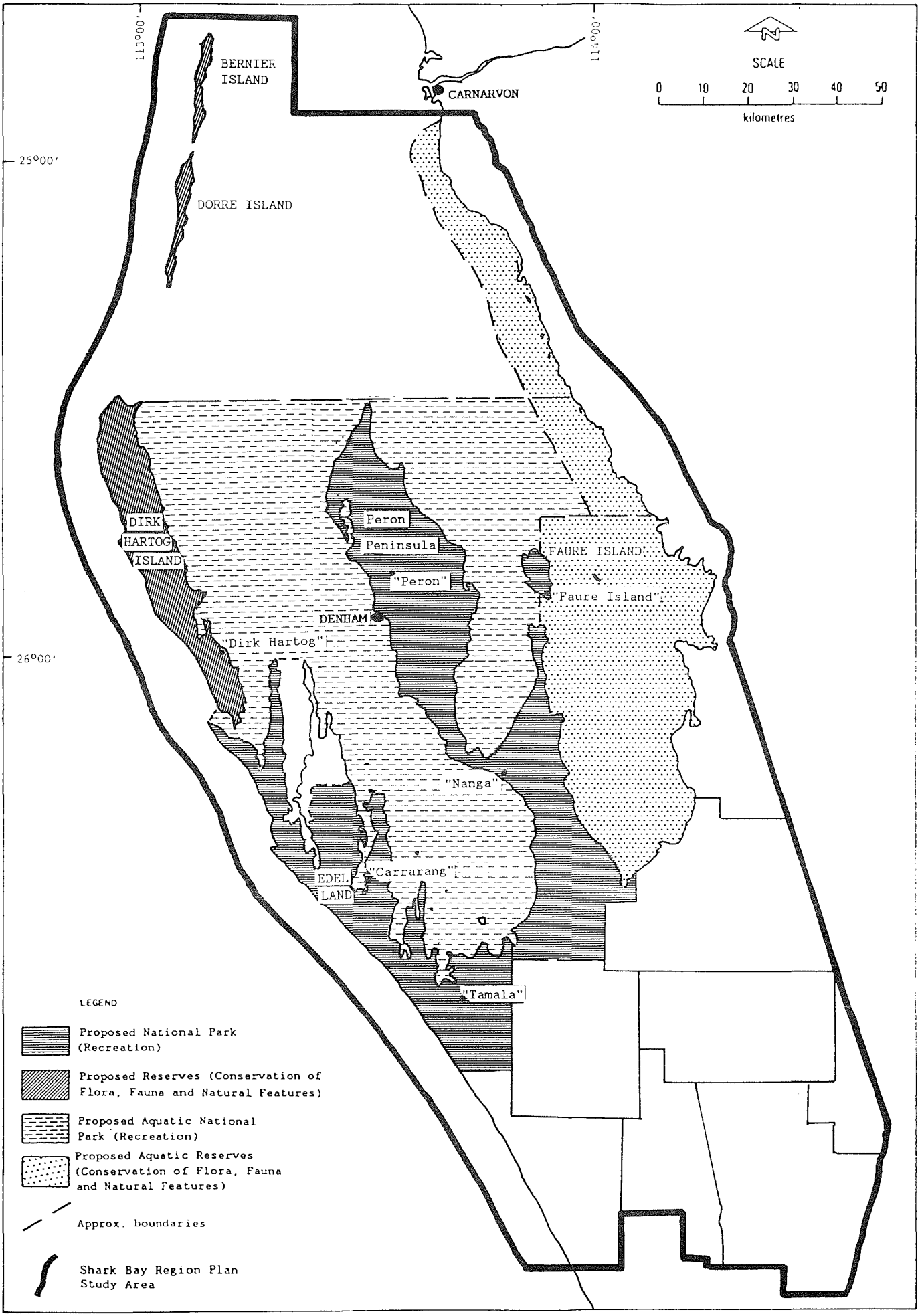
2. BACKGROUND - EPA 'RED BOOK' RECOMMENDATIONS

Shortly after its formation in December 1971 the EPA recognised that the establishment of an adequate conservation reserves system would be an important input towards "protecting and enhancing the quality of the environment". With this in mind, the EPA at its first meeting decided to appoint a Conservation Through Reserves Committee (CTRC) which among other things, was asked to review and update 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.

To provide a framework for its assessments the CTRC divided the State into 12 systems, the boundaries of which related as nearly as possible to natural geographic and demographic boundaries. The committee sought submissions from the public and private sectors and considered these submissions in framing its report and recommendations to the Environmental Protection Authority, which became known as the 'Green Book'.

The EPA subsequently sought comments on this 'Green Book' from the private and public sectors of the community. Such comments were considered essential inputs to the development of recommendations for consideration by Government.

The EPA's first report to Government as a 'Red Book', was produced in December 1975, titled 'Conservation Reserves for Western Australia as Recommended by the Environmental Protection Authority 1975 - Systems 4, 8, 9, 10, 11, 12.



Map I The Shark Bay Region Plan Study Area compared to the area recommended by the Environmental Protection Authority for Conservation

The recommendations in this report, which includes the Authority's recommendations for Shark Bay, were endorsed by State Cabinet in February 1976.

Red Books for Systems 1,2,3 and 5 were endorsed in October 1976, and for System 7 - the Kimberley, in September 1981.

Finally, recommendations for System 6 were endorsed by Cabinet in March 1984.

The overall process took some 12 years to complete.

To date some 65% of the recommendations, outside System 6, have been fully implemented. Cabinet requires that implementation of outstanding EPA proposals for conservation reserves be dealt with individually, and be the subject of separate and specific decisions by Cabinet.

The committee was aware that for its proposals to be accepted there would be a need to minimise conflict with other land users. In developing its recommendations, one of the guiding considerations of the Committee, as expressed in the 'Green Book' was:

> "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".

The EPA considers the Western Australian System of Conservation Through Reserves to be the cornerstone of conservation in this State. The selection of reserves was arrived at by striking a balance between land as conservation reserves, land as managed resource areas (conservative use) and land which is heavily modified (as defined by IUCN). The conservation reserves are both 'special' parts of the environment and 'representative' natural ecosystems and are set aside from development. The managed resource areas (eg State forest, pastoral areas) are usually modified in some way and although they may have 'representative' conservation values they do not in any way replace the need for conservation reserves. Heavily modified areas are towns, mines, roads etc.

In the absence of a conservation reserve system the pursuit of both conservation and development is constrained because there is no clear identification of what is 'special' or 'representative' in any potential development area. Hence a proper balance of conservation reserves are important for conservation and development alike.

3. A STATEWIDE PERSPECTIVE - CONSERVATION IN PASTORAL LANDS

3.1 PASTORAL LANDUSE IN WESTERN AUSTRALIA

The use of land for pastoral purposes was one of the first extensive forms of landuse practised in Western Australia by the European settlers. Pastoral leases were provided for under land regulations issued from London in the form of Colonial Office circulars in 1828 and 1829, to guide and regulate the allocation and development of Crown Land.

This historical precedence and the absence of competing landuses enabled pastoralism to become the major economic pursuit over large portions of the State. In this context, pastoral landuse dominates the Kimberley, Pilbara, Gascoyne, Murchison, Northern Goldfields and Nullarbor Regions of the State wherever vegetation has some grazing potential.

Approximately 430 pastoral leases account for 95 million ha, or 38% of the State. By comparison agriculture, the next most extensive landuse, occupies some 7.5%, and the total conservation estate is 5.6%, the bulk of which is located in large desert reserves.

The pastoral rangelands include some of the most fragile lands, inherently unsuitable for open range pastoral use. Serious degradation of soil, vegetation and natural water resources has often resulted from consistent and continuous grazing of pastoral leases beyond the capacity of the environment to recover. Often the most serious degradation has occurred on the more productive pastures as a result of intensive use. Thus the quality of the pasture is of itself not an adequate indication of suitability for open range pastoral use.

3.2 CONSERVATION RESERVES IN PASTORAL REGIONS OF WESTERN AUSTRALIA

Because the CTRC attempted where possible to avoid making recommendations which conflicted with pre-existing commercial interests, environments supporting vegetation with high pastoral value are under represented in the conservation reserve system. Where areas of important conservation and/or recreation significance existed on pastoral leases, and alternative areas were not available, the EPA recommended the purchase of the lease when it came on the market or failing this, reservation of the land when the lease expires, in the year 2015.

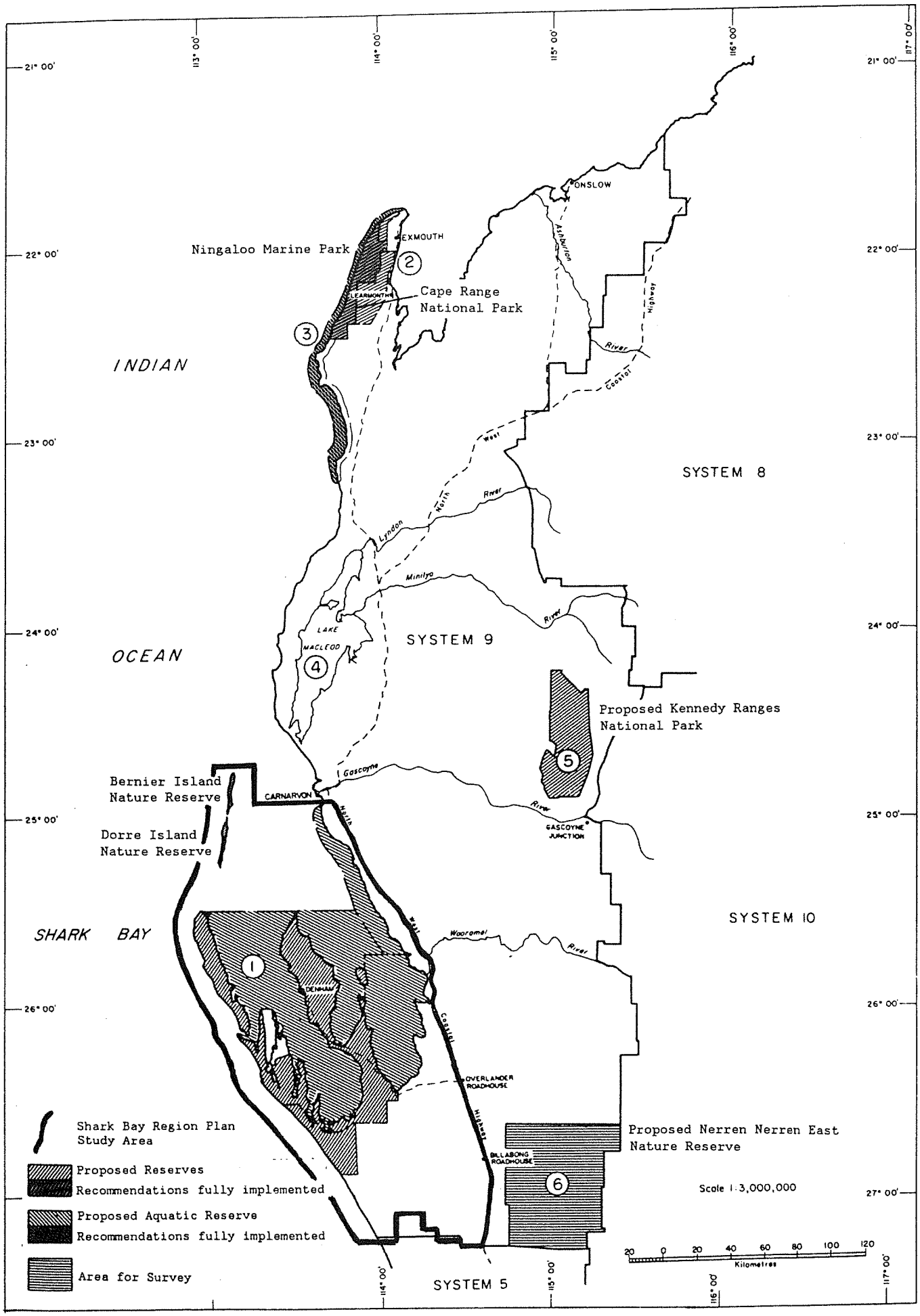
In support of this position the EPA noted in the preamble to the first 'Red Book' that:

> "We have not endorsed what has been called a 'land grab'. Such a move could well be counter productive to conservation where success is so dependent upon a sympathetic body of public opinion".

To date this course of action has been followed in implementing 'Red Book' Recommendations state-wide. Only one complete pastoral lease has been resumed for reservation. In this case Millstream Station on the Fortescue River was acquired under the Public Works Act, primarily to protect the area's water resources. However, the resumption enabled the (then) small Millstream National Park to be significantly enlarged. It should be noted, however, that in several instances areas have been excised from pastoral leases, following negotiated agreement with the lessee, so that reserves may be created. Negotiations with several other lessees are continuing in relation to further excisions or land exchange.

Given the small total size and scattered distribution of the conservation reserve estate, it cannot by itself effectively conserve the flora, fauna and range of environments present in the State.

It must be recognised in this context that pastoralists collectively, because of the vast size and continuity of pastoral lands, have a responsibility to maintain the condition of the rangeland environment if the flora and fauna of the pastoral lands are to be conserved in the long term.



Map II Map of System 9 showing boundaries of existing and proposed reserves as endorsed by Cabinet in 1976, and the Shark Bay Region Plan study area

This responsibility would be all the greater, however, in the absence of a reserve system providing a high level of conservation to outstanding and representative environments.

4. CONSERVATION AND PASTORAL LANDUSE IN SYSTEM 9

4.1 A REGIONAL PERSPECTIVE

EPA System 9 refers to the Central West Coast Region of the State, shown in Map II.

The total area of the system is approximately 94 910 km^2 of which pastoral leases occupy approximately 80%. Leases and reserves for mining salt and gypsum cover approximately 4 000 km^2.

System 9 by and large, is deficient in conservation areas. The only substantial reserves are:

- Cape Range National Park;

- Ningaloo Marine Park;

- Cooloomia Nature Reserve; and

- Bernier and Dorre Island Nature Reserves.

The total land area of these reserves is approximately 111 000 ha. This represents approximately 1.2% of the land area of System 9. The recently declared Ningaloo Marine Park includes a further 483 350 ha below the high water mark.

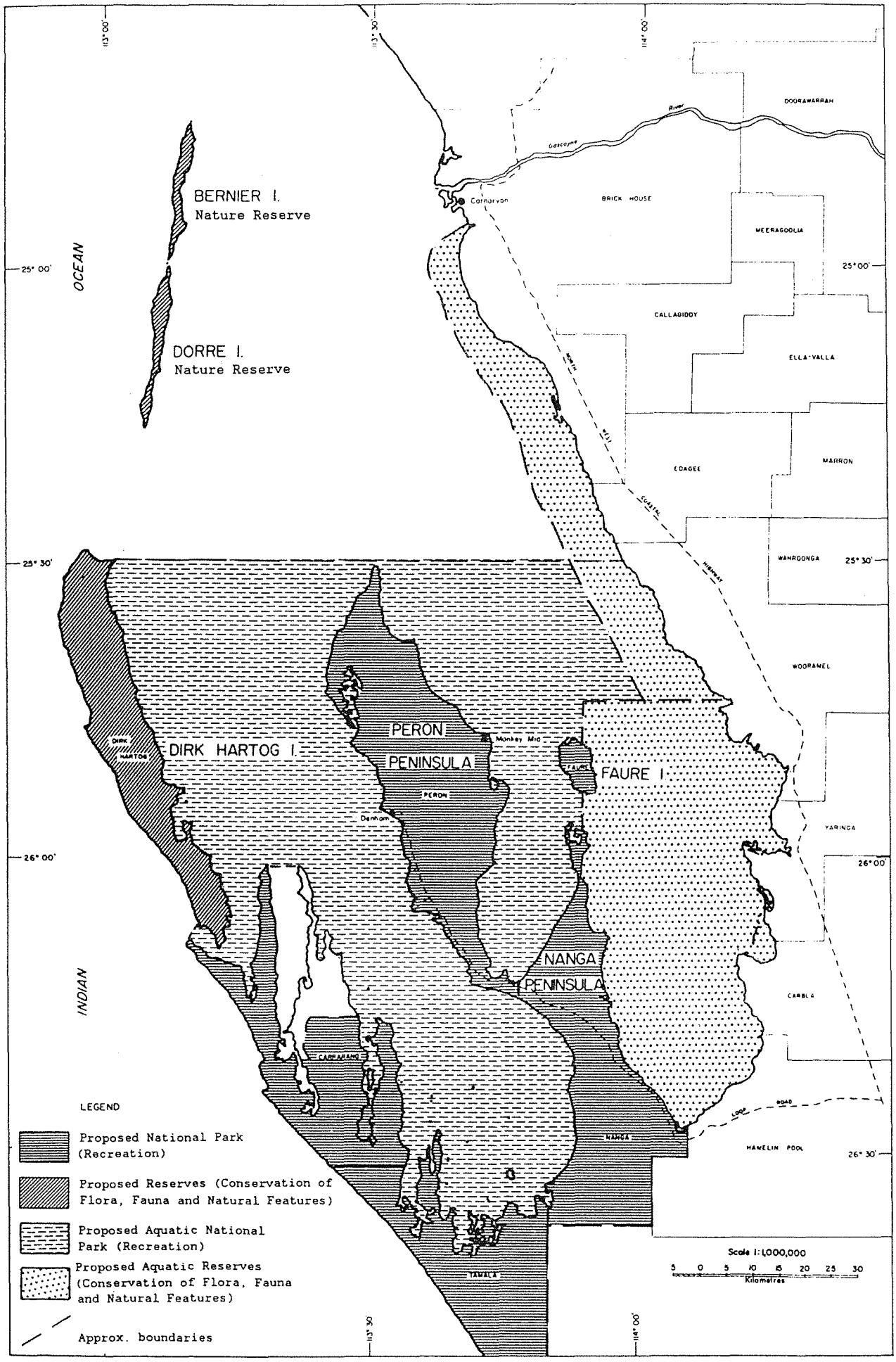
EPA 'Red Book' Recommendations for Shark Bay (9.1), Kennedy Range (9.5) and Nerren Nerren East (9.6) are yet to be implemented. The Kennedy Range comprises an elevated plateau of limited pastoral value, and Nerren Nerren East is vacant Crown land; both recommendations are well advanced towards implementation.

The 'Red Book' Recommendations for Shark Bay refer specifically to the area's marine embayments, and land areas occupied by six pastoral leases. (See Map III). Statistics for these leases are:

Table 1:

STATION	AREA (ha)	STOCK ON HAND (1984)*	
Carrarang	80 515	2918 Sheep	15 Cattle
Tamala	129 766	2370 Sheep	181 Cattle
Peron	105 200	8200 Sheep	-
Nanga	175 066	2700 Sheep	-
Dirk Hartog Island	61 674	3200 Sheep	-
Faure Island	5 816	1261 Sheep	-
TOTAL	558 037 ha	20649 Sheep	196 Cattle

* Source: Pastoral Board Records



Map III Shark Bay region, showing proposed reserves as endorsed by Cabinet in 1976.

In 1984, the year for which stock numbers are given in the Shark Bay Region Plan, the'Red Book' Recommendation area for Shark Bay carried just over 20 000 stock. This represents approximately 50% of the 40 000 stock in the area subject to the Shark Bay Region Plan.

The Shark Bay Region, moreover, contributes only a small proportion of pastoral production in the Carnarvon Basin which occupies an area similar to, though slightly smaller than, the full EPA System 9 area. In 1984 there were 50 leases in the Shires of Exmouth, Carnarvon and Shark Bay, carrying 515 000 sheep and 3 800 cattle.

Though some of the areas of pastoral lease at Shark Bay are regarded as being of moderate to high pastoral value, these ratings are relevant only to semi-arid rangeland grazing conditions.

Compared with the average carrying capacity of agricultural lands, pastoral areas are of very low value. At the 1984 stocking rate the pastoral leases at Shark Bay subject to 'Red Book' Recommendations supported approximately 1 sheep to 28 ha. By contrast improved pastures in the cleared agricultural regions of the State typically carry about 4 sheep to the hectare, a stocking rate greater than 100 times the intensity of the Shark Bay pastoral leases. The vast differences in carrying capacity mean that the 6 pastoral leases subject to 'Red Book' Recommendations for Shark Bay, occupying in excess of half a million hectares, carry the equivalent stock to just over 5 000 ha of improved pasture agricultural land, or approximately 5 average sized farms.

4.2 PASTORAL USE OF SHARK BAY 'RED BOOK' RECOMMENDATION AREAS

The pastoral value of the leases subject to 'Red Book' Recommendations at Shark Bay is addressed in Payne et al. "An Inventory and Condition Survey of rangelands in the Carnarvon Basin, Western Australia".*

This Report was a major source of information used in the preparation of the Shark Bay Region Plan. It recognises that:

> "At least three land systems currently alienated could not be economically developed for pastoralism, as the pastures they support are of extremely low carrying capacity. Alternative forms of landuse may be more appropriate. These systems are Nanga and Zuytdorp in the south west of the survey area and Inscription on Dirk Hartog Island."

It also recognises that:

> "One land system, Coast, is highly susceptible to wind erosion once vegetative cover is depleted by any means and almost 8% of the system consists of massive blowouts and mobile dunes. Because of its high sensitivity to disturbance and the need to maintain dense vegetation cover most of the system is unsuitable for development for pastoral purposes. Other forms of landuse, with the option of limited pastoral use in some instances, may be more appropriate."

Together these land systems account for a substantial proportion of several of the Shark Bay leases, as shown below:

PASTORAL LEASE	UNSUITABLE LANDSYSTEMS	TOTAL % OF LEASE AREA UNSUITABLE FOR GRAZING
Carrarang	Coast 36.1%	36%
Tamala	Coast 17.8%, Nanga 33.2%, Zuytdor p 22.3%	73%
Peron	-	-
Nanga	Nanga 75.7%, Zuytdorp 1.3%	77%
Dirk Hartog Island	Coast 41.9%, Inscription 24.3%	66%
Faure Island	-	-

* WA Department of Agriculture Technical Bulletin No 73. (In Press)

It is significant that these systems are generally not developed, or only lightly used, for pastoral purposes on the respective leases.

Satellite imagery shows, however, that some use is or has been made, of the Coast land system on Tamala and Dirk Hartog Island pastoral leases, and that use may have contributed to the destabilization of dune systems in these areas. Payne et al. record "... there is clear cut evidence that some blowouts on the Coastland System have originated near man-made stock watering points".

The remaining land systems in the Shark Bay Region are of moderate to high pastoral value when in good condition and are generally stable.

This does not mean that their use for pastoral purposes has not affected their conservation value or that it will not continue to do so.

The condition of the small area of useful pastoral land on Tamala Station suggests that it may in past times have been cleared to encourage pasture growth (Payne et al.). It now supports a pasture in which introduced annual species including wild oats, barley grass, lupins, wild turnip, medics and others have largely replaced the original shrub vegetation.

The rangeland condition survey indicates that parts of the productive pastoral land systems on the other 5 leases have been degraded through overgrazing. These areas are generally within a few kilometres of watering points or are associated with stock yards. The effects are generally the replacement of native shrub species with introduced annual grasses and pasture species, and on susceptible land systems, evidence of wind erosion.

The rangeland condition survey shows that considerable modification to the environment has occurred. Such a survey, which is intended primarily to determine whether the productive capacity of the rangeland has been effected, will not give a complete picture of the extent of the environmental impacts of pastoralism. The more wide ranging effects of pastoral landuse are listed in the Shark Bay Action Group report - A Sustainable Future for Shark Bay (pp32-33) reproduced from Ovington 1984 (see Appendix II).

The contention by Shark Bay pastoralists that "pastoralism does not interfere with the major conservation interests of the area", which appears in the Shark Bay Region Plan (p34), cannot be supported. Even in those parts where pastoralism is sustainable, it is likely the ecology is adversely affected by grazing.

From the foregoing, the EPA concludes that the effect of continuing stock grazing of sensitive and valuable areas is not compatible with long term conservation.

4.3 THE VALUE OF PASTORAL LANDUSE TO THE REGION

The economic importance of the pastoral industry to the Shark Bay Shire is a factor raised in the Region Plan as an argument against the implementation of the 'Red Book' Recommendations. The Authority has considered the matter both from the context of its role in the region's economy and as a revenue source for the Shark Bay Shire Council.

In Shires with small diffuse populations and a large area such as Shark Bay, local authority rates only contribute a small proportion to the Shire's total budget allocation. The greatest single source of funds is often from State and Commonwealth grants, notably Main Roads Department Road Grants.

Figures from the Australian Bureau of Statistics indicate that of some $750 000 income the Shire receives, only some $67 300 comes from Shire rates (ABS 1985) much of which relates to sources other than pastoral leases. As only about one quarter of the pastoral land in the Shire is subject to 'Red Book' reserve recommendations, the revenue generated from this source is likely to amount to only a few thousand dollars.

Though the Shark Bay Region Plan suggests that pastoralism is a major component of the Region's economy, the value of the industry is only placed at $1 million. By comparison, commercial fishing is estimated to contribute $25 million, mining $16 million and 'other' $2 million to the economy.

Moreover, the leases subject to the 'Red Book' Recommendation, as indicated earlier, contribute only 50% of the value of pastoralism in the Region Plan study area. Full implementation of the land component of the 'Red Book' Recommendations for Shark Bay may therefore be expected to affect about $500 000 of the Region's total economy of $45 million; or just over 1%.

While clearly much of the revenue generated by the fishing and mining industries would be spent outside the Shire, this is also likely to be true of the pastoral industry.

It should be recognised, however, that the EPA has not in the past recommended the sudden imposed resumption of pastoral leases to achieve reserves, nor does it do so now. Any changes would be gradual with the pastoralists involved compensated. Changes in the Shire revenue and employment base would likewise be gradual.

This of course does not take account of the likely future effect of economic activity generated by additional tourism in the Region following its designation for conservation, nor the economic input associated with park management itself. These factors are likely to be significant, particularly if the area is nominated for World Heritage listing.

The EPA believes that progressive implementation of reserves in accordance with the intent of the 'Red Book' Recommendations is unlikely to have a major effect on the local economy.

4.4 CONSERVATION, HERITAGE AND RECREATION SIGNIFICANCE

4.4.1 CONSERVATION

The significance of the Region's natural and cultural attributes have been documented in the CTRC 'Green Book' (Appendix III), and are also given prominence in the Shark Bay Region Plan. These details are drawn from a wide-range of scientific and historical publications. Overall they highlight the remarkable landform and wildlife of Shark Bay. The major features are:

4.4.1.1 Geomorphological Attributes

The unusual conditions of Shark Bay result from relatively recent flooding of the area, followed by shallow marine sedimentation. These events are described in a definitive volume on the Region by Logan, Davies, Read and Cebulski (1970).* The main features include:

. The World's most extensive seagrass beds	- particularly the Wooramel Seagrass Bank, and seagrass platforms in Freycinet Estuary, both developed over unusual calcareous sediments.
. Rare Stromatolites	- unusual columnar structures built-up from sediment trapping algae and developed in and dependent on the hypersaline environment of Hamelin Pool. Very similar to some of the earliest fossil structures found in rocks 3000 million years old.
. Hypersaline embayments	- principally Hamelin Pool, where the Faure Sill, composed of calcareous sands, restricts seawater exchange with the open ocean resulting in the maintenance of highly saline water,** supporting a unique biota.

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* Logan, B W, Davies, G R, Read, J F, and Cebulski, D E, (1970). Carbonate Sedimentation and Environments, Shark Bay, Western Australia: American Association of Petroleum Geologists, Memoir 13.

** In these hypersaline waters calcareous (carbonate) sediments have been deposited as sandy shoals comprised of unusual spheroidal grains known as 'ooids'. Also shell beds, known as 'coquina' (and used locally as a building stone), have developed.

. Linear offshore islands - including Bernier, Dorre and Dirk Hartog Islands which were isolated from the mainland following flooding, and which now form refuges for restricted faunas, and

. Spectacular cliffs - thick limestone forming the 'Zuytdorp cliffs' marking the western margin of the Region.

4.4.1.2 Biological Attributes

The flora of the Region is termed 'transitional', where plants of the winter wet South West Botanical Province merge with more arid tolerant species of the northern and inland Eremean Province. The marine plants are also transitional.

Some of the Region's fauna is rare and endangered.

The main features are:

. Restricted land plants and Marine Communities - The Region features a great diversity of vegetation types, including vegetation representative of the South West Botanical Province, the Eremean Botanical province of the arid zone and communities transitional between these two and peculiar to the region. The flora includes a number of rare species and species endemic to Shark Bay. Many species are at the limit of their range.

Offshore seagrass proliferates on calcareous sandy shoals. The Wooramel Seagrass Bank, and other shoals are extraordinary biological features of considerable scientific interest and provide an important nursery area for a rich fishery. The algal stromatolites represent living examples of one of the earliest life forms on earth.

. Rare land animals - Bernier and Dorre Islands support the only surviving populations of the Western Barred Bandicoot, Shark Bay Mouse and Banded Hare-wallaby.

. Rare or extraordinary marine mammals	- dugong	- Shark Bay supports one of the two largest populations of this rare marine grazer at the extreme southern limit of the species range in Australia.
	- humpback whale	- now rare.
	- dolphin	- the extraordinary behaviour of wild dolphin at Monkey Mia, where these animals voluntarily approach humans and have formed a relationship continuing over many years.

Separately and collectively the environmental attributes of the Shark Bay Region deserve strong management measures to ensure protection of these special values.

4.4.2 CULTURAL HERITAGE

Though Shark Bay was undoubtedly important to the Aboriginal population there remain few obvious signs of aboriginal occupation.

The Region however, is most noted for its association with early European landings, explorations and scientific investigations including -

. Dirk Hartog	- landed at Cape Inscription in 1616, on the island which now bears his name. He was the first recorded European to set foot on Australian soil.
. Willem de Vlaming	- visited Cape Inscription in 1697.
. William Dampier	- charted part of the coast in 1699.

The French took a great interest in the western side of the Australian continent in the latter part of 18th Century, and into the 19th. Many place names in the Shark Bay Region are of French origin, having been named by explorers such as -

. St Allouarn	- who in 1772 charted Shark Bay and claimed it for France.
. Baudin	- conducted further surveys in 1801 and 1803.
. Hamelin	- accompanied Baudin, and re-charted part of the area.
. de Freycinet	- made further explorations in 1818.

also of cultural significance is the fact that Steep Point on Edel Land peninsula is the western-most point on the Australian mainland.

4.4.3 RECREATION

The CTRC, and subsequently the EPA, in their respective reports on conservation reserves for Western Australia, underscored the growing needs and demands for recreation in natural areas. They saw that tourism was an expanding industry, compatible with the objectives of national parks of providing inspiration and heightened enjoyment.

The principal recreational and tourist features include:

. a rich and varied fishery; and friendly dolphins;

. wide, sweeping beaches suitable for a range of aquatic activity;

. a broad heathlands and coastal scenery;

. stark and spectacular cliffs, and

. unusual structures, such as stromatolites and coquina.

4.4.4 SUMMARY OF THE REGION'S SIGNIFICANCE

As indicated by the preceding pages Shark Bay possesses a range of features of major conservation significance, has important historical links with the discovery of Australia by Europeans and is a major recreation and fishery resource. The Region Plan, it must be stated, records the significance of the subject area in respect of all these values. The extent to which the Region Plan's proposals reflect the region's significance is addressed in a subsequent section of the report.

Recognising the region's significance the EPA in its 'Red Book' recommended that the region be variously reserved as national park, and aquatic national park or aquatic conservation reserve. In presenting these proposals the Authority made it clear that with the exception of the proposed aquatic conservation reserve, other uses notably recreation and recreational and commercial fishing were appropriate and part of its concept for the region.

The EPA sees no reason to depart from the intent of its earlier opinion on these issues.

4.5 WORLD HERITAGE LISTING

The Authority is aware that since its 'Red Book' Recommendations of 1976, the unique attributes of Shark Bay have been recognised by some sectors of the community as perhaps fulfilling criteria for listing the Region, or parts of it, under the World Heritage Convention.* Within this Convention Australia already has had listed 7 properties, all assessed as having outstanding universal value. They are:

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* The International Convention for the Protection of the World Cultural and Natural Heritage - adopted by the General Assembly of UNESCO 1972.

The Great Barrier Reef,
The Lord Howe Island Group,
Kakadu National Park,
The Willandra Lakes Region of New South Wales,
Uluru National Park (Ayres Rock and Mt Olga),
Western Tasmania Wilderness National Parks, and
The Australian East Coast Temperate and Sub Tropic Rain Forest Parks.

With respect to natural features a number of specific criteria need to be fulfilled to determine whether a property is appropriate for being assessed as having universal value. It is a particular principle of the Convention however, that it is not intended to provide for the protection of all properties of great interest, importance or value, but only those exhibiting the most outstanding features from an international viewpoint.

In summary a property would need to fulfil one or more of the following criteria:

(i) be an outstanding example representing the major stages of the earth's evolutionary history; or

(ii) be an outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment; as distinct from the periods of the earth's development, this focuses upon ongoing processes in the development of communities of plants and animals, landforms and marine areas and fresh water bodies; or

(iii) contain superlative natural phenomena, formations or features, for instance, outstanding examples of the most important ecosystems, areas of exceptional natural beauty or exceptional combinations of natural and cultural elements; or

(iv) contain the most important and significant natural habitats where threatened species of animals or plants of outstanding universal value from the point of view of science or conservation still survive.

It is generally recognised that Shark Bay meets not only one but probably the last three of the four criteria.

From a viewpoint of biological evolution and ongoing geological processes, the modern sedimentary environment of Shark Bay is of universal importance because of the occurrence of living algal stromatolites, the oldest form of megascopic life appearing as fossils in rocks up to 3.5 billion years old as well as unusual calcareous (carbonate) sedimentary deposits. These features prompted the EPA in 1973, during the investigations of the Conservation Through Reserves Committee, to convene a group of international scientists to report on conservation measures, specifically for Hamelin Pool. They concluded that this embayment and the Faure Sill were of international importance and deserved total protection from development or alteration.

It can be argued on scientific grounds that Shark Bay, particularly the hypersaline embayment of Hamelin Pool, and the Wooramel Seagrass Bank, constitute outstanding examples of superlative natural phenomena or formations.

The Shark Bay region can also claim outstanding natural habitats supporting threatened species of universal value. Bernier and Dorre Islands are regarded as perhaps the most important of Australia's island nature reserves and of international significance. They support the only surviving populations of the Western Barred Bandicoot, Banded Hare-Wallaby, Shark Bay Mouse and a sub-species of the Variagated Fairy-Wren. They also support colonies of the

Boodie (found elsewhere only on two other islands) and the Rufus Hare-Wallaby (otherwise known only from two small colonies in the Tanami Desert) Dirk Hartog Island, Edel Land and Peron Peninsula are also known to support populations of several rare or endangered species.

The marine embayments support one of the largest and more secure Dugong populations in the world. Though widespread in tropical coastal waters this species is threatened by over hunting and/or pollution throughout most of its range.

The Federal Government has contributed significant funds to the planning and management of most of the Australian properties placed on the World Heritage List. In other ways also, moneys have been provided for compensation to State Governments or private operators for the removal of various enterprises from these properties.

It is reasonable to expect that similar contributions could be made to Shark Bay, if it also was listed.

The following is an indication of the resources committed by the Federal Government for the planning and management of World Heritage Areas in Australia.

	1985/86	1986/87
Great Barrier Reef Marine Park	$6.4 million	$6.7 million
Western Tasmanian Wilderness National Parks	-	$2.0 million
Kakadu National Park	$7.1 million	$8.15 million
Willandra Lakes		$65 000
Uluru National Park	$1.79 million	$1.79 million
Lord Howe Island		$30 000
Australian East Coast Temperate and Sub Tropical Rain Forest		$203 000

Source: Department Arts, Sport, the Environment, Tourism and Territories.

These figures do not include the amount of compensation which the Commonwealth Government agreed to pay to Tasmania for injurious effect, following the declarations of Western Tasmanian Wilderness National Parks area as World Heritage against the wishes of the Tasmanian Government.

The EPA is aware that the Government has followed the recommendations of the Draft Region Plan and has established a committee to investigate, and advise on, the merits of having Shark Bay or parts of the 'Region' placed on the World Heritage List. The Authority supports this approach and is prepared to assist in this process.

5. OVERVIEW OF THE SHARK BAY REGION PLAN

The Shark Bay Region Plan attempts through the application of planning mechanisms to provide for community and economic development of Shark Bay and to conserve important elements of the natural and cultural environment.

The objective was to prepare a Planning Strategy which identifies and provides for the region's development, community and conservation needs.

The strategy was to:

a) identify the preferred and multiple uses for the land and marine environments of the region;

b) indicate the reservations of the land and marine environment required to give effect to the preferred and multiple uses and to protect the local environment;

c) include broad guidelines for subsequent formulation of management programs.

It could be expected that such an objective would lead to a fair balance for conservation if the whole of System 9 were considered. In this case, however, the "region" considered in the Shark Bay Plan was concentrated around the land and sea already recommended for CTRC reserves. Such an objective was likely to lead to a de-emphasis of conservation reserves.

The land use planning strategy, a key element of the Region Plan, was developed using an overlay technique in which;

> "Maps indicating areas which have a significant importance for each use relevant to each objective were prepared as overlays to topographic base maps".

This method was used to identify areas where competing demands exist.

It is assumed that this is intended to imply that the recognised technique of applying land suitability criteria was used in developing the land use strategy. The Shark Bay Region Plan does not specify how importance for conservation was compared with importance for an existing landuse, in considering competing demands.

The landuse planning strategy that resulted from the above approach recognised fourteen different landuses as appropriate for the Region. For the most part existing pastoral leases would continue. Though areas of fragile coastal land including the whole of Dirk Hartog Island would be zoned "Protection of Coastal Landforms" this would not preclude grazing from these areas (Table III and Fig 6, Shark Bay Region Plan).

The most substantial changes on land are the designation of the northern portion of Peron Peninsula (part of Peron Station) and part of Edel Land (within Carrarang Station) as proposed national parks, and the southern parts of Tamala and Nanga Stations as a proposed addition to Cooloomia Nature Reserve. Though the 'Red Book' refers to the reservation of Tamala and Nanga stations the accompanying map does not include the southern portions of these stations in the proposed national park.

The reservation of these areas of very limited pastoral value, which are proposed in the Draft Region Plan, is highly desirable.

With respect to mining, areas subject to Solar Salt extraction, and mining tenements for Gypsum, are identified and zoned for these purposes.

The Shark Bay Region Plan also divided the marine embayments into a number of areas designated as serving specific purposes. Thus areas serving conservation purposes include Hamelin Pool and most of the Faure Sill area which is designated for "Protection of Stromatolites and Sedimentary Deposits"; several important feeding grounds for dugongs are zoned "Dugong Habitat Protection"; the Wooramel Seagrass Bank designated "Prawn Nursery and Seagrass Protection" and a small area near Monkey Mia designated "Dolphin Habitat Protection".

The remaining marine areas, which comprise the greater portion of the marine embayments other than Hamelin Pool are designated for multi-purpose functions. A "Commercial Fishing and Trawling and Recreation zone" generally occupies areas with a water depth of greater than 11 metres. The remaining areas of shallower water not used for trawling are zoned "Recreation and Commercial Fishing". Emphasis in this zone is to be given to management of seagrass and the marine environment with priority given to its use for recreation and commercial fishing.

The Shark Bay Region Plan recommends that provisions similar to those in the Waterways Conservation Act be written into the CALM Act to allow for such areas serving a range of purposes to be managed as a multiple use marine park.

Restricted public access to Hamelin Pool and Faure Sill in order to protect the important features of these areas, are a feature of recommendations in both the Region Plan, and in the alternative submitted by the conservation movement.

6. REVIEW OF RECOMMENDATIONS FOR THE SHARK BAY REGION

6.1 RECOMMENDATIONS FOR LAND AREAS

The previous sections in this report attempt to place the pastoral industry at Shark Bay into a regional and Statewide context. Even within the Shire of Shark Bay the six pastoral leases previously identified as of conservation value in the 'Red Book' Recommendation make but a minor contribution to the income generated in the region.

The Shark Bay Region Plan moreover identifies that some areas of high conservation interest within the Region are of low pastoral value for pastoralism and that some further areas of west coastlands are extremely fragile. Despite this the 'Plan' retains some of these areas for pastoralism in its proposed landuse zones.

The Region Plan acknowledges conservation as a planning objective in the case of pastoral leases, but considers that pastoral use is compatible with achieving the conservation objectives. As a result, with the exception of the relatively limited conservation reserves proposed, the'Plan' does not define specific means of achieving conservation objectives identified on pastoral lands. The EPA contends that continued grazing of stock on areas with identified conservation values is not consistent with the restoration and maintenance of those values. It was for this reason that the 'Red Book' Recommendations sought reservation of these areas.

The EPA through its 'Red Book' Recommendations has endeavoured to set aside in reserves areas both of outstanding conservation, scientific and recreational value and areas representative of the range of natural environments present in Western Australia. Only a very small percentage of the State has been recommended for inclusion in the conservation reserve system.
At present the conservation reserve estate within System 9 is very deficient covering only a tiny and unrepresentative 1.2% of the land area.

The Shark Bay region is strategically located on the transition zone between the South-West Botanical Province and the Eremean Botanical Province of the arid zone. The proposed 'Red Book' reserves and southern extension proposed in the Region Plan include vegetation communities representative of both these provinces together with communities transitional between the two and peculiar to the region.

These vegetation differences reflect the changing rainfall pattern from west to east across Shark Bay, varying degrees of exposure to strong drying seabreezes in summer and the range of soil types present in the region. This combination of factors means that it is possible within a relatively small area at Shark Bay to effectively conserve a significant proportion of the floristic diversity representative of the System 9 region in a single contiguous reserve.

The strategic location of such a reserve at Shark Bay is of particular importance given the global climatic warming that is expected to occur over the next 30 to 50 years as a result of the Greenhouse effect. The rising temperatures, southward extension of summer monsoonal rainfall and contraction of the area of winter rainfall domination is likely to have a marked effect over time on the distribution of plant species and communities. This effect is likely to be most marked at the transitional zone where many species are already at the limit of their environmental tolerance. In this situation a large contiguous reserve at Shark Bay may enable plant species and community ranges to adjust to the new conditions

The replacement of pastures based on native species by improved pastures, based on exotic fodder species and the adaption of goats as stock species, both options considered in the Region Plan, may very significantly reduce the value of pastoral lands for the conservation of flora and fauna and place even greater emphasis on the need for an expanded reserve system to achieve this end.

Failure to fully implement the intent of the reserve proposals would leave major gaps in the conservation reserve system. In this context, the establishment of conservation reserves representative of the range of environments at Shark Bay removes some of the pressure that may otherwise exist for reservation of similar environments on other pastoral leases. In the case of many of the outstanding environments at Shark Bay, of course, alternative reservation options are not available.

within the protection of a reserve. Elsewhere, species and communities in the transitional zone will be subject to the substantial additional stress exerted by grazing pressure associated with pastoral use, which may work to prevent successful adjustment to the changed climatic conditions. Of all the reserves in the State's conservation reserve system Shark Bay would be amongst the most important in this regard.

The role of conservation reserves, however, is not confined to protecting flora and fauna. Conservation of physical features and historic sites for aesthetic, cultural, scientific and recreational reasons is an important component of the function of national parks and marine parks.

This function is reflected in the Conservation and Land Management Act (1984) which requires that national parks and marine parks shall be managed to:

> "... fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest."

In developing its recommendations for System 9 the Conservation Through Reserves Committee was attempting to conserve both outstanding features and areas representative of the range of environments present in the System. It was also very aware of the need to cater for the wider values of the Bay, notably its recreational significance.

The Shark Bay region is significant on all counts. The conservation, recreation, scientific and cultural heritage values of Shark Bay represent a public asset of outstanding value.

There is inadequate priority for conservation of land areas at Shark Bay in the Draft Shark Bay Region Plan. In striking a balance between conservation and pastoral use, the EPA sees that the Region Plan has placed pastoral use in too dominant a role. In particular the Authority is concerned that Dirk Hartog Island and fragile areas of Edel Land would remain under pastoral use. The Authority believes that a conservation priority for these areas should be paramount.

It is understood that the intent of the recommendations in the Region Plan are that in addition to the areas recommended for reservations, further research should be undertaken to identify the conservation values of other areas, with a view to determining requirements for further reservation. The EPA endorses further work to identify conservation values, however there remains a need for early steps toward conservation of important environments, notably Dirk Hartog Island and Edel Land.

6.2 RECOMMENDATIONS FOR MARINE AREAS

In proposing a series of marine reserves serving multiple purposes of conservation of flora, fauna and sedimentary deposits, commercial and recreational fishing, the 'Red Book' Recommendations were well in advance of legislative mechanisms capable of fully implementing the intent of the recommendations. This is a major reason why the recommendations have not been implemented before now. In recent years, however, the concept of a multiple use marine park zoned to cater for a range of activities has been developed and implemented in the Great Barrier Reef Marine Park.

To a large extent the management zoning recommendations proposed in the Region Plan for the marine areas of Shark Bay preserve the intent of the 'Red Book' Recommendations, though they are presented in a rather complicated manner.

Like the 'Red Book', the Region Plan recognises continuing roles for commercial and recreational fishing as well as conservation, and proposes that a multi use marine park be declared to cater for this range of uses.

The recommendations in the Draft Region Plan appear to suggest that a number of separate marine parks and marine nature reserves would also be created. It is understood that this is proposed initially to enable early reservation of particularly important conservation areas under the provisions of the existing CALM Act, but that once the CALM Act has been amended to allow for multiple use marine parks, these reserves may be amalgamated.

The Authority believes that management of the marine areas of Shark Bay could be greatly improved and simplified if the entire area, excluding areas where the primary use is for commercial trawling, were managed as a single multi-purpose marine park, incorporating a range of zones with differing management emphasis. The multiple use concepts embodied in the Great Barrier Reef Marine Park appear to be successful and could provide an appropriate model for such a reserve.

The EPA generally endorses the use zones identified in the Region Plan for marine areas on the basis that they are interpreted as zones of management emphasis rather than specific purpose use areas. It does, however, express concern at the proposed continued use of Gladstone as a boat launching facility given that the access channel is constrained on both sides by the sensitive environments of Faure Sill and the Wooramel Delta, a habitat believed to be critically important to the survival of the Dugong population of Shark Bay.

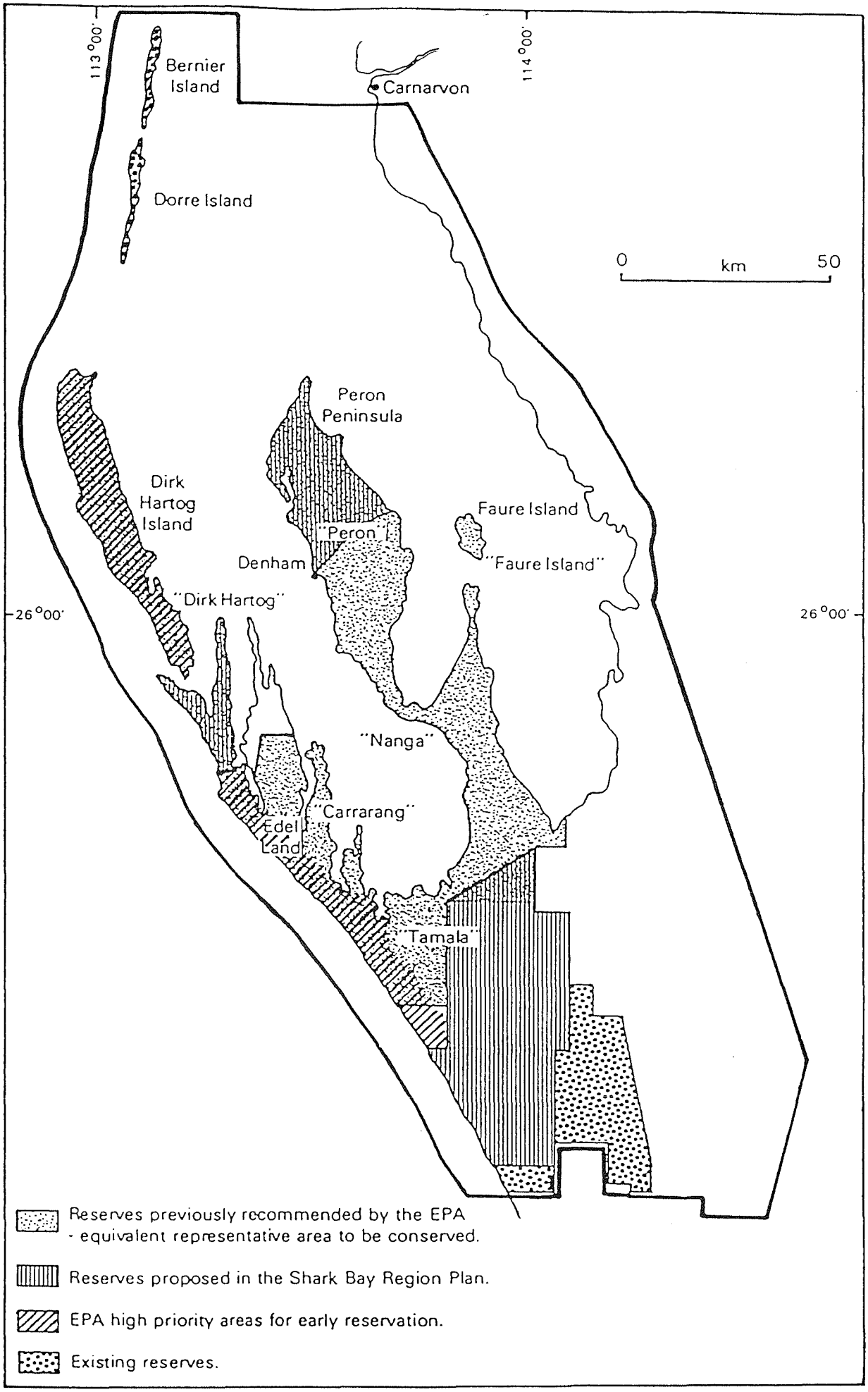
6.3 CONCLUDING COMMENTS

Physically and biologically Shark Bay is a well defined and distinctive region, and ecologically it functions as an interdependent unit. These factors, together with the very long convoluted coastline and concentration of recreational interest and use pressures in the coastal fringe, require that the Region be recognised and managed as a single functional unit with a high degree of coordination between land and marine areas.

The Authority believes that the intent of the 'Red Book' Recommendations for Shark Bay remains as appropriate today as when they were endorsed by Government in 1976. In the intervening period the Region has, however, become better known, more accessible, and much more heavily utilized as a recreational and tourist destination. The need for action to conserve and ensure coordinated management of the Shark Bay environment is more urgent now than ever.

The Draft Shark Bay Region Plan has identified the northern ends of the Peron and Edel Land Peninsulas as areas that should be reserved for conservation. The EPA believes that this is inadequate for conservation, and that the important and fragile areas of Dirk Hartog Island and Edel Land should also be conserved.

Previously other extensive parts of the Shark Bay Region have been identified as worthy of conservation as environments representative of the Region. The Shark Bay Region Plan should seek to further identify equivalent representative areas and indicate how they are to be conserved (See Map 4).



Map 4. The Shark Bay Region Plan Study Area showing existing and proposed conservation reserve areas.

The remainder of the Region should be managed to achieve sustainable use of the renewable resources, and ensure there is no ongoing loss of the productive capacity of the region.

Shark Bay is an environment of State, National and International significance and conservation should be the major priority. Appropriate conservation measures are unlikely to cause decline in the local economy but could provide a significant boost to it.

The Draft Region Plan recognises that conservation is a priority and it proposes to conserve many of the individual components of environmental quality. Appropriate conservation and multiple use of the marine environments would largely be achieved. This represents a major step forward. However, with respect to the land areas, though the plan proposes the creation of national parks for the northern end of Peron Peninsula and Edel Land, and a major addition to Cooloomia Nature Reserve, it does not achieve the intent of the EPA recommendations. Grazing should not be allowed to continue on important and fragile land areas including Dirk Hartog Island and central and southern Edel Land. There should also be further progress towards conservation of other representative areas.

7. CONSERVATION OBJECTIVE FOR THE SHARK BAY REGION

The EPA reaffirms its view that conservation is the most appropriate objective for Shark Bay, recognising that a range of commercial and recreational activities pursued at a sustainable level, are also appropriate in this context.

To achieve the primary objective the most appropriate strategies must be:

. to put in place a Conservation Management System based on secure tenure, - the intent of the System 9 Recommendations for Shark Bay are not unreasonable in this regard;

. to stop further degradation of the environment and encourage regeneration of damaged areas; and

. to plan future development of the Region to be consistent with the primary conservation objective.

Fundamental to any planning for the region is the need to recognise that the primary causes of degradation of the environments at Shark Bay are:

. the grazing of stock on important and fragile environments;

. inadequately managed and inappropriately sited recreational use of fragile and significant environments;

. excessive fishing pressure on some species; and

. potential conflict between intensive recreational boating and Dugongs in key Dugong habitats.

In reviewing the Region Plan the Authority:

. recognises the investment that pastoralists have made in the Region including their contribution towards catering for and managing tourism, and their desire to remain in the Region;

- is aware that the current provisions of the Land Act set minimum stocking rates for pastoral leases which may prejudice to the conservation objective;

- believes that the conservation priority established for Shark Bay should not preclude nodes of appropriately located, and managed development, like tourism;

- considers that Denham is an appropriate focus of development in the region. A substantial infrastructure zone should be designated around the townsite such that future development and infrastructure needs are not constrained;

- acknowledges the continuing role for the existing solar salt production facilities at Useless Loop, and the rights of the existing gypsum mining operations in the region; and

- notes that a committee comprising Ministers of relevant portfolios and representatives of Local Government is investigating the issue of World Heritage listing, and provided suitable mechanisms for achieving this status are proposed, considers it appropriate that the outstanding values of the region be so recognised.

8. RECOMMENDED ACTIONS

In reviewing the Shark Bay Region Plan the Authority has not commented on individual recommendations presented in it, many of which do not have a significant environmental component.

The Authority believes that the strategies outlined in the Region Plan do not go far enough toward conservation of the peninsula and island areas of the Region. In respect of the land areas the proposals do not fully comply with the intent of the EPA 'Red Book' Recommendations. In particular, though the Draft 'Plan' recognises the conservation value of the land areas it does not propose adequate mechanisms for achieving these conservation objectives for land areas subject to 'Red Book' Recommendations.

The Authority therefore recommends that the Shark Bay Region Plan be amended to clearly specify positive steps that will be taken to realise the primary goal of conservation of the important land environments in the region, and the intent of the previously endorsed framework of conservation reserves for Shark Bay, of conserving both areas of outstanding conservation, scientific and recreational value, and the representative environments.

This may be achieved by:

(1) **establishing as the primary planning objective, a move from a grazing dominated land use for those areas subject to the 'Red Book' Recommendations to one in which conservation is the primary planning objective; there is a priority to exclude grazing from Dirk Hartog Island and Edel Land.**

(2) **the adoption of planning mechanisms, analogous to reservation of regional open space, facilitating the removal of grazing pressure by progressively destocking areas of high conservation value. Early steps should be taken toward achieving conservation of important environments. Mechanisms for achieving this process should include avenues of recourse for compensation such that pastoralists are not unreasonably disadvantaged by this process.**

Options may include:

- planned progressive conversion from grazing to tourism and conservation emphasis on pastoral leases. Appropriate tourism development could be sited on suitably located short term conditional leases on completion of a tourism park and in conjunction with negotiated acquisition of pastoral leases;

- progressive negotiated acquisition of leases, on a priority basis;

- entering into a management agreement with pastoral lessees, in accordance with the provisions of the Conservation and Land Management Act. The EPA recognises that this would first require amendments to Section 16 of the CALM Act to make it feasible; or

- a combination of the above means of securing land areas.

(3) preparing a tourism development and management plan for Shark Bay reflecting the conservation priorities, recreation and education opportunities and management constraints of the region;

(4) sensitively managing land areas, notably coastal recreational areas, for multiple uses compatible with the primary conservation objectives for the Region, but recognising that nodes of mixed use incorporating tourism developments may be appropriate in certain locations;

The Authority notes the emphasis in the Draft Region Plan on the possible development of a range of sites for recreation and tourism use and/or day use and endorses this concept. However the EPA suisggests that this should not occur until the completion of the tourism development and management plan referred to above, and in the context of areas of identified conservation significance, only in accordance with appropriate management plans; and

(5) ensuring that conservative pastoral land management practices are established on lands within the watershed draining into Shark Bay, particularly within the catchment of the Wooramel River.

In the context of marine areas, the Authority recognises the substantial conservation gains realised in the recommendations of the Shark Bay Region Plan. It endorses the establishment of a conservation management system for marine areas allowing for multiple uses where appropriate, but placing a priority on the conservation of rare and unusual species and environments.

The recommendations in the Draft Region Plan suggest that a large marine park and would be created. It is understood that this early reservation of important conservation areas would be under the provisions of the CALM Act.

The Authority recommends that:

(1) the declaration of the proposed marine park be pursued as a high priority;

(2) Consideration be given to the declaration of a single marine park over those areas for which a conservation management priority has been identified, incorporating zones of differing management emphasis, as has been achieved with Great Barrier Reef Marine Park;

(3) because of the sensitivity and significance of the marine environment of Gladstone and the likely increasing use of the Shark Bay region for recreational boating the use of this site for boat launching should not be further encouraged. Every effort should be made to find a suitable alternative site or sites. The EPA supports the Draft Region Plan in recognising that Gladstone is not a suitable site for development of tourist facilities;

(4) in order to include representation of high energy marine environments within the marine reserve systems, consideration be given to the desirability of extending the marine reserves adjacent to Bernier, Dorre and Dirk Hartog Islands around the western sides of these Islands.

APPENDIX I

EPA 'RED BOOK' RECOMMENDATIONS FOR SHARK BAY

9.1 SHARK BAY

9.1.1 Bernier and Dorre Islands

The EPA endorses the present status (A 24869), purpose (Conservation of Flora and Fauna) and vesting (WA Wild Life Authority) of Bernier and Dorre Islands. It recommends that the reserve boundaries be extended to low water mark, and that public access to the islands be strictly controlled.

9.1.2 Dirk Hartog Island

The EPA recommends that:

1. the Department of Lands and Surveys be requested that attempts be made to purchase Dirk Hartog Island should it come on the market thus facilitating the reservation of the land as a Class A reserve for the purpose of "National Park", vested in the National Parks Board, otherwise the land be reserved when the lease expires, in which case it is assumed that the lessee will be paid the value of improvements on the land;

2. the Department of Lands and Surveys be requested that the lessee not be given authority at any time to clear or chain any of the land or to do anything to disturb the land other than is provided in the lease.

9.1.3 Edel Land

The EPA recommends that:

1. the Department of Lands and Surveys be requested that attempts be made to purchase Carrarang Station and Tamala Station should they come on the market, thus facilitating the reservation of the land as an A Class reserve for the purpose of "National Park", vested in the National Parks Board, otherwise the land be reserved when the leases expire, in which case it is assumed that the lessees will be paid the value of improvements on the land;

2. the Department of Lands and Surveys be requested that the lessees not be given authority at any time to clear or chain any of the land or to do anything to disturb the land other than is provided in the leases;

3. that Boat Haven, Depuch and Disappointment Loops and Blind Strait be set aside for fisheries management and aquatic recreation placed under the control of the Director of Fisheries and Wildlife;

9.1.4 Peron-Nanga Area

The EPA recommends that:

1. the Department of Lands and Surveys be requested that attempts be made to purchase leases in the Peron-Nanga area should they come on the market, thus facilitating the reservation of the land as a Class A reserve for the purpose of "National Park", vested in the National Parks Board, otherwise the land be reserved when the leases expire, in which case it is assumed that the lessees will be paid the value of the improvements on the land;

2. the Department of Lands and Surveys be requested that the lessees not be given authority at any time to clear or chain any of the land or do anything to disturb the land other than is provided in the leases;

3. the proposed reserve comprises the interdune lagoons in the vicinity of Denham and Cape Lesueur and extend to low water mark.

9.1.5 Small Islands, Shark Bay

The EPA endorses the status, purpose (Wildlife Sanctuary) and vesting (WA Wild Life Authority) of the small islands currently reserved in Shark Bay, and recommends that, should Slope Island be released in the future, it be included in the reserves and the causeway severed.

The importance of the bird population in Shark Bay, can be illustrated by the Wedge-tailed Shearwater Puffinus pacificus which show a variation of plumage unknown elsewhere in Western Australia or indeed in any other nesting station in the Indian Ocean. The Shearwater example suggests that there may be unknown and less obvious, but comparable variations as yet unstudied in other species.

(Serventy, D.L. 1972)

9.1.6 Hamelin Pool and Faure Sill

The EPA recommends that:

1. the existing Class A reserve 30885, be extended to 40 m above high water mark, have its purpose amended to protection of Sedimentary Deposits and Conservation of Flora and Fauna, and be vested in the WA Wild Life Authority;

2. the area of Hamelin Pool and Faure Sill below low water mark as designated in fig. 9.4, be declared an aquatic reserve for the purpose of protection of Sedimentary Deposits and Conservation of Flora and Fauna, vested in the WA Wild Life Authority;

3. until legislation is enacted to allow conservation reserves to include submarine lands, the Fisheries Act be employed to protect the marine areas designated in recommendation 2 and the Director of Fisheries and Wildlife be made responsible for their protection.

9.1.7 Wooramel Seagrass Bank

The EPA recommends that:

1. the Wooramel seagrass bank be reserved in a manner which will protect the seagrass and its environment. When appropriate legislation is available, the seagrass bank should be reserved for the purpose of Fisheries Management and Recreation under the control of the Director of Fisheries and Wildlife who should be required to manage it as though it were a "National Park";

2. the boundaries of the reserve include the area below high water mark extending seaward to the 25 metre isobath, between latitudes 25° S and 26° S, including adjacent tidal flats.

9.1.8 Denham Sound, Freycinet Reach and Estuary, Hopeless Reach and Lharidon Bight

The EPA recommends that the area of Denham Sound, Freycinet Reach and Estuary, Hopeless Reach and Lharidon Bight as shown in figure 9.2 be set aside for Fisheries Management and aquatic recreation and placed under the control of the Director of Fisheries and Wildlife.

9.2 CAPE RANGE NATIONAL PARK

The EPA recommends that:

1. the Cape Range National Park be extended to the boundaries shown in fig. 9.8;

2. that the status and purpose of the Park be amended to Class A for the purpose of "National Park" and that it be placed under the control of National Parks Board with power to lease;

The EPA does not concur with the Conservation Through Reserves Committee that reserve 31367 should be cancelled and not made available to the Game Fishing Club.

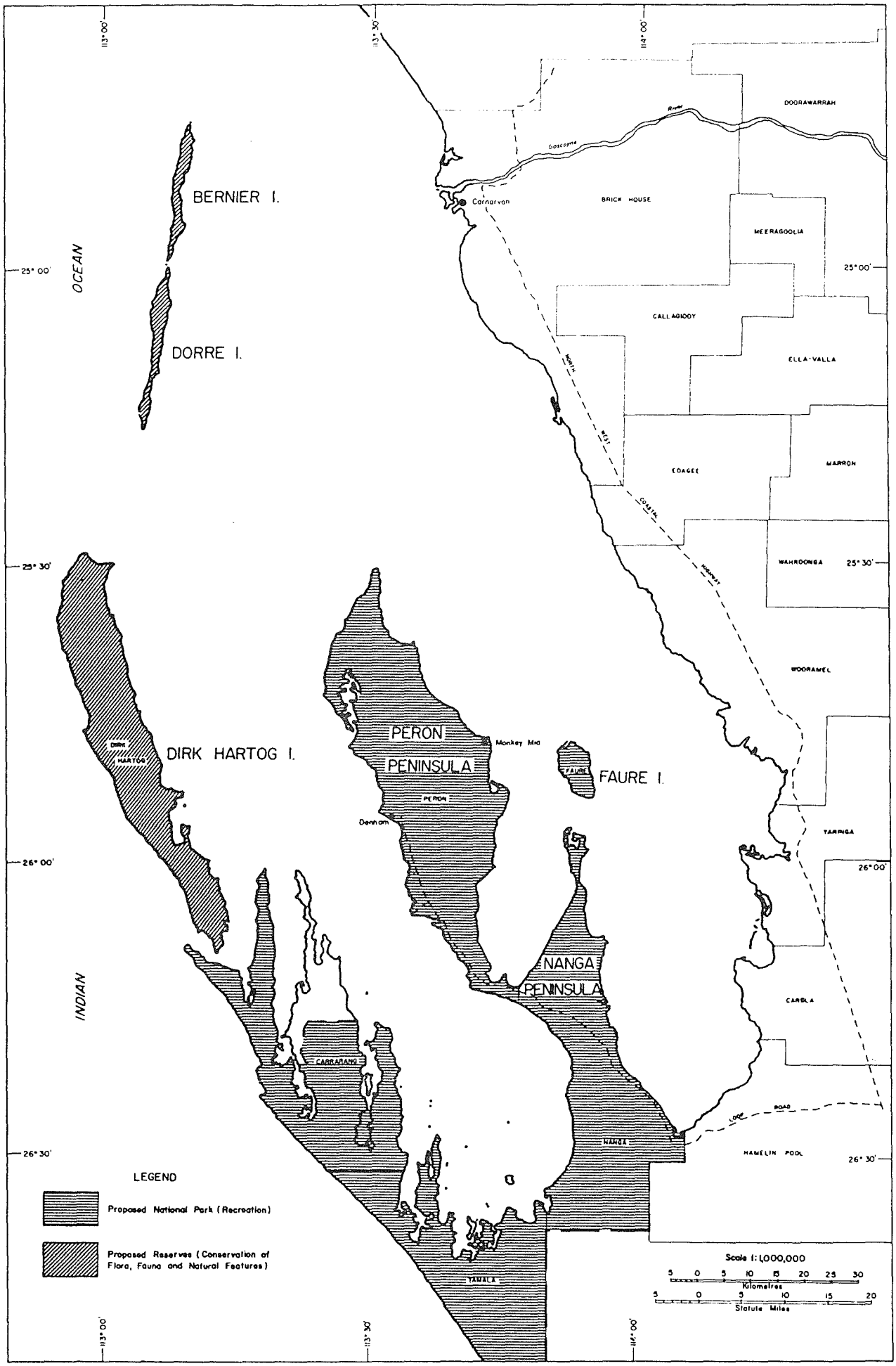


Figure 9·1 Shark Bay region, showing proposed reserves

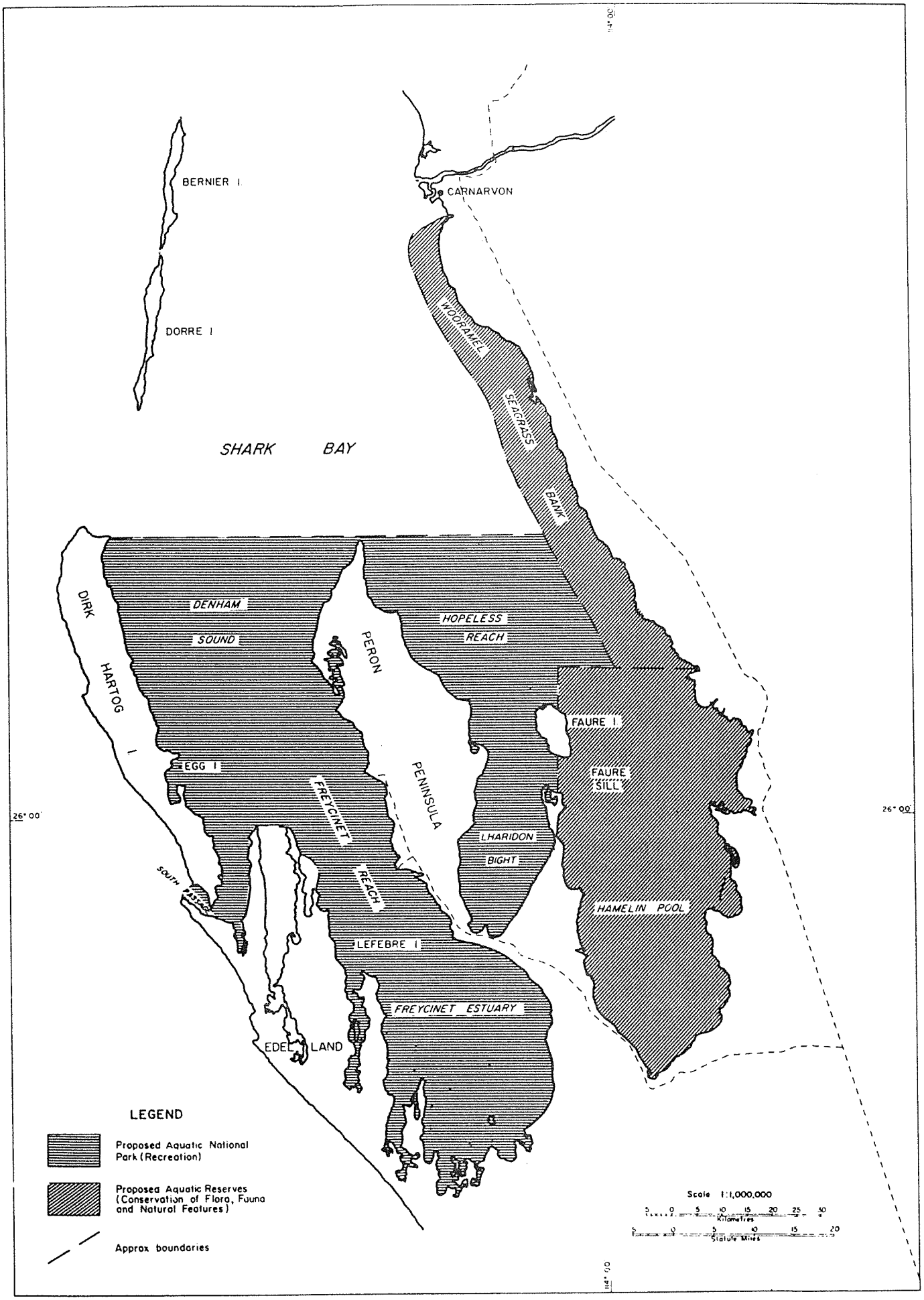


Figure 9·2 Shark Bay region, showing proposed aquatic reserves.

APPENDIX 2

SOME EFFECTS OF GRAZING BY DOMESTIC STOCK ON FIVE ECOLOGICAL PROCESSES

Ecological process	Effects
Natural succession	a. Modification of natural succession by treading and selective grazing leading to dominance of unpalatable species. b. Invasion of weeds and exotic species. c. Reduction of palatable tree, shrub and perennial species and expansion of grassland particularly of annual species. d. Increased competition with native herbivores. e. Excretion of dung and urine making vegetation unacceptable with native species. f. Disturbance of native animal species by domestic grazing.
Organic production and decomposition	a. Primary production diverted to ground level with loss of trees and shrubs. b. Reduction in total biomass and possible energy capture. c. Decrease in biomass of native animals. d. Natural decomposition process circumvented by grazing animal cycle. e. More of primary production diverted to large herbivores. f. Increased herbage intake leading to less litter and lower rates of decomposition.
Nutrient circulation	a. Reduction in nutrient pool with fewer nutrients in vegetation. b. Local and uneven re-allocation of nutrients according to distribution of faeces and urine. c. Increased rate of nutrient circulation. d. Replacement of slow cycling through soil organisms by more rapid, plant animal cycling pools. e. Initial stages of decomposition in rumen and gut of grazing animals. f. Loss of nutrient capital with removal in animal products.
Water circulation	a. Increased surface run off. b. Reduction in interception and transpiration. c. Soil surface layers drier. d. Increase in evaporation from soil surface with loss of vegetation cover.

APPENDIX 2

SOME EFFECTS OF GRAZING BY DOMESTIC STOCK ON FIVE ECOLOGICAL PROCESSES (CONT)

Ecological process	Effects
Soil development	a. Localized overgrazing resulting in soil erosion. b. Increased exposure of soil especially where animals congregate. c. Increased salinity with loss of trees and shrubs. d. Increased soil compaction due to treading.

Source: OVINGTON, J D (1984). 'Ecological Processes and National Park Management, pp.60-64 in J A McNeely and K R Miller (eds) National Parks, Conservation, and Development: The Role of Protected Areas in Sustaining Society. IUCN Commission on National Parks and Protected Areas, Smithsonian Institute Press, Washington, DC.

EXTRACT FROM CTRC 'GREEN BOOK'

9.1 SHARK BAY

The Shark Bay region (Figs. 9.1, 9.2) contains places important in science and history. Plants and animals found nowhere else in the world occur here. Parts of the marine embayments are environments unique in modern seas and contain a wealth of natural features, notably stromatolites, seagrass banks and coquina deposits which are invaluable for scientific and educational purposes. In the 1600 km of the west coast south of North West Cape, Shark Bay and Cockburn Sound are the only protected marine embayments. It is clear that there will be intensive pressure for recreational development of the Shark Bay region in the next few decades. During 1972-73, approximately 7000 tourists visited Denham, and about 800 small craft used this town and nearby Monkey Mia as bases for sport fishing. These figures can be expected to rise substantially when the access road is sealed and tourism will then become the principal economic industry in the area.

The embayment supports prawn, scallop and scale fisheries worth $3,275,000 (value of landed catch) in 1970/71. The maintenance of these fisheries is dependent on the marine ecosystem, particularly the shallow bays and seagrass banks, and the recommendations for reserves in the area takes cognisance of this point.

The Shark Bay region is recommended as a multipurpose national park for public recreation, conservation of flora and fauna and unique natural features. Areas of the proposed national park are:

1. Bernier and Dorre Island
2. Dirk Hartog Island
3. Edel Land peninsula, loops and inlets
4. Peron - Nanga area
5. Small islands of Shark Bay
6. Hamelin Pool and Faure Sill
7. Wooramel Seagrass Bank
8. Denham Sound, Freycinet Reach and Estuary; Hopeless Reach and Lharidon Bight.

Bernier and Dorre Islands

Bernier and Dorre Islands (Fig. 9.1) are Class A reserves for the conservation of flora and fauna vested in the WA Wild Life Authority. They are wildlife sanctuaries of world importance. Their biology has been documented by Ride *et al* (1962). Natural history records for the islands date back nearly 200 years. The islands present a diverse pattern of steppe, scrub and dune formations.

The flora combines elements from all three botanical provinces, especially the South-West and Eremean. It provides an interesting yardstick against which that of Dirk Hartog Island can be compared, while that of the adjacent mainland provides a further comparison.

The islands contain the only known populations of the Banded Hare-wallaby (Lagostrophus fasciatus), Marl or Barred Bandicoot (Perameles bougainville) and the Shark Bay Mouse (Pseudomys praeconis). They share with Barrow and Boodie Islands, populations of the Boodie (Bettongia lesueur). They also contain populations, possibly the only ones extant, of the Western Hare-wallaby (Lagorchestes hirsutus).

Dirk Hartog Island

Dirk Hartog Island is under pastoral lease. The biology of the island has been described by Burbidge and George (1973). Plant life is diverse, over 250 species having been recorded. Some of these are endemic to the island while others are little-known plants rarely collected on the mainland or occurring well away from their mainland range.

Dirk Hartog once had populations of marsupials of the same species as occur on Bernier and Dorre Islands but they have been killed by introduced cats and are now extinct there. The Sandy Inland Mouse (Pseudomys hermannsburgensis) and a variety of birds, notably the Black-and-white Wren (Malurus leucopterus), occur there. The latter is restricted to Dirk Hartog and Barrow Islands. As the largest island off the western coast, Dirk Hartog is ideal for the re-establishment of native fauna under controlled conditions and in the absence of terrestial predators or competitors. Work on this repopulation has already commenced, with the assistance of the present lessee, Sir Thomas Wardle.

The island is also historically important as the site of the first documented landing of a European in Australia, Dirk Hartogs in 1616. It was also visited by Vlamingh in 1697, William Dampier in 1699, French scientific expeditions in 1801 and 1818 and British explorers in 1812 and 1837.

Edel Land Peninsula, Loops and Inlets

Edel Land Peninsula and enclosed marine inlets and loops (Fig. 9.2) form a unit that is recommended as a National Park with recreational emphasis.

The area is a terrain of calcareous aeolianite dune ridges and interdune depressions. The western margin, fronting the Indian Ocean, is formed by the majestic Zuytdorp Cliffs that rise to heights of 70 to 170 m above sealevel and descend sharply to depths of about 40 m. The cliffs are greatly undercut at sea-level by heavy swells from the Indian Ocean; beach-lined embayments break the otherwise continuous cliffs at Dulverton Bay and False Entrance.

The eastern margin of the peninsula contrasts with the west. It is a region of calm bays and inlets. The inlets include Blind Strait, Useless Inlet, Boat Haven Loop - Brown Inlet, Depuch Loop and Disappointment Loop (Fig. 9.2). The inlets are picturesque, being bordered by sandy beaches that are interspersed with rocky platforms and headlands of aeolianite; they terminate on the south in elongate supratidal and inter-tidal flats. North-trending ridges up to 70 m high border the inlets and extend below sealevel into Freycinet Reach as a series of shallow banks.

The Committee views Edel Land Peninsula as one of the major areas for public recreation in the proposed Shark Bay National Park. The protected inlets are ideal for aquatic activities, such as boating and fishing, and additional scenic attractions include the rugged Zuytdorp Cliffs and the more serene inlets.

The southern parts of Tamala Station fulfil the requirements of a wilderness area and include the "Zuytdorp" wreck site.

There also are conservation requirements: i) the inlets are part of the Shark Bay marine ecosystem; ii) there are many features of scientific interest. Exposures of calcrete soils occur in many locations with classic sections at Baba Head (Read 1971b). Marine Pleistocene sequences crop out at the margins of tidal flats and interfinger with the soils. These features are being used in geological education (e.g. ANZAAS field trip, August 1973). Development of Edel Land Peninsula as a recreational area should take place under controlled conditions compatible with environmental requirements.

The proposed reserve includes Carrarang Station above low water level, excluding Useless Inlet, Useless Loop and those areas already given over to the production of solar salt (Fig. 9.1). It also includes Tamala Station, and is bounded on the east by the Tamala-Nanga Station boundary (Fig. 9.1).

In the following recommendations the designation of the inlets as aquatic reserves for recreational use is based on the view that in the future careful management involving regulation of fishing and other aquatic activities, resort development and extractive exploitation will be required.

Peron-Nanga area

The Peron-Nanga area (Fig. 9.1) is a physiographically distinct region which is underlain by quartz sandstone (Peron Sandstone). The area includes the north-trending Peron and Nanga Peninsulas, which divide southern waters of Shark Bay into a series of broad, semi-enclosed gulfs; from west to east these are Freycinet Reach and Freycinet Estuary, Hopeless Reach, Lharidon Bight and Hamelin Pool.

The coast in the Peron-Nanga area contains narrow beaches and headlands. The beaches are covered with quartz sand and the Peron Sandstone is exposed to erosion on the headlands. There are wide expanses of intertidal and supratidal flats and beach ridges of coquina and sand in the southern parts. The landscape comprises broad, undulate, red sand dunes fixed by a vegetation of sclerophyllous plants. Maximum elevations are about 45 m, whereas interdune depressions are only a metre or so above present sealevel. Most of the topography is controlled by a zone of calcrete which lies between the dune sands and the Peron Sandstone. This calcrete zone, which is exposed in coastal cliffs, ranges from 2 to 45 m above sealevel.

Many of the interdune depressions contain evaporite pans called "birridas" in local usage and "montbazin" by Freycinet (1818); several contain marine lagoons. Most of the pans lie in closed,

amphitheatre-like depressions surrounded by dunes. A few have remnant, evaporite-filled channels which open to the adjacent coast, but these pans are flooded by seawater only during periods of abnormally high storm tides. The pans range from a hundred metres to a kilometre in width.

Lying at the northern end of the South-West Botanical Province, the area is the northern limit for many plant species. The southern end of Nanga Station contains dense tall sandplain vegetation with many species of genera such as Grevillea, Hakea, Calothamnus, Hibbertia, Banksia, Pityrodia, Conospermum, Newcastelia and Eucalyptus, all typical of the South-West. Northwards along the Peninsula, the South-Western species gradually disappear and the dense heath is replaced by an open shrub-spinifex steppe. Species of Acacia and spinifex (Triodia/Plectrachne) become dominant.

In the dense heath at the southern end of Nanga, several species are of outstanding interest, e.g. Eucalyptus roycei, Adenanthos acanthophyllus, Grevillea rogersoniana, Newcastelia chrysophylla and Lamarckea hakeifolia var. hakeifolia. Near the Tamala Station boundary and near Peron homestead are populations of Eucalyptus which are undescribed and are being currently studied.

A number of blue-flowered plants which so impressed William Dampier during his visit in 1699 are readily visible to the visitor using main roads and tracks. They include Halgania littoralis, Brachycome latisquamea, Solanum spp. and Porana sericea (George 1971).

Three species of Kangaroo are present: Red (Megaleia rufa), Grey (Macropus fuliginosus) and Euro (Macropus robustus). This is the northernmost limit in Australia of the Western Grey Kangaroo. Other species recorded include the Echidna (Tachyglossus aculeatus) and hopping mice (Notomys spp.). The area is very rich in bird life, field camps by the Royal Australasian Ornithologists Union having recorded about 100 species, compared with 75 recorded from Dirk Hartog Island. A bird which reaches its southern limit on Peron Peninsula is the Yellow Silvereye (Zosterops lutea). It is interesting to see this species and the Western Silvereye (Z. lateralis gouldi) in close proximity, yet never actually intermingling. The former is restricted to mangroves while the latter never leaves the scrub and thickets. Some south-western species are at the northern end of their range, such as the Mallee-Fowl (Leipoa ocellata) and the Southern-Scrub Robin (Drymodes brunneopygia).

Faure Island is the site of sea-bird breeding colonies. One interesting record is a skull of the Woilie (Bettongia penicillata) which is now restricted to small areas of the South-West. Skulls of this species have also been found in cave deposits on Dirk Hartog Island and there is a record of it from Shark Bay in the British Museum.

Peron Peninsula is the core of the proposed Shark Bay National Park system and is the area most used for recreational purposes, with resorts at Denham, Monkey Mia and Nanga (Fig. 9.1). Approximately 7000 visitors stayed at Denham in 1972-73 and substantial increases can be expected with the sealing of the main access road and active promotion of the tourist industry.

The main recreational base is aquatic (boating, fishing, shell collecting) but there are other attractions including coastal scenery, interdune lagoons (Fig. 9.3), flora, wildlife and historical associations. The area borders on the porposed Hamelin Pool-Faure Sill nature reserve with its unique natural features, and there is the possibility of controlled public access to this reserve from the Denham road. Development of facilities and access to a wider area of the peninsula should be encouraged.

The peninsula has an insular character, being connected to the mainland at the narrow Tailefer Isthmus across a tidal-supratidal flat that was once a shallow seaway connecting Freycinet Estuary and Lharidon Bight (Logan et al., 1970). The narrow width of the isthmus has lead to suggestions that the peninsula could be sealed by fencing, and native fauna re-introduced after eradication of the introduced fox, cat and rabbit.

Peron Station lease which includes all the Peninsula north of Tailefer Isthmus was offered for sale to the State as a possible National Park in 1972. The National Parks Board, WA Wild Life Authority and the Department of Fisheries and Fauna supported this acquisition but funds were not then available and the lease passed on to private hands.

Small Islands, Shark Bay

The Shark Bay area contains a number of small islands, many of which are of conservational importance, particularly as sea-bird breeding sites. Some of these are:

Freycinet Estuary

Salutation Island
North and South Guano Islands
Three Bays Islands
Baudin Island
Wilds Island
Double Island
Freycinet Island
Mary Anne Island
White Island
Slope Island

Denham Sound

Sunday Island
Egg Island
Meade Island

Hamelin Pool

Pelican Island

Hamelin Pool and Faure Sill

The area including Hamelin Pool and the Faure Sill is of paramount scientific importance as a unique marine environment and a major field laboratory for continuing education and research in carbonate sedimentation, marine biology, physical oceanography and geochemistry.

The environments also are an integral part of the Shark Bay ecosystem, and conservation of commercial fisheries and marine biota of the embayment requires the maintenance of the natural hydrologic system to which all marine species are geared.

Hamelin Pool is a landlocked marine basin partially separated from Shark Bay by a shallow barrier bank, the Faure Sill (Fig. 9.4). The basin is one of the few areas in the world where marine waters are hypersaline with salinities of 55 to 70 parts per thousand, almost twice the salinity of normal seawater. The size, depth and other geomorphologic features of the basin combine with salinity to make this an environment unique in modern seas.

Hypersaline conditions in Hamelin Pool have led to the development of a number of unique geological and biological features. Outstanding among these are algal stromatolites (Fig. 9.5) which are "living fossils" of comparable scientific importance and rarity to protected elements of the Australian fauna and flora. There also are restricted communities of marine organisms tolerant of hypersalinity, vast deposits of organic shells (coquinas), ooid shoals and lithified sediments of Recent age, all rare or scientifically important. The biota inhabiting hypersaline waters is of special interest to marine biologists because of physiological adaptations necessary for life in waters of these high concentrations.

A key element in the formation and maintenance of the hypersaline environment has been the growth and shoaling of the Faure Sill. This structure is a barrier bank constructed in the past 5000 years through the accumulation of skeletons of marine organisms living in seagrass meadows that flourish on the bank surface. Shoaling and growth have lead to restriction of tidal influx into Hamelin Pool and to the development of hypersaline concentrations. The progression to hypersalinity from low (oceanic) salinities can be "read" from sediment cores taken in the basins (Hagan 1973).

Conservation of the Hamelin Pool environment depends primarily on maintenance of hydrologic conditions in the area of the Faure Sill. Unnatural interference with the Sill could lead to an increase in tidal exchange and salinities in the Hamelin Pool basin would fall to normal levels. This would lead to widespread changes in biota and in sedimentation resulting in the destruction of algal stromatolites, molluscan populations and a cessation of ooid formation and lithification.

The inclusion of the Sill in any reserve is therefore essential. The preservation of algal stomatolites, coquinas, ooid shoals and cemented sediments also requires measures which will prevent destruction by activities of man.

The Hamelin Pool stomatolites between high and low water marks are at present protected by a Class A reserve, No. 30885 for the "Protection of Sedimentary Deposits" (not vested). This reserve was created in response to a request made in 1968 to the Department of Lands and Surveys by the Department of Geology, University of Western Australia, for a reserve covering Hamelin Pool, the Faure Sill, and the coast up to 5 chains (100 metres) inland.

This proposal was supported by the Western Australian Geological Survey Branch of the Mines Department. However, it was decided to reserve only the intertidal areas because the State had no legislation authorising the creation of marine reserves, and a 5-chain reserve above high water mark would have required resumption of land from the adjoining pastoral properties. The boundary of these properties lies 2 chain above high water mark, and the 2-chain strip could be included in the reserve without resumption.

A committee of international experts (Environmental Protection Authority Report, 1973) met in Perth on 24, 25 and 26 August 1973 and prepared a report on conservation measures for the Hamelin Pool area. This group unanimously recommended that Hamelin Pool and the Faure Sill be classified as an A Class reserve, vested in the Western Australian Wild Life Authority in terms of the existing legislation, without power to lease. Among their major recommendations were that:

1. the existing Class A reserve No. 30885, as administered by the Department of Lands and Surveys, be extended to 2 chains (40 metres) inland above high water mark, and, once appropriate legislation is enacted, that the area of the balance of Hamelin Pool, as defined further below, be included in this reserve;
2. the purpose of the reserve be extended to include conservation of sedimentary deposits, fauna and flora used in geological and biological education and scientific research;
3. in the interim, the Department of Fisheries and Fauna be requested to prohibit interference with fauna and flora on the seafloor of this area as far as practicable;
4. tourist access be prohibited, except as follows, with the permission of the WA Wild Life Authority. Public access to the coastal area of stromatolites and beach ridges should be provided from the road to Denham on the western side of Hamelin Pool in the vicinity of Nilemah. Tourist sites should be selected by the management authority in conjunction with expert advice;
5. honorary wardens resident in the district be appointed to assist in policing the reserve;
6. no vehicles or power boats be permitted on the reserve without permission;
7. no development, exploration or mining within the reserve, or within 5 chains of its boundaries, be allowed without permission of the Department of Environmental Protection;
8. resort development and unauthorised camping be prohibited in the Hamelin Pool area.

   The future need for additional tourist development in the Shark Bay area is recognised, but there are more attractive places than Hamelin Pool for tourist development, e.g. Lharidon Bight, Freycinet Estuary and Dirk Hartog Island.
9. the entrance channels be not interfered with, particularly by any attempt to introduce commercial prawn cultures in Hamelin Pool or on the Faure Sill with attendant disturbance of the sea bed;
10. existing levels of commercial fishing do not appear to be interfering with the present ecology in the area and there does not seem to be any need to restrict the present level

The committee of international experts further recommended the proposed reserve as follows:

11. Hamelin Pool and its margins south of Australian National Grid, Zone 1 co-ordinate 1,770,000 yards north and including the coast to 2 chains (40 metres) inland from high water level;
12. the Faure Flats area north of Hamelin Pool, including the submerged banks and channels in the area bounded to the north by the 1,800,000 yards north co-ordinate; bounded by the co-ordinate 170,000 yards east, and to the east by the mainland coast extending to a distance of 2 chains (40 m) inland from high water level.

This committee of experts stressed that conservation measures which do not include the protection of the Faure Sill would be ineffectual, as this barrier has been the key element in the development of the environment and in the maintenance of hypersaline conditions in Hamelin Pool.

The Conservation Through Reserves Committee has considered these recommendations and endorese their intention.

Wooramel Seagrass Bank

The Wooramel seagrass bank forms a shallow marginal platform along the eastern shore of Shark Bay (Fig. 9.1). The bank covers an area of 1030 km^2 and is 129 km long; average width is 8 km.

The bank structure is a widge-shaped body of sediment, composed mainly of biogenic carbonate debris that is admixed with terrigenous detrital grains. There is no rigid skeletal framework within the bank. The bank was built in a high-energy environment of tidal currents and waves generated by strong, prevailing southerly winds. Formation and preservation of the banks in this environment are attributed to the modifying influence of seagrasses on processes of sedimentation (Fig. 9.6).

The seagrasses act as organic baffles, and also provide habitats for organisms which contribute skeletal carbonate. Fifty-four tidal channels are the main paths for tidal-water exchange across the intertidal and sublittoral zones. The Wooramel bank contains a variety of marine habits. The outer margin, channel levees and floors are populated by seagrass communities; wide sublittoral and intertidal sandflats are inhabited by molluscan faunas and there are extensive mangrove or algal-mat communities in the intertidal and supratidal zones. The bank is one of the largest bodies of carbonate sediment formed by an organic baffle yet recorded from a modern environment. The only deposits of similar origin and comparable size are the seagrass-bound "mattes" on the Mediterranean coast of France, described by Molinier and Picard (1952). Smaller seagrass-covered banks have been described by Ginsburg and Lowenstam (1958) and Baars (1963) from the Florida region.

The Wooramel seagrass bank was documented by Davies (1970a) in a paper that has become a standard reference for research on carbonate banks, seagrasses and other organic baffles. The bank remains the main field reference for scientific purposes. The majestic proportions of this seagrass bank must be emphasised. In size, continuity, growth rate and variety of features it surpasses most modern coral reefs that have long fascinated scientist and layman. The scientific research potential of the structure has been only partially exploited and there remain significant projects in sedimentation, marine biology and physical oceanography.

The bank structure is a major part of the Shark Bay ecosystem. Its southern parts are nurseries for prawns on which the commercial fishery is based and it is probable that the jungle-like growths of seagrass form an important element in the nutrient cycles of the marine biota throughout Shark Bay. Tidal waters draining from the structure influence the hydrology of the embayment and contribute to the unusual steady-state conditions which pertain (Logan and Cebulski, 1970).

Denham Sound, Freycinet Reach and Estuary, Hopeless Reach and Lharidon Bight

Denham Sound, Freycinet Reach and Estuary, Hopeless Reach and Lharidon Bight are broad gulfs (Fig. 9.1) bordered by shallow platforms and seagrass banks (Fig. 9.7). The gulfs contain prolific marine life and support a commercial scale fishery, intensive sport fishing and shell-collecting by amateurs and professionals. The biota also includes the rare dugong, turtles, rays, sharks and giant cod. There also are populations of immature prawns. Freycinet Reach and Estuary are dotted with numerous small islands most of which are wildlife sanctuaries established to protect sea-bird breeding sites.

The area is picturesque with broad stretches of relatively protected water, colourful coastal cliffs, beaches and lagoons (see Peron-Nanga area; Edel). There are numerous sheltered anchorages for small craft in bays and behind islands and shoals. Tourism at the centres of Denham, Nanga and Monkey Mia is largely based on sport fishing but yatchting, criusing and other aquatic activities are developing and will expand with public realisation of the attractions of the region.

The scale fishery is a major industry. The principal commercial species are whiting (Sillago spp.), Schnapper (Chrysophrys sp.) and mullet (Mugil sp.). Netting for whiting and mullet is carried out mainly in sublittoral sandflat environments. Whiting populations use metahaline (salinities 40 to 53 parts per thousand) areas as nurseries and large populations of young are found in southern parts of Hopeless Reach and Freycinet Reach (Lenanton, 1970). The whiting catch in 1970-71 was 326,000 lbs worth $158,000. The main schnapper fishery is located in Freycinet Reach and Denham Sound but this species also is taken in Hopeless Reach; the total commercial catch in 1970-71 was 247,000 lbs valued at $100,000. Sport fishing is intensive and expanding. Schnapper and other species are favoured. No statistics are available for the amateur catch but it is believed to be in the order of several tens of thousands of pounds and may eventually impose pressures on commercial fishing.

Commercial trawling is prohibited in the areas south of latitude 25° 30' S and east of the Peron Peninsula, and in Freycinet Reach and Estuary south of latitude 26° S. These regulations are to protect immature prawn populations and nursery areas for other species.

The Committee proposes that the area as shown in Fig. 9.2 should be reserved but recognises that management of it will eventually involve reconciliation between commercial and sport fishing, control of small-craft movements, and conservation of islands as wildlife sanctuaries. In addition, marine invertebrates (mainly mollusca) must be protected against over-collecting. The stability of the ecosystem must be maintained because of the relationships between this area and the important prawn and scallop fisheries in northern Shark Bay.