Dampier Archipelago Nature Reserves

Draft Management Plan

June 1989

Department of Conservation and Land Management

DAMPIER ARCHIPELAGO NATURE RESERVES

DRAFT MANAGEMENT PLAN

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PREFACE

The islands of the Dampier Archipelago, located off the Pilbara coast, have significant conservation, historic and archeological values. Since 1965 they have also been a valued recreation resource for the public from nearby Pilbara communities.

Many of the islands are nature reserves, vested in the National Parks and Nature Conservation Authority (NPNCA), and managed by the Department of Conservation and Land Management (CALM). In addition to these, there are other islands and parts of islands in the Archipelago also vested in the NPNCA and managed by CALM, which are reserved for conservation and recreation. This draft plan proposes management programs only for the nature reserves of the archipelago, and recommends that their purpose be changed to national park to allow for the recreational use of the islands. At the expiry of this plan, the islands presently reserved for conservation and recreation will be incorporated into the national park and a comprehensive management plan produced.

The plan is in two major parts: Part A. The Dampier Archipelago Resource identifies the key biological and physical resources, historical and archeological aspects, land-use and conservation values of the reserves. Much of the biological information collected during the preparation of this management plan will be published as a separate resource document: Part B. Plan for Management details the management objectives and the strategies necessary to achieve these objectives.

Following public review the plan will be amended to take account of submissions to the plan. The final plan will then be considered by the NPNCA and forwarded to the Minister for Conservation and Land Management for approval.

The final plan will be current for up to ten (10) years, from the date of adoption, but may be revised within this period, following statutory requirements for public review.

ACKNOWLEDGEMENTS

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PART A

THE DAMPIER ARCHIPELAGO RESOURCE

1.0 STUDY AREA

1.1 Location

The Dampier Archipelago comprises 42 islands, islets and rocks lying within a 45 km radius of the town of Dampier on the north-west coast of Western Australia (Figure 1). The archipelago lies within the Shire of Roebourne between latitudes 20°20'S - 20°45'S and longitude 116°25'E - 117°05'E and at the eastern end of an extensive chain of coastal islands between Exmouth and Dampier. For management purposes, Eaglehawk Island is regarded as the western-most island of the archipelago, and Delambre Island the eastern-most.

1.2 Land Status

1.2.1 Nature Reserves

Twenty-five of the islands in the Dampier Archipelago are incorporated into 4 nature reserves (Table 1, Figure 2), and it is these islands only that are covered by this management plan. These are vested in the National Parks and Nature Conservation Authority (NPNCA) for the conservation of flora and fauna, and managed by the Department of Conservation and Land Management (CALM). All the nature reserves extend to low water mark.

The nature reserves have varying reservation status, viz:

(a) Class A (in terms of the Land Act, 1933) Nature Reserve 36915 comprising the whole of Rosemary (except for a Department of Land Administration Special Lease of 7 ha) and Enderby Islands, having a total area of 4436 ha.

(b) Class B Nature Reserve 34944 comprising the whole of Dolphin Island and having an area of 3203 ha.

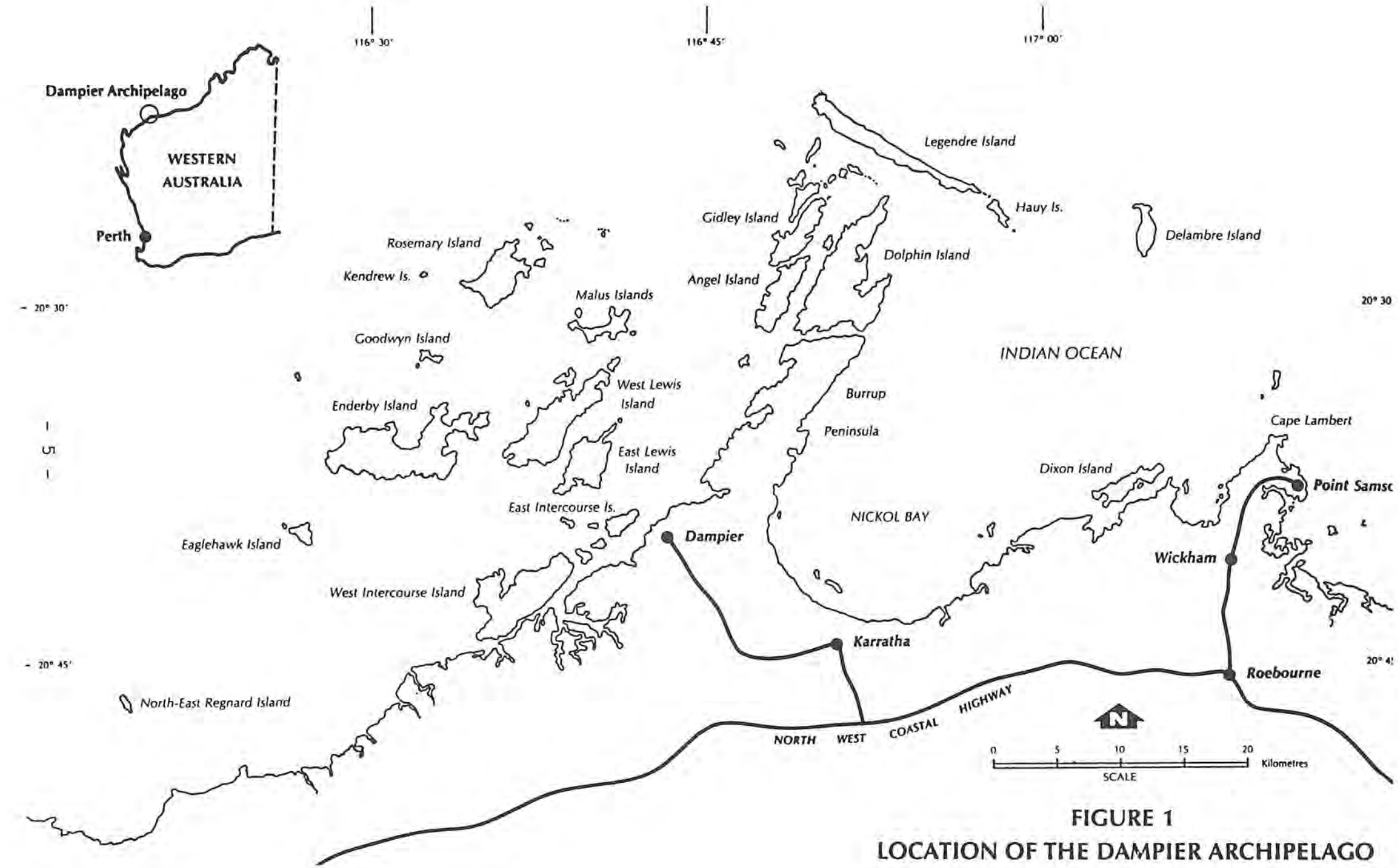

FIGURE 1
LOCATION OF THE DAMPIER ARCHIPELAGO

TABLE 1 Status of Islands in the Dampier Archipelago
(see below for explanation of abbreviations)

Reserve No. and class	Is. Name	Vested Authority	Date of Vesting	Purpose	Area (ha)
B 34944	Dolphin Island	N.P.N.C.A.	12/10/77	Cons F & F	3203
C 36907	East Lewis Island	N.P.N.C.A.	AUG 1987	Cons & Rec	1018
C 36909	West Lewis Island	N.P.N.C.A.	AUG 1987	Cons & Rec	2082
C 36910	Malus Island (part)	N.P.N.C.A.	AUG 1987	Cons & Rec	76
	Angel Island		24/10/80		880
	Bare Rock		25/05/84		3
	Brigadier Island		25/05/84		6
	Collier Rocks		24/10/80		408
	Conzinc Island		25/05/84		11
	Delambre Island		24/10/80		320
	Eaglehawk Island		25/05/84		140
	Elphick Nob		25/05/84		22
	Egret Island		25/05/84		1
	Gidley Island		24/10/80		845
C 36913	Goodwyn Island	N.P.N.C.A.	24/10/80	Cons F & F	65
	Hauy Island		24/10/80		105
	Keast Island		24/10/80		51
	Kendrew Island		25/05/84		6
	Lady Nora Island		25/05/84		27
	Malus Island (part)		24/10/80		170
	Mawby Island		24/10/80		3
	Millers Rocks		25/05/84		1
	Nelson Rocks		25/05/84		1
	Tozer Island		25/05/84		1
	Wilcox Island		25/05/84		20
A 36915	Enderby Island	N.P.N.C.A.	24/10/80	Cons F & F	3290
	Rosemary Island		24/10/80		1062
C 39202	Cohen Island	N.P.N.C.A.	29/09/85	Cons F & F	11
S. lease 3116/3469	East Intercourse Is.			Mining (H.I.)	300
	Tidepole Island				10
S. Lease 3116/4976	Mistaken Island			Mining (D.S.)	20
Crown Land	Dixon Island				500
	East Mid Intercourse Is.				2
	Haycock Island				5
	Intercourse Island				20
	Legendre Island	Min Ind Dev			1300
	Pemberton Island				2
	Roly Rocks				1
	Walcott Island				10
	West Intercourse Is.				2300
	West Mid Intercourse Is.				2

Explanation of abbreviations:

Reserve Class A - Purpose of reserve can only be changed by an Act of Parliament.
B - Purpose of reserve can only be changed with the consent of both Houses of Parliament.
C - Purpose of reserve can be changed by the Minister.

N.P.N.C.A. - National Parks and Nature Conservation Authority.

Min Ind Dev - Minister for Industrial Development.

Cons f & f - Conservation of Flora & Fauna.

Cons & Rec - Conservation and Recreation.

H.I. - Hamersley Iron Pty Ltd.

D.S. - Dampier Salt Pty Ltd.

S. Lease - Special Lease

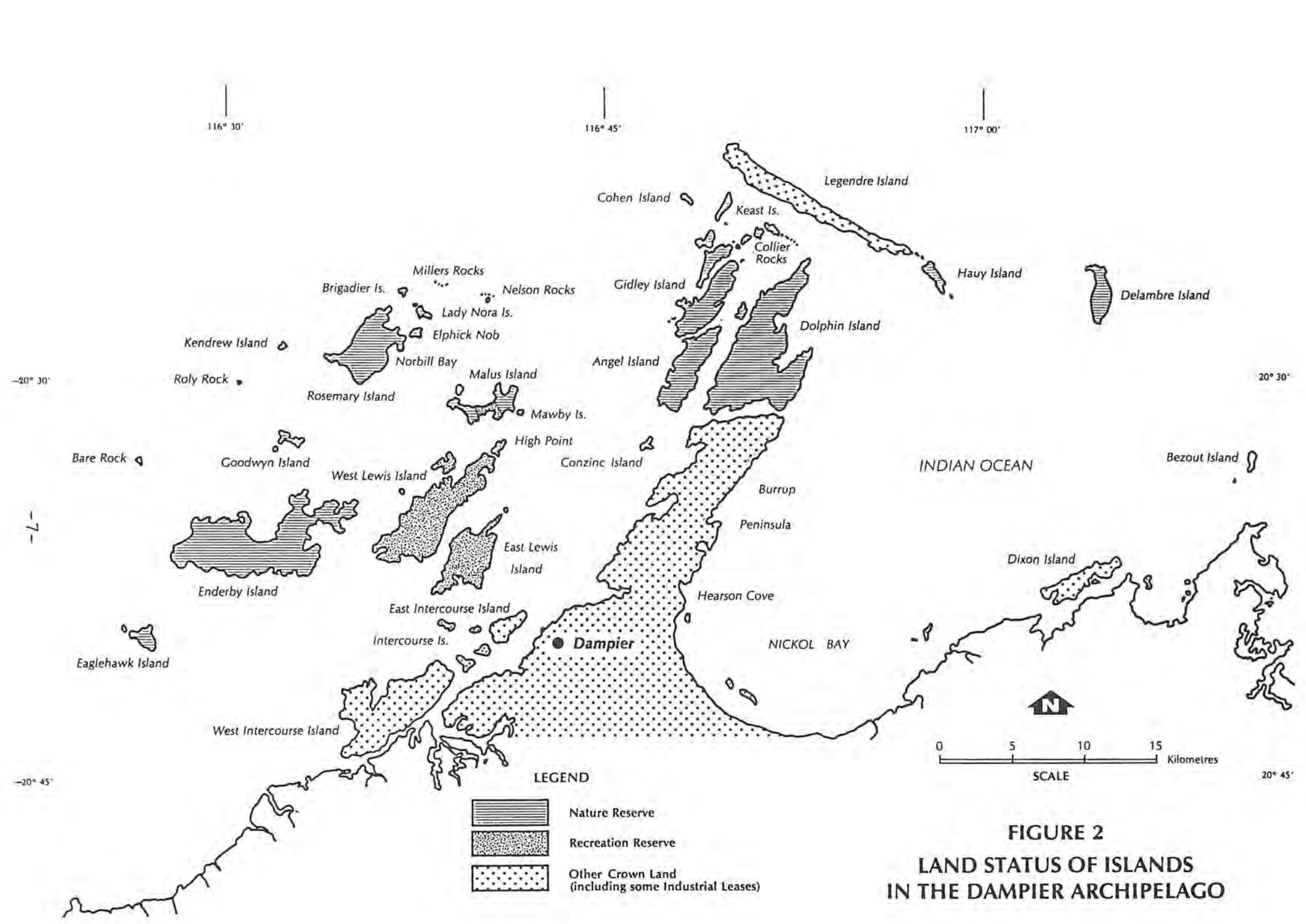

FIGURE 2
LAND STATUS OF ISLANDS IN THE DAMPIER ARCHIPELAGO

(c) Class C Nature Reserve 36913 comprising the whole of Egret, Eaglehawk, Goodwyn, Kendrew, Brigadier, Lady Nora, Conzinc, Angel, Gidley, Tozer, Wilcox, Keast, Hauy, and Delambre Islands; Bare Rock, Nelson Rocks, Millers Rocks, Collier Rocks and Elphick Nob; various un-named islands between Gidley and Keast Islands; and a portion of Malus Island; with a total area of approximately 3020ha.

(d) Class C Nature Reserve 39202 comprising the whole of Cohen Island, an area of 11 ha.

1.2.2 Recreation Reserves

The central portion of Malus Island (C36910), and all of East and West Lewis Islands (C36907 and C36909 respectively) are reserves for conservation and recreation, vested in the NPNCA. These reserves are also managed by CALM, however they are not covered by this management plan (see Section 1.2.5).

1.2.3 Leases under the Land Act, 1933

(a) North West Game Fishing Club:
Since 1963 the North West Game Fishing Club (NWGFC) has, under the Lands Act (1933), leased a 7 ha site on Norbill Bay, Rosemary Island, for their club house and associated buildings. This lease continued after Rosemary Island became a nature reserve in 1980, and is renewable every ten years.

(b) Marine Navigation Beacons:
Three marine navigation beacons are positioned on leases in the archipelago. One of these, on Legendre Island, consists of approximately 250 ha and is adjacent to a Ministerial Reserve. The other two, on Courtenay Head, Malus Is., and Rosemary Is. are each approximately 400 m^2 and surrounded by nature reserve.

1.2.4. Other Crown Land

The remainder of the islands in the Dampier Archipelago are Crown land, some of which are covered by Special Leases (Mining) owned by Hamersley

Iron Pty. Ltd., or Dampier Salt Pty. Ltd. (Table 1). The majority of Legendre Island is vested in the Minister for Industrial Development.

The Burrup Peninsula was formerly known as Dampier Island, as it was separated from the mainland by tidal creek systems and mudflats. With the development of Dampier in the 1960's and later the Dampier Salt fields, service causeways and levee banks were constructed across the creeks and mudflats, and their regular tidal inundation was prevented. Hence the Burrup Peninsula is now regarded as part of the mainland. Much of it is covered by special leases for mining and industrial purposes. The northern portion (about 3000 ha) is crown land covered by a Temporary Reserve vested in the Minister for Mines.

1.2.5. Scope of the Management Plan

This management plan will apply only to the islands in the Dampier Archipelago which are currently nature reserves. This plan does not cover the reserves vested for conservation and recreation (portion of Malus Island, East and West Lewis Islands). It is expected that these will be incorporated in subsequent plans when land tenure issues have been resolved.

1.3 Climate

The climate of the Dampier Archipelago region can be described as semi-desert tropical (Bagnouls and Gaussen 1957), with two seasons; a hot summer extending from October to April, and a mild winter from May to September. The area usually experiences the effects of 2-3 cyclones per year. These cyclonic disturbances are accompanied by heavy rainfall, strong winds and higher tides. Since 1969, meteorological data have been available from Dampier Salt Pty. Ltd., approximately 5 km from the coast adjacent to the Dampier Archipelago. A summary of these data are shown in Table 2.

1.3.1 Temperature

Mean summer temperatures range from a minimum of 24°C to a maximum of 35°C. Mean winter temperatures range from a minimum of 17°C to a maximum of 29°C.

1.3.2 Rainfall

Rainfall is seasonal but unreliable. The mean annual rainfall is 276 mm from 31 rain days. There are two peaks of rainfall during the year. The first peak from January to March is due to tropical thunderstorms and cyclonic activity. The second peak from May to June is due to the passage of low pressure systems through the south of the state. The driest period is between September and November. Evaporation is approximately 2500 mm per year and exceeds rainfall by a factor of nine. The islands possibly receive more rain than the adjacent mainland. Consistently higher rainfall was recorded by a rain gauge set on Enderby Island in the period 1983-87.

	Dampier Salt	Enderby Island
1983	43.5 (mm)	67.5 (mm)
1984	261.9	293.5
1985	140.9	155.5
1986	248.4	268.0
1987	260.4	270.0

The Dampier Salt recordings for this period were all below average and reflect the variable nature of the rainfall.

1.3.3 Growing Period

Ombrothermic curves using the Dampier Salt meteorological data show that rainfall intersects the temperature curve only in March, suggesting that plant growth is most likely to occur at this time. This short growing period is typical of the semi-desert tropical bioclimatic zone (Bagnouls and Gaussen 1957).

1.3.4 Humidity

Relative humidity is highest during the summer months, averaging 48% at 0900 hrs and 43% at 1500 hrs. Early morning dews can occur in both summer and winter.

TABLE 2

A Summary of the Meteorological Data from Dampier Salt Pty. Ltd. (1969 - 1985).

(Meteorological Station Number 0050601, lat 20°43'S, long 116°45' elevation 8.0m)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
Mean Daily Maximum Temperature (°C)	35.4	36.2	36.1	33.5	29.5	26.5	26.1	27.3	30.2	32.0	34.1	35.8	
Mean Daily Minimum Temperature (°C)	26.2	26.5	25.7	22.2	18.0	14.9	13.7	15.0	17.0	19.6	22.2	25.3	
Mean Relative Humidity (%)													
0900	56	57	55	44	43	45	46	45	35	38	39	47	
1500	51	48	45	37	36	37	37	37	31	36	40	44	
Rainfall (mm)													
mean	31	53	60	21	36	32	19	10	1	1	1	11	276
median	17	52	43	2	18	5	6	1	1	0	0	1	303
No. raindays	4	4	5	2	3	3	4	2	0	1	1	2	31

1.3.5 Wind

Wind patterns are significantly different between winter and summer. Winter wind patterns generally consist of an easterly wind modified by a later night and early morning south-easterly land breeze. This changes in the afternoon to a north-westerly sea breeze. Wind speeds are at a maximum during the early morning, often exceeding 20 knots, and decrease during the afternoon and evening.

The summer wind pattern consists of a prevailing westerly wind modified by a night and early morning south-easterly land breeze, and an afternoon north-westerly sea breeze. Wind speeds occasionally exceed 20 knots in the afternoon (Anon. 1979). Winds of up to 100 knots can be experienced during tropical cyclones.

1.3.6 Tides

Tides in the Dampier Archipelago are semi-diurnal with a maximum spring tidal range of 4.7 m and a minimum neap tidal range of 0.4 m. Storm surges may increase the tidal range by 2.0 m during cyclonic activity. Some islands (such as Goodwyn and Malus Islands) are regularly divided into 2 or more smaller islands by spring tidal activity.

1.4 Landscape

1.4.1. Landform

The Dampier Archipelago was formed 6000 - 8000 years ago when rising sea levels, caused by the melting of polar ice caps during the warmer interglacial period, flooded coastal valleys leaving hills and ridges exposed as islands (Merrilees 1979, Semeniuk *et al.* 1982).

The islands range in size from rock islets of less than 1 ha. to Enderby Island, the largest, of 3290 ha. Dolphin is the highest island in the archipelago rising to 120 m above sea level.

Topographically, many of the islands resemble the adjacent mainland and Burrup Peninsula, and are steep and rugged, with coastal cliffs and large rock piles. These rock piles and cliffs are separated by valleys,

beaches and coastal sandplains. Sparsely vegetated sand dunes rising to 3 m have formed at the landward margin of beaches and may also occur further inland on the sandplain. Drainage lines which run from the valleys across the sandplain to the ocean, cut through these dunes. Rock holes in the valleys fill with fresh water following rain, however no permanent fresh water source is known on the islands.

The small islets such as Millers and Nelson Rocks, and the islands to the north of the archipelago such as Hauy and Delambre, are low and flat, and the beaches are often backed by a low limestone cliff rather than a sand dune. These islands tend to be aligned around the seaward margin of the archipelago and represent remnants of the coastal dune system of an earlier period when the mainland shore was located further north than at present. At that time the igneous islands of today were rocky hills on a coastal plain.

1.4.2 Geology

The geology of Dampier Archipelago has been mapped at a scale of 1:50 000 as part of the urban geology series (Department of Mines, Geological Survey of Western Australia Sheets 2156I, 2256I, 2256IV, 2257II, 2257III and 2356IV). Unlike most island nature reserves off the north-west coast, which are composed of Quaternary and Tertiary limestones, many of the islands of the archipelago are composed of igneous rock of Precambrian age. They consist of Proterozoic basaltic flows overlying a basement of Archaean granite (about 2700 million years old). On the eastern islands, such as Dolphin, Angel and Gidley, these basaltic flows are coarse grained Gidley granophyres and gabbro, and are frequently intruded by dolerite dykes. The Archaean basement granite is exposed in several places. On the western islands, such as Enderby, Rosemary and Malus, finer grained Mt. Roe Basalts occur, together with granophyre and gabbro. Beaches and sandplains of Holocene shelly sands have formed in the bays of the islands. Sandplains are more extensive on the western islands. Mud and silt replace the shelly sands in some bays. Older sand deposits occur further inland and some valleys contain weathered alluviums and red-brown silty sands.

The flatter islets and islands to the north of the archipelago are composed of Pleistocene dune limestone. Areas of fringing Holocene sands also occur on these limestone islands, however, most sandplain areas are pink-brown limestone derived sands.

1.5 Implications for Management

1. The existing status of islands in the Dampier Archipelago is confusing to the public and needs to be rationalised to ensure efficient management of the area.

2. Management planning, research and operational activities must consider the predominantly rugged and arid nature of the nature reserves. The beaches adjacent to sandplains are relatively easy points of access to many of the islands and hence will be a focus of any public activity. These areas will therefore require most attention with respect to management for public use. In particular, the sand dunes adjacent to the beaches are prone to erosion if disturbed.

3. The climate dictates that most public use of the nature reserves would occur during the winter months.

4. Many of the small islands and rocks do not have beaches and are relatively inaccessible to the public.

2.0 HISTORY AND LAND USE

2.1 Aboriginal Occupation

The islands of the Dampier Archipelago show abundant evidence of previous occupation by Aboriginal people in the form of, for example, shell middens, stone "factory" sites, rock engravings, hunting hides and habitation sites. Aboriginal people probably utlized the area since well before it became an archipelago, approximately 8000 years ago.

It is now believed that two groups utilized the islands (Rhoads and Gara 1984). At the time of European settlement of the Roebourne district in the 1960s, the Yapurarra people were considered to be the traditional inhabitants of the Dampier Archipelago and Burrup Peninsula, and were referred to as the "island people" by the neighbouring Aboriginal groups. Some of the more western islands in the archipelago were also visited by the Martuyhinira people, a predominantly mainland group occupying land to the west of the Nickol Bay area.

It is estimated that the Yapurarra once numbered 100 - 120 individuals (Rhoads and Gara 1984), but none now survive. These people used rafts to travel between the islands and made extensive use of the abundant marine life for food. Fresh water was available to them for part of the year from rock pools. Latz (pers. comm.) also suggests that shallow wells may have been dug in suitable areas on sandplains following rain. It is probably this group that Lieutenant Philip Parker King saw and communicated with during his visit to the Dampier Archipelago in 1818 (Lee 1925). Their decline in the late nineteenth century followed the introduction of disease (such as smallpox), exploitation by whalers and pearlers, and violent confrontation with European settlers, for example the Flying Foam massacre in 1868 (Gara 1983).

2.2 Early European Exploration

The group of islands now known as the Dampier Archipelago were known to early Dutch navigators. It appears together with Barrow Island and the Montebello Islands on a chart drawn in 1628 for the Dutch East India Company (de la Rue 1979).

The first recorded European visit to the Dampier Archipelago was made by the Englishman William Dampier in 1699. He landed on an island which he named Rosemary Island because of the presence of the plant *Olearia axillaris*, which reminded him of the English herb, Rosemary. However, it is now agreed that the island which bears this name today is not the one originally named by Dampier (King 1817, Tuckfield 1955, George

1971). McIlroy (1979) suggests that Malus Island was the island visited by Dampier and the "Bluff Head" referred to was Courtenay Head on the north of Malus Island.

In 1772 St. Allouarn noted "Rosemary Island" while sailing from North West Cape to Timor, however no landing was made (Henn 1934). In 1801 Nicholas Baudin in the "Geographe" named the group of islands Dampier's Archipelago, and apparently misinterpreted Dampier's naming Rosemary Island. Baudin named Malus Island and assigned the name Rosemary to an island 4 km to the north-west of Malus Island. Legendre, Hauy and Delambre Islands were also named during this visit. Further east, Baudin named Depuch Island and the Forestier Archipelago. Lieutenant Philip Parker King made a more detailed excursion into the Dampier Archipelago during his voyage in the "Mermaid" along the north-west coast in 1818. During his 2 week visit Enderby, Gidley, the Lewis Islands and the Intercourse Islands were named, as was Nickol Bay to the east of the Dampier Archipelago.

In September 1851, Lieutenant F.B. Helpman visited the Archipelago in seach of guano deposits and made particular mention of "numerous fresh native foot marks on the beach..." and "... three graves lying side by side" on Enderby Island (McIlroy 1979). These graves were believed to be of early whalers, however their exact location is not known, and they have not been found since.

The first party of Europeans to explore the inland Pilbara region landed at Hearson Cove, on the Burrup Peninsula, in 1861. This party under the leadership of F.T. Gregory, travelled from Fremantle in the "Dolphin" to determine the potential of the north west for agriculture. Dolphin Island was named after this ship, and several other features such as Pemberton, Walcott and Dixon Islands and Cape Lambert were named by Gregory after members of this expedition (Gregory and Gregory 1884).

2.3 Land-use 1860 - 1960

Following Gregory's reports of good grazing land in the Pilbara in 1861, settlers journeyed from the south to establish the pastoral industry, and by 1866 the town of Roebourne had become established. Cossack was established as the port for Roebourne in 1872. Gregory also noted that pearl shell was abundant in the waters of the Dampier Archipelago and he took several valuable pearls with him when he returned to Fremantle. A pearling fleet soon became established at Cossack, and Flying Foam Passage, between Angel and Gidley Islands to the west and Dolphin Island to the east, became the major pearling area in the north-west between 1870 and 1900. In 1873, 500 people including Europeans, Malays, Chinese and Aboriginals were working in this area, and rock pools on Dolphin Island were used to supply fresh water for these operations. The remnants of a pearling camp can be found today in Black Hawke Bay on Gidley Island (MacIlroy 1979). Flying Foam Passage was also used extensively during this period as a sheltered route for shipping between Cossack and Fremantle. Six graves on the west side of Dolphin Island are believed to be of pearlers.

From 1870 to 1872, a whaling station was established on Malus Island to process Humpback whales taken by longboats operating around the Dampier Archipelago (MacIlroy 1979). Remains of the try pots and ovens are still evident. (This site is now on Recreation Reserve 36910).

The stone ruins of a pastoral settlement are found on the east side of West Lewis Island. The date of occupation and name of lessee are not known; however it is thought to have been abandoned prior to 1900. It has been estimated that the stockyards were large enough to hold several hundred sheep, however the actual number was probably less due to watering constraints (MacIlroy 1979). Several pastoral leases were granted by the Department of Lands and Surveys over islands in the Dampier Archipelago between 1900 - 1930, however the earliest of these post-dates the abandonment of the settlement on West Lewis Island.

Between 1900 - 1960, islands in the Dampier Archipelago were used for shelter and as campsites by commercial fishermen (oysters and wet line fishermen) from Point Samson and Onslow. During this period turtles and their eggs were taken commercially around the Dampier Archipelago and until 1936 a turtle meat canning company operated at Cossack. The last turtles were taken commercially in 1963 when the licenced fishermen ceased hunting in the area because the large tidal variation made the shallow waters too dirty to catch efficiently. Very little recreational activity was undertaken by the public as the population of the region was small and the islands were relatively inaccessible at this stage.

Two war time wrecks can be found on Enderby Island. One of these is the remains of the 30 ton yacht "Sedjatra" which was wrecked on the north west side in 1942 while en route from Indonesia to Fremantle after the Japanese invasion of Singapore. The other is the dismantled parts of a PBY 5 Catalina flying boat located on the east side of Enderby Island. This flying boat belonged to the 10th Air Wing of the United States Navy which operated from Crawley Bay (Perth), Geraldton and Exmouth between 1942 and 1944. During this time they conducted reconnaissance and night bombing raids over Japanese held islands in the Timor region. One of these flying boats was forced to put down in the sea near Enderby Island due to mechanical problems, and during the night broke its moorings and was washed ashore.

2.4 Land-use 1960-present

a) Background and Population Estimates:

The majority of people using the islands for recreation are residents in the Shire of Roebourne towns of Dampier, Karratha, Wickham and Roebourne, all of which are within a 50 km radius of the archipelago.

When the Commonwealth Government eased restrictions of iron ore exports in 1960, exploration and development of ore deposits in the Pilbara proceeded rapidly, and since 1965, the permanent population of the Shire of Roebourne has increased dramatically (Table 3). The increase began in 1965 when Hamersley Iron Pty. Ltd. constructed the town and port of Dampier to accommodate the company's 2500 employees involved in the export of iron ore. The adjacent Dampier Archipelago, at this stage vacant Crown land, immediately became a focus for recreational activities and shacks were erected on Enderby, Malus, East and West Lewis Islands. From 1965-1976, the population increased 10 fold as further development of ports and towns for the iron ore industry occurred, in particular Karratha and Wickham. With the development of the North West Shelf Gas project by Woodside Offshore Petroleum Pty. Ltd. and with Karratha becoming a significant regional centre, by 1981, the population of the Shire of Roebourne was 14 887, the most populated of the 4 Pilbara local government areas. This trend is continuing. The second stage of the North West Gas Shelf project commenced in 1985, and this in addition to the proposed developments of the Channar iron ore deposit by Hamersley Iron Pty. Ltd. will result in an estimated increase in population to 18 000 by 1991 (Anon 1986).

Boat ownership rates are extremely high in these towns (approximately one boat to every 10 people in Karratha) and recreational use of the islands will increase as the population increases. In addition to the local population, the archipelago is also visited during the cooler months by organised marine charters and cruising yachts from elsewhere in Australia and overseas.

TABLE 3

Shire of Roebourne
Population 1965-1991

Year	Population	Data Source
1965	1 000	Anon (1986)
1976	10 650	Aust. Bur. Stat. Census 1976
1981	14 887	Aust. Bur. Stat. Census 1981
1985	15 500	Anon (1986)
1991	18 000	Anon (1986)

b) Public Use Survey:

Between 1982 - 1985 regular surveys of public use of the archipelago were undertaken during holiday and non holiday periods (Table 4). The following points characterise public use of the islands:

i) Because of the climate and topography of the islands, camping and day trips are restricted almost exclusively to the beaches.

ii) Campers and daytrippers prefer to use beaches on their own, avoiding other users. Hence they generally use nature reserve beaches, rather than "shack" beaches on recreation reserves for their recreational activities.

iii) Most camping occurs during long weekends or holidays in the cooler months (April - September). However because of the rostered day off system operated by the larger companies in the region, which provides long weekends for employees outside public holidays, some camping occurs during ordinary weekends. The maximum number of camps observed on the nature reserves was 32 (Easter 1984 - Table 4). If it is assumed that 4 people occupy each camp this equates to approximately 120 people.

iv) The extent of day trip use of nature reserves was more difficult to estimate, however up to 17 boats (approximately 70 people) at a time were observed on the islands, but not associated with a camp. Up to 150 boats were observed around the islands at any one time. These were mainly involved in amateur fishing and diving activities and fishermen often clean fish on the islands before returning to Dampier.

v) Many of the public users were not aware of which islands were nature reserves and which were not. Dogs often accompanied campers and day trippers, and open fires were used by campers.

TABLE 4

Estimates of the maximum public use of nature reserves in the Dampier Archipelago from October 1982 - October 1985. Approximately four people are associated with each boat or camp. [(-) = no observation]

	LONG WEEKEND/ HOLIDAYS			NORMAL WEEKEND	
	Number of Public Holidays	Max. No. of boats	Max. No. of camps	Max. No. of boats	Max. No. of camps
JAN	2	106	15	76	0
FEB	0	0	0	5	0
MAR	1	68	8	-	0
APR	2	151	32	53	0
MAY	1	23	0	53	0
JUN	1	25	11	8	1
JUL	1	79	4	72	0
AUG	1	117	7	-	0
SEP	1	43	12	37	3
OCT	1	86	4	12	3
NOV	0	0	0	-	0
DEC	2	-	0	-	0

c) Shacks:

Apart from the North West Game Fishing Clubs facilities on Rosemary Island (See 1.2.3), all shacks are now located on recreation reserves 36907 (East Lewis Island) 36909 (West Lewis Island) and 36910 (part of Malus Island). Thirty-three shacks (June 1986) exist on these reserves. Three dilapidated shacks remain on Delambre Island, and the concrete floor of a shack removed in 1984 remains on Goodwyn Island. Some temporary frames have been left by the public on some nature reserve beaches.

d) Research Station:

The Department of Conservation and Land Management controls a research station on Enderby Island, and this is used as a base for research and management operations in the Dampier Archipelago.

e) Airstrip and Vehicle Tracks:

As part of their use of Rosemary Island prior to it becoming a nature reserve, the North West Game Fishing Club constructed an airstrip and a well on the north side of the island. Vehicle tracks connect these, and other parts of the island to their base in Norbill Bay. Use of the airstrip was stopped in 1983 and in May 1985 explosives were used to break up the compacted airstrip surface to facilitate vegetation regrowth. Another track connects the marine navigation beacon on Rosemary Island with Norbill Bay and is used by the Department of Transport and Communications for servicing purposes.

2.4.2 Mining and Industrial Use

a) Mining Tenements for limesand and limestone:

In 1968, an iron ore pelletizing plant commenced operating in Dampier. Associated with this Hamersley Iron Pty. Ltd. lodged applications for mining tenements covering the beaches and sandplain on any of the islands in the Dampier Archipelago (Rosemary, Enderby, Malus, Collier

Rocks, Delambre, Hauy, Legendre, Keast, East Lewis and Goodwyn Islands). These applications were for the extraction of limesand, used in the production of iron ore pellets, and limestone for possible use in future iron and steel production. Prior to creation of the nature reserves in 1980, Cabinet approved the application for mineral leases on Enderby Island, but refused those on Rosemary Island. When the majority of other islands were reserved for Conservation of Flora and Fauna (C36913), Cabinet decided that all existing and future applications for mining tenements be granted on no more stringent conditions than are reasonably required to protect the environment, and provide for adequate rehabilitation after the completion of mining. The pellet plant ceased operating in 1980 and no extraction of limesand or limestone occurred on any of the islands, although some exploratory pits were dug on Enderby Island. All limesand for the pellet plant was obtained from deposits at Hearson Cove on the Burrup Peninsula.

b) Radio Positioning Base Stations:

With the development of the North West Shelf Gas Project in 1980, there have been regular requests by Woodside Offshore Petroleum Pty. Ltd. to erect temporary manned and unmanned radio positioning base stations on nature reserves in the Dampier Archipelago. These have always been approved subject to preliminary site inspection by the CALM personnel and compliance with the Wildlife Conservation Regulations (1982). Recently permanent navigation aids were installed on Angel and Gidley Islands by Woodside, to assist in the safe movement of gas and condensate tankers to and from the Withnell Bay loading facility.

2.5 Possible Future Land-Uses

Because of the limited availability of suitable beaches on the mainland, and the preference by the public for water based recreational activities, use of the nature reserves by the public will increase as the populations of nearby towns (in particular Karratha) increases.

Mining tenements covering several of the nature reserves are still held by Hamersley Iron Pty. Ltd., and the extraction of limesand and limestone from them is possible in the future. Requests by Woodside

Offshore Petroleum Pty. Ltd. for temporary radio base positioning stations on the nature reserves are likely to continue.

Until December 1987, Rosemary, Enderby and Goodwyn Islands were covered by petroleum exploration permit WA 192-P. This permit lapsed, however this area has again been offered for petroleum exploration under the Petroleum (Submerged Lands) Act (1967). Exploratory surveys of the waters and lands within this area are possible in the future. Production facilities could be established in the area if exploration indicated petroleum reserves are present.

Legendre Island is vested in the Minister for Industrial Development because of its potential as a deep water port site (Gillespie 1975). Should this proposal proceed, Legendre Island would be linked to the Burrup Peninsula with a causeway across several of the island nature reserves.

2.6 History of Reserve Status

The value of the islands of the Dampier Archipelago to nature conservation and for future recreational use was realised in 1962 when the Australian Academy of Science recommended that:

a) the Dampier Archipelago be gazetted as an "A" Class reserve comprising a national park,

b) a biological survey should be undertaken with recommendations made concerning areas for public recreation and areas for the preservation of flora and fauna.

No further action was taken at that time but as the Pilbara iron ore industry developed so did recreational pressures on the islands. A detailed biological survey was undertaken (Burbidge and Prince 1972) and the Conservation Through Reserves Committee (CTRC) recommended to the Environmental Protection Authority (EPA) in 1974 that the majority of the islands be declared Class "A" reserve for the Conservation of Flora and Fauna. It was also recommended that Enderby Island be reserved for recreation and conservation, and that other islands be left unreserved for future port sites and associated industries and for a causeway to Legendre Island.

The residents of Dampier and Karratha felt that the CTRC recommendations did not adequately provide for recreation and through their Dampier Archipelago Reserves Committee submitted proposals for 5 "open recreation" areas on the islands. These areas would allow for the construction of shacks, as well as camping and day trips.

In the EPA report to Cabinet in 1975, the CTRC recommendations were modified and provided for more recreation reserves than initially suggested.

In October 1977 Dolphin Island was declared a B Class reserve for the Conservation of Flora and Fauna. The Dampier Archipelago Recreation Advisory Committee (DARAC) was appointed in 1978 to advise the Minister for Conservation and the Environment on the management of proposed recreation reserves in the archipelago. However in 1980, before DARAC reported to the Minister, the majority of the islands were declared nature reserves with portions of some reserved for recreation. By this stage several shacks had been erected on some of the islands and their distribution to a large extent determined the positioning of the recreation reserves. Camping for up to 5 nights, and day trips were permitted to continue on nature reserves, however no permanent structures were to be erected (West Australian Wildlife Authority 1980). Legendre Island remained vacant Crown land for possible future development as a port site (Gillespie 1975).

In 1984, the reserve status of the islands was reviewed and all of East and West Lewis Islands (formerly nature reserves) became recreation reserves. The recreation reserve containing shacks on Malus Island remained as such, however all other recreation reserves on Rosemary, Angel, and Delambre Islands were cancelled and incorporated into the adjacent nature reserve. This resulted in the reserve status as presently exists and which is described in A 1.2 of this management plan.

2.7 Implications for Management

1. The full significance of the Aboriginal sites in the Dampier Archipelago (other than the Burrup Peninsula) is unknown and a

detailed site survey is required. Nevertheless, there is no doubt that the rock art on the islands has enormous cultural value.

2. Aboriginal sites and objects are protected under the Aboriginal Heritage Act (1972). It will be necessary to obtain permission from the Western Australian Museum before management operations, which may involve Aboriginal sites, can be undertaken.

3. The Dampier Archipelago has featured in the early coastal exploration and development of the north-west of Western Australia and several historic sites are known from the islands. Relics from more recent events such as the Second World War also occur. These sites and relics are worth preserving for their educational and heritage values. Much is known about these sites and this information should be used in the interpretive process for the nature reserves.

4. With the development of the iron ore industry since 1960, recreational use of the islands has increased dramatically. Some environmental degradation has occurred and regulation of public use will be necessary to protect the nature reserves' conservation values.

5. Further increased recreational use of the islands will occur. The use of nature reserves for camping is incompatible with management objectives for nature reserves and it would be appropriate for the purpose of the islands to be changed to national park immediately. Further, it would be appropriate that, at the expiry of this plan, the recreation reserves be incorporated into the national park.

6. Further industrial use of the islands is likely. In particular, liaison should be maintained with Woodside Offshore Petroleum Pty. Ltd. regarding the location of permanent and non-permanent navigation sites and radio positioning sites on the nature reserves. Use of the islands for the extraction of limesands, or exploration for petroleum would be subject to Government policy on mining in nature reserves, and the Environmental Protection Act (1986).

3.0 BIOLOGICAL RESOURCES

3.1 Flora

3.1.1. Collecting History

The islands of the Dampier Archipelago have considerable significance in the history of botanical research in Western Australia.

The first recorded collection of plants from the archipelago was by William Dampier in 1699. He collected specimens of the Sturt Pea *Clianthus formosus* and the native Rosemary shrub *Olearia axillaris*, and noted other species such as *Ipomoea pes-caprae* (George 1971).

The botanist Alan Cunningham collected several species from the Dampier Archipelago in 1818 when he accompanied Philip King on a journey of exploration along the north-west coast. Species collected include the native fig *Ficus platypoda, Cynanchum floribundum, Swainsona pterostylis* and an *Acacia* sp. possibly *A. bivenosa* (Lee 1925). The type specimen of the native tomato *Solanum phlomoides* was collected from Enderby Island by Cunningham (Purdie *et al.* 1982).

In 1861, Pemberton Walcott collected from the "Dampier Archipelago" (probably Burrup Peninsula and Dolphin Island) while he waited for F.T. Gregory to return from exploring the inland Pilbara region. Many native grasses were included in his collection (Gardner 1952).

In 1961 a W.A. Museum expedition, and in 1962 a joint W.A. Museum and W.A. Herbarium expedition visited several of the islands. Both collected flora specimens but a more detailed collection was undertaken in 1970 as part of a biological survey of the Dampier Archipelago (Burbidge and Prince 1972). More recently Blackwell *et al.* (1979) have compiled a report on the flora and vegetation of the Burrup Peninsula and southern part of Dolphin Island. In 1987, Long (1988) undertook a flora survey of selected islands in the Archipelago, on behalf of CALM.

3.1.2. Flora Composition

Two hundred and eighty eight species of native terrestrial plants from 60 families are known from the Dampier Archipelago. The Poaceae and Papilionaceae are well represented. Six species are listed as poorly collected and/or geographically restricted in the Pilbara by Van Leeuwen (1983); *Terminalia supranitifolia, Trianthema turgidifolia, Brachychiton acuminatum, Triumfetta leptacantha, Paspalidium tabulatum,* and *Scaevola cunninghamii*. Further surveys may find that some of these species such as *Terminalia supranitifolia* and *Brachychiton acuminatum* are more widespread. Long (1988) recorded undescribed species of *Heliotropium* and *Paspalidium*, and the occurrence of *Scaevola amblyanthera*, a species not previously recorded in W.A.

Dolphin Island (3202 ha) is the most floristically diverse with 157 species. Enderby Island, of similar size (3290 ha), but of slightly different geological formation, supports 117 species of plant, although further surveys will possibly increase this number. The sandplain and water-course areas in particular on Dolphin Island support a diverse flora.

Currently there are no data on the intertidal marine flora, although it is obvious that there are many species of algae and sea-grass inhabiting the intertidal zone of the nature reserves.

3.1.3 Introduced Plants

At least seven species of introduced plant are known from isolated areas in the archipelago. Buffel Grass *Cenchrus ciliaris* is well established on the old airstrip on Rosemary Island; Kapok Bush *Aerva javanica* occurs on some sandplains, and the prickly pear *Opuntia stricta* did occur on Enderby Island but was eradicated by departmental officers in 1985.

This species is also well established on East and West Lewis Islands and has been subject to control attempts by the Agriculture Protection Board. Spraying with the herbicide 245-T in 1979 was unsuccessful, however biological control trials with *Cochineal* insects (1984-1986)

were successful. In October 1986 *Cochineal* insects were distributed to all Prickly Pear infestations around East and West Lewis Islands. Palms (*Cocos nucifera)* and a Tamarisk tree have been planted on the North West Game Fishing Club lease on Rosemary Island. A Palm *Phoenix dactylifera* has also been planted near the well site on Rosemary Island. *Salsola kali*, which is common on many islands is now also regarded an an introduced species (Wilson 1984).

3.2 Vegetation

The Dampier Archipelago lies immediately adjacent to the Abydos Plain in the Fortescue Botanical Province (Beard 1975). The vegetation is predominantly Eremaean in character, however, the Burrup Peninsula, Dolphin, Angel, and Gidley Islands are botanically different from the Abydos Plain with a higher number of Northern Botanical Province (Kimberley) species (Blackwell *et al.* 1979). The rockpile formation of the islands, together with the higher humidities and incidence of dews on the coast contribute to this difference. The vegetation of the islands has been infrequently burnt and has been largely unaffected by pastoral and mining activities and represents a climax situation in most instances.

Beard (1975) broadly mapped the Dampier Archipelago as grass steppe, (i.e. spinifex *Triodia pungens*) plains with no trees or shrubs. However, Burbidge and Prince (1972) recognised six vegetation associations in the Archipelago varying with soils and topography, and these form the basis of the vegetation description used in this management plan. The vegetation and flora of the Burrup Peninsula and southern portion of Dolphin Island have been assessed in detail by Blackwell *et al.* (1979) as part of the Environmental Review and Management Program for the North West Shelf Gas Development Project.

The vegetation associations, commencing at the lowest point on the landscape are:

a) Littoral Association

Mangrove communities occur as narrow bands of vegetation in sheltered locations such as tidal creeks or bays where the substrate is muddy. These attain a height of 4 m and form dense thickets on the shore line. Gordon (1983) estimates that approximately 330 ha of mangal occur around islands in the Dampier Archipelago, predominantly on Enderby, Gidley and Dolphin Islands. The White Mangrove, *Avicennia marina*, is the most common species however, another five species are also known. The only Pilbara mangrove species not recorded on the islands is *Osbornia octodonta*.

Salt water tolerant communities are often found at the mouths of drainage lines and on the landward side of the mangrove communities. These areas are frequently inundated by sea water during spring tides. Dominant species include Salt Water Couch *Sporobolus virginicus*, *Halosarcia halocnemoides* and *Enchylaena tomentosa*. On the small limestone islets such as Nelson Rocks, which are subject to frequent salt spray, *Thelkeldia diffusa* is a dominant species.

b) Sandplain Association

Recently formed (that is in the last 6000 years or so) sandplains of shelly sands occur adjacent to many of the beaches in the Dampier Archipelago, particularly on the basalt and granophyre based islands. The sandplain vegetation is probably the most diverse of any association on the islands.

The vegetation is sparse low shrubs to 2 m dominated by native wattles *Acacia bivenosa* and *A. coriacea* and *Myoporum acuminatum* over mid-dense hummock grasses *Spinifex longifolius* and *Triodia pungens*. Bloodwood Eucalypts *Eucalyptus terminalis* and Weeping Box *E. patellaris* to 4 m occur on sandplains at the west end of Enderby Island. These species also occur on rocky soils on Dolphin Island. Annual species such as the Sturt Pea *Clianthus formosus*, *Swainsona pterostylis* and *Trichodesma zeylanicum* appear following rain, particularly along drainage lines.

The creeper *Ipomoea pes-caprae* is common on the foredunes. On the pink-brown sandplains of the limestone islands, dominant species include *Triodia* spp., *Salsola kali, Ptilotus exaltatus, Sorghum plumosum,* and *Sarcostemma australe.*

c) Run-on Areas and Flats Association

These are areas of heavier alluvial soils which become water logged or flooded after heavy rain. They support a variety of mid-dense grasses, and a few shrubs. Dominant species include the grasses *Sorghum plumosum, Setaria dielsii, Chrysopogon pallidus* and *Eulalia fulva,* the ground covers *Tribulus occidentalis, Mukia maderaspatana* and shrubs *Sesbania cannabina* and *Cassia venusta.*

d) Drainage-lines Association

Drainage lines among the rocky slopes of the larger islands support a diverse array of flora particularly on Dolphin Island. The vegetation consists of sparse trees and/or shrubs to 4 m, predominantly *Eucalyptus microtheca, E. terminalis, E. patellaris,* and *Terminalia canescens,* over sparse shrubs to 2 m including *Sarcostemma australe, Cassia* spp. and *Sesbania cannabina.* Where water is retained in rock pools for long periods *Cyperus vaginatus* and *Scirpus litoralis* occur. Dense *Triodia angusta* tussocks grow in drier water courses.

e) Rocky Slope Association

This is the most common association in the archipelago and is probably Beard's "grass steppe".

The vegetation consists of very sparse shrubs (less than 2 m) of *Acacia pyrifolia, Grevillea pyramidalis* and *Hakea suberea,* over mid-dense hummock grass *Triodia wiseana,* on rocky soils. Other grasses such as *Themeda australis* and *Eriachne obtusa* also occur.

A very sparse vegetation cover is found on the higher rock piles and outcrops. On Dolphin, Angel and Gidley Islands, the vegetation consists of small pockets of fire-sensitive tree and shrub species such as *Brachychiton australe*, native figs *Ficus platypoda* and *F. virens*, weeping *Pittosporum phylliraeoides* and *Terminalia supranitifolia*. Grasses such as *Triodia wiseana* and *Themeda australis* occur where soil has accumulated. The rocky areas of Enderby and Rosemary Island are not as diverse.

The rocky outcrops on the limestone islands are not as rugged, but they also support sparse shrubs to 2 m, predominantly *Ficus platypoda* and *Pittosporum phylliraeoides*.

3.3 Fire History

Fires are likely to have occurred on the islands in the past through burning by Aboriginal people, and wild fires as a result of lightning strike.

The Yapurarra people who occupied the islands of the Dampier Archipelago prior to the 1860s would have used fire for a variety of management purposes including regeneration of food plants, clearing camp sites, and hunting. These fires were regular, but probably only covered small areas of land, producing a mosaic of vegetation seral stages. Superimposed on this, occasional lightning strikes may have produced more extensive fire patterns. Since the 1960s these less frequent, but more extensive fires have been the pattern, and this is reflected in the climax and in some instances, senescent vegetation seral stages, which dominate on the islands. Thus in the last 100 years or so, the "natural" fire regime has changed from one of small but frequent fires to one of large but less frequent fires.

Aerial photography taken in 1957 does not show any discernible fire scars on the islands in the Dampier Archipelago. In November 1979 a wildfire burnt the majority of Angel Island, having escaped from a signalling fire lit by stranded fishermen. In October 1982, another wildfire presumably started by a lightning strike burnt a large portion

of Legendre Island. In January 1987, approximately 200 ha on the south east side of Dolphin Island was burnt. This fire was contained by the lack of vegetation on the rocky slopes. In August 1988, approximately 9 ha at the east end of Hauy Is. was burnt as a result of an escaping camp fire, and in January, 1989 the majority of Collier Rocks was burnt. No other wildfires are known since the town of Dampier was established in 1965. There are however old fire scars, possibly 20 - 50 years old, on the *Eucalyptus* trees on the west end of Enderby Island.

In 1980 a small area on the east end of Enderby Island was deliberately burnt by Department of Fisheries and Wildlife personnel as part of the research program into the requirements of Rothschilds Rock Wallaby, *Petrogale rothschildi*.

3.4 Fauna

3.4.1 Collecting History

Notes on the fauna of the Dampier Archipelago, particularly sea-birds and turtles, were made by William Dampier in 1699. Alan Cunningham recorded some of the marine fauna during King's visit to the Dampier Archipelago in 1818 (Lee 1925). In 1901 J.T. Tunney collected the first specimens of the native rodent *Rattus tunneyi* from the Lewis islands and Rothschilds Rock Wallaby *Petrogale rothschildi* from Enderby Island. F. Lawson Whitlock recorded several nesting sea-birds in the Dampier Archipelago in 1918 (Whitlock 1981, Serventy and Whittel 1976). Several vertebrate and invertebrate specimens were collected during W.A. Museum visits to the islands in 1961, 1962, 1971 and 1972 (Kendrick 1961, Kitchener and Vicker 1981). The first detailed biological survey of the Dampier Archipelago was undertaken in 1970 (Burbidge and Prince 1971), following a recommendation by the Australian Academy of Science in 1962 that the islands become Class A reserves. Further biological surveys have been undertaken by Connell (1983) and by CALM between 1982 - 1986 during the preparation of this management plan. A collection of aquatic invertebrates from a freshwater rock pool on Dolphin Island was made in March 1984, and a collection of terrestal invertebrates, predominantly insects, was undertaken on Enderby and Rosemary Islands and Nelson Rocks in July 1985 by Mr P. McMillan.

There has been limited study of the marine fauna of the archipelago. A W.A. Museum field team made an extensive collection of invertebrates on the shores of Rosemary Island in 1961, and conducted an intensive study of a population of Crown of Thorns Starfish at Kendrew Island in 1972-74 (Wilson and Marsh, 1975). During the later study a detailed survey was made of the intertidal fauna at Kendrew Island, but the results have not been published. Further study on the marine flora and fauna was made by the Department of Conservation and Environment in 1981/84, including some habitat mapping of the shallow zones of the archipelago. Resulting from that project Simpson (1985) published an important paper on mass spawning by corals in the archipelago.

3.4.2 Faunal Composition

a) Mammals:

Eleven species of native mammal, including 3 species of marsupial, 4 species of rodent and 4 species of bat have been recorded from the islands in the Dampier Archipelago. One of the bat species the Little Red Flying Fox *Pteropus scapulatus* is only known from remains of one individual collected on a beach at Enderby Island. This species is probably a rare visitor to the islands although common on the mainland along the coast.

Two introduced mammal species are also known from the islands, and one other the sheep *Ovis aries* was kept on West Lewis Island between 1890 - 1900. The European Red Fox *Vulpes vulpes* and Feral Cat *Felis catus* occur on the islands adjacent to the Burrup Peninsula: Dolphin, Angel, Gidley, Collier Rocks, Keast, Legendre and Hauy. Over the last 50 years they have invaded these islands from the Burrup Peninsula which at low tide is connected to Dolphin Island. Control of foxes and cats on the Burrup Peninsula and adjacent islands has been undertaken since 1980 using meat baits impregnated with lethal doses of 1080 (sodium fluoroacetate). Tolerance trials undertaken by the Agriculture Protection Board indicate that at the doses used, this baiting is not lethal to the native fauna, which has a natural resistance to the effects of 1080.

On the Burrup Peninsula, Tingay (1978) and Butler (1983) recorded 12 species of native and 4 species of introduced mammal. The presence of the introduced Black Rat *Rattus rattus* is of particular concern as this species had readily colonized other north-west islands where it is the subject of eradication programs.

At least 5 species of marine mammal occur in the waters around the Dampier Archipelago: the Dugong *Dugong dugon*, Humpback Whale *Megaptera novaehollandiae*, Risso's Dolphin *Grampus griseus*, Bottlenosed Dolphin *Tursiops truncatus*, and an unidentified species of Dolphin. Many of the shallow bays and areas between islands are used by the Dugong for feeding on sea grasses. Humpback whales and their young are often seen among the islands from July - September on their way to southern waters. Between 1870 - 1872 they were taken by whalers in the archipelago and processed for oil on Malus Island.

b) Birds:

Ninety-two species of bird have been recorded in the Dampier Archipelago. One species, the Mangrove Kingfisher *Halcyon choloris* is gazetted as fauna which is likely to become extinct or is rare (Government Gazette 2/12/88). The larger Enderby and Dolphin Islands, with their more diverse vegetation, support the most species, 66 and 57 species respectively. These islands' close proximity to the mainland also contributes to their avian species diversity.

At least 26 species (10 land bird species and 16 sea bird species) are known to breed on the islands. As many of the land birds are resident on the islands, the number of species breeding is probably higher than indicated. Many of the smaller islands and islets such as Goodwyn and Keast Islands and Nelson Rocks are important as sea bird nesting sites. Some sea birds such as the Fairy and Bridled Tern are only present in the archipelago during their breeding season, while others such as the Osprey, White-breasted Sea Eagle and Silver Gull are present throughout the year. Migratory waders, which are protected under a joint agreement between the Australian, Japanese and Chinese Governments, use the archipelago's beaches and mud flats as feeding and resting sites during their long flights between Australia and their breeding grounds in northern Russia.

Eighty-eight species of bird have been recorded on the Burrup Peninsula (Tingay and Tingay, 1978).

c) Reptiles:

Thirty-seven species of terrestrial reptile are known from the Dampier Archipelago. This is a more diverse terrestial herptofauna than either Barrow Island (35 species) or the Burrup Peninsula (32 species). Dolphin Island supports nearly half (18 species) of the total known for the Archipelago. The Pilbara Olive Python *Morelia olivacea barroni*, which shelters in rock piles and feeds in adjacent areas is gazetted as fauna which is in need of special protection (Government Gazette 2/12/88. The Mulga or King Brown Snake *Pseudechis australis* is the only dangerous reptile recorded. However, the Desert Death Adder *Acanthopis pyrrhus* has been recorded on the Burrup Peninsula (Butler and Butler 1983) and possibly also occurs on islands in the archipelago, particularly Dolphin Island.

Four species of marine turtle, the Green *Chelonia mydas*, Hawksbill *Eretmochelys imbricata*, Flatback *Natator depressus* and Loggerhead Turtle *Caretta caretta*, use the beaches of the Dampier Archipelago for nesting during the summer months. Up to 12 species of sea snake could occur in the waters off the Dampier Archipelago (Cogger 1979). These are also dangerous.

d) Amphibians:

Two species of frog, the Desert Tree Frog *Litoria rubella* and Mains' Frog *Cyclorana maini* have been recorded from fresh water rock holes on Dolphin Island. These are also found on the Burrup Peninsula and are wide-spread in the Pilbara.

e) Invertebrate Fauna:

The limited surveys undertaken suggest that the Dampier Archipelago supports a diverse invertebrate fauna. At least 16 species of aquatic invertebrate occur in the fresh water rock pools of Dolphin Island, and at least 152 species of predominantly terrestrial invertebrates

(Arthropoda) occur on Enderby Island. Of particular interest are the attractive Jewel Beetles (Family Buprestidae) which are protected in Western Australia under the Wildlife Conservation Act. Of the nine species recorded on Enderby Island, four are yet to be described. In arid areas, Jewel Beetles act as pollinators for many of the native plant species. On Enderby Island they are associated predominantly with flowering *Acacia* spp.

Three species of land snail (family Camaenidae) have been collected from various islands: *Thersites convicta; Bellrhagada plicata* and *Kimboraga* sp. Land snails are important for the breakdown of vegetation litter and returning of nutrients to the soil. They rely on dense vegetation cover, especially spinifex *Triodia* for survival through the dry periods of the year.

f) Marine Invertebrate Fauna:

The intertidal zone of the Dampier Archipelago is characterised by wide sand and muddy flats, rocky shores, coral reefs, and mangals (mangrove habitats), all of which support an extremely abundant and diverse invertebrate fauna. Although there is no published account, the common species are well known.

Included in the marine intertidal fauna there are a number of molluscs which are avidly collected by amateur and commercial conchologists. Some of these species, for example, the volutes, have direct development i.e. the young hatch direct from attachment egg masses and there is no planktonic dispersal stage so that they are vulnerable to local extinction from over collecting.

Since the nature reserves extend to low water mark, the intertidal fauna is protected in the same way as the terrestrial fauna of the islands.

3.5 Nature Conservation Values

3.5.1 Diverse Biotic Assemblages

The majority of the larger islands in the Dampier Archipelago are different geologically from other Pilbara offshore islands, being

composed of Proterozoic basalts and granophyres, and Archaean granites, rather than Quaternary and Tertiary limestones. They are similar to, and biologically representative of the range country of the Pilbara mainland, but have not however, been subject to the same disturbance since European settlement, particularly from mining and pastoral activities. Hence they still now support a high diversity of flora and fauna which contributes significantly to the biota of the Pilbara region. Approximately 32 percent of the flowering plant species and 30 percent of the vertebrate fauna species known from the Pilbara region, occurs on the islands.

3.5.2 Undisturbed Vegetation/Habitat

The undisturbed vegetation associations are known to be important for the continued survival of much of the fauna. The sandplain and mangrove associations are particularly important and vulnerable to disturbance. Mammals such as Rothschilds Rock-wallaby, Little Northern Native-cat and Common Rock-rat forage on sandplains adjacent to their rock pile refuges. Tunneys Rat and the Sandy Inland Mouse are totally restricted to sandplain habitat. Many of the larger shrubs and trees occur on sandplains and these are important as nesting sites for many of the resident land bird species. Mangrove communities are also a vital natural resource in terms of plant primary production, feeding and breeding areas for a wide array of marine, terrestrial and aerial fauna, and are important stabilizing agents for beach areas subject to erosion.

3.5.3 Infrequent Fires

The biotic assemblages on the islands have been subject to some fire disturbance in the past and this has been discussed in Section 3.3. However, they have been spared the frequent extensive fires that have characterised the mainland since European occupation, and which have been implicated in the decline of certain native mammal species over the last 50 years (Burbidge 1985). Blackwell *et al.* (1979) comment "The most difference between Dolphin Island and the the Burrup Peninsula is the density and development of vegetation. In the absence of fire on Dolphin Island, the plant communities have developed to the climax stage with deep, almost continuous ground cover of *Triodia* hummocks and relatively clear boundaries between communities. On the Burrup

Peninsula however, wide ranging fires during the last decade have exposed substrate and obscured boundaries between communities", and also "On the peninsula the rarest species and plant communities were in unburnt areas".

3.5.4 Absence of Introduced Species

Because of their relative isolation many of the islands in the archipelago have not been invaded by introduced plants and animals and hence support populations which are close to their most "natural" state. Some introduced species do occur on the islands, however they are restricted in distribution and can be controlled effectively. The introduced fox and cat have been implicated in the decline of many medium sized marsupials such as rock wallabies. Enderby and Rosemary Islands support the only feral animal free populations of Rothschilds Rock Wallaby, a species which is restricted to the Pilbara region. The breeding of sea-birds and marine turtles is also enhanced by the absence of introduced predators.

3.5.5 Breeding and Refuge Sites for Marine Species

The islands provide important undisturbed nesting and refuge sites for several marine species. Sixteen species of sea and shore birds nest on the islands. Most species breed during the winter months, however throughout the year there is at least one species nesting at any one time (Table 5). The nesting record of the Australian Pelican on Feast Island is only the eighth location for the State (Serventy and Whittel 1976). The Wedge-tailed Shearwater reaches the northern limit of its breeding range in the Dampier Archipelago, and the Bridled Tern is close to its northern breeding limit (Serventy and Whittel 1976). The Fairy Tern has declined in the south-east of Australia, largely due to its habit of nesting on mainland beaches during the summer months. In W.A. this decline is not as noticeable, but, protected island nesting sites such as the Dampier Archipelago may become important for this species in the future. Many other sea-birds (for example Pied and Sooty Oyster-catchers, Caspian Tern) also nest on exposed beaches or amongst vegetation close to beaches such as *Spinifex longifolius*. Several

TABLE 5

Breeding of sea and shore birds
in the Dampier Archipelago

	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Wedgetailed Shearwater	---	---	---							---	---	---
Australian Pelican	---	---	---									--
Eastern Reef Heron								---	---	---	---	
Mangrove Heron								---	---	---		
Osprey					---	---	---	---	---	---		
Brahminy Kite								---	---	---		
White-breasted Sea Eagle								---	---	---		
Beach Stone-curlew								---	---	---	---	
Pied Oystercatcher								---	---	---		
Sooty Oystercatcher								---	---	---		
Red-capped Plover								---	---			
Silver Gull	---	---	---									
Caspian Tern							---	---	---	---		
Bridled Tern	---	---	---								---	---
Fairy Tern								---	---	---	---	
Crested Tern				---	---							

species of migratory wader birds use the beaches and mudflats in the Dampier Archipelago as resting and feeding areas during their long flights between southern Australian feeding areas and northern hemisphere breeding sites. Waders and their habitat are protected by a joint agreement between the Governments of Australia, Japan and China.

Four species of marine turtle nest on beaches in the Dampier Archipelago during the summer months, and these are being tagged as part of a long term turtle tagging program which will provide information on the movements of turtles, both within and outside Australian waters, and on their reproductive behaviour. All are protected in Australian waters. One of these, the Flatback Turtle, is believed to be endemic to Australian waters, however the others, especially the Green Turtle, are thought to be migratory and are taken in south-east Asian waters for food and shell. Nesting sites are also prone to disturbance in these areas. Mangrove lined creeks on the islands are important habitat as feeding and refuge areas for juvenile turtles.

3.5.6 Species of Special Interest

The Dampier Archipelago supports two species of vertebrate fauna, the Mangrove Kingfisher and Pilbara Olive Python, that are gazetted as fauna which is likely to become extinct or is rare, or otherwise in need of special protection. Several species of protected Jewel beetles (*Buprestidae*) also occur on the islands. Several of the plant species found on the islands are considered to be geographically restricted, presently undescribed, or in need of taxonomic revision, and at least one species was previously thought not to occur in W.A.

The islands also support several species with an unusual geographical distribution. While the flora is Eremeaean in general character, it contains a group of species more typical of the Kimberley region. These are found almost exclusively in the more humid, moist and fire free rock pocket, and creek bed areas of Dolphin, Angel and Gidley Islands, but also occur in similar locations on the Burrup Peninsula. Several of the faunal elements are also considered to be Kimberley species. The Little Northern Native-cat and Common Rock-rat have extensive distributions

across the north of Australia, but also penetrate the Pilbara, including the Dampier Archipelago. Tunney's Rat occurs on many of the islands in the Dampier Archipelago, however is not found on the Pilbara mainland although it does occur in the neighbouring Kimberley and Shark Bay regions. Some birds such as the Jabiru and Brown Booby approach the southern extremity of their distribution in the vicinity of the Dampier Archipelago.

3.6 Implications for Management

1. The maintenance of the islands' conservation values should be the primary objective of management.

2. The sandplain and beach areas of the islands will require particular management attention as they are the most likely areas to be subject to degradation through public use (e.g. erosion, escaped camp fires, collection of firewood) and are potential areas for the mining of limesand. The sandplain also support a diverse array of flora and fauna. Beaches are important as sea-bird and marine turtle nesting sites.

3. Knowledge of appropriate fire management practices is lacking. Research should be directed towards this as soon as possible.

4. The location of plant species considered to be geographically restricted, presently undescribed, or in need of taxonomic revision need to be known by CALM's regional personnel, to ensure that management operations do not unintentionally affect these species.

5. Continued monitoring of sea-bird and marine turtle nesting sites is essential if the success of management strategies advocated in this plan are to be determined. Most sea-bird breeding occurs during the winter months when most use is made of the islands by the public for recreation.

6. Management strategies should include a continuation and refinement of the control programs for foxes and feral cats on the northern portion of the Burrup Peninsula and adjacent islands. Weed control should be implemented where necessary.

7. Unlicensed shell collecting in the nature reserves' intertidal zones is, by definition, illegal. Because of the breeding strategy of many target species, especially the volutes, shell collecting can cause local extinction. It is necessary to ban shell-collecting in these areas except that which is conducted for scientific or education purposes under permit.

PART B

PLAN FOR MANAGEMENT

4.0 MANAGEMENT OBJECTIVES

4.1 General Objectives

This management plan recommends that the purpose of the nature reserves in the Dampier Archipelago be changed to national park. Given the conservation, historic, archeological and recreational values of the reserves, this purpose is considered to be the most appropriate.

Objectives for the management of nature reserves in W.A. are laid out in Section 56(i)(d) of the Conservation and Land Management Act (1984):

> "... to maintain and restore the natural environment and to protect care for, and promote the study of indigenous flora and fauna."

No provision is made in these objectives for recreation on nature reserves. However such provision is made in the objectives for management of national parks in W.A., and this status would be more appropriate to the islands which are presently nature reserves in the Dampier Archipelago.

Objectives for management of national parks in W.A. are laid out in Section 56(i)(c) of the Conservation and Land Management Act (1984):

> "... to fulfill 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 features of archeological, historic or scientific interest."

4.2 Specific Management Objectives:

Giving due consideration to the above, the following are the management objectives for the islands of the Dampier Archipelago subject to this plan.

a) To conserve the flora and fauna, in particular to maintain the full

complement of native species present, their habitats, and the natural ecological processes which sustain their communities.

b) To conserve the physical landscape.

c) To conserve the archeological and historic values.

d) To provide for the proper recreational and educational use of the islands.

5.0 MANAGEMENT FOR CONSERVATION OF FLORA, FAUNA AND LANDSCAPE

To conserve the flora, fauna and physical landscape of the islands subject to this plan, active management is required in the following areas:

a) Fire protection;
b) Control of introduced plants;
c) Control of introduced animals;
d) Control of access for mining and industrial purposes;
e) Habitat degradation and rehabilitation;
f) Research and monitoring.

5.1 Fire Protection

5.1.1 Objectives

1. To protect the conservation values of the islands.

2. To limit the area affected by uncontrolled fires.

3. To protect departmental facilities and equipment on nature reserves.

5.1.2 Rationale

Wildfires from either a lightning strike or escapes from camp fires are always a likely event on the islands. On smaller islands a fire would probably burn most of the island, however on larger islands such as Dolphin and Enderby Islands, physical and natural features such as

sparsely vegetated rocky slopes and mangrove lined creeks and mudflats would probably restrict fire to sandplain areas.

Frequent wildfires are a major contributor to degradation of native vegetation and success of introduced plant species, particularly grasses. The removal of vegetation by fire also makes the landscape prone to wind erosion.

5.1.3 Management Strategies

1. Until further research is conducted on the relationship of fire to the maintenance of habitat diversity on semi-arid northwest islands, a fire exclusion policy for the islands will be implemented, except where limited burning is undertaken for research purposes.

   While the Departments ability to suppress a wildfire on the islands is limited, attempts should be made if possible. (CALM personnel and equipment will also be available to assist in the control of wildfires on recreation reserves).

2. A contingency plan for action in the event of a wildfire will be prepared. Site control of a wildfire on the islands will be the responsibility of the senior CALM officer present.

3. Burn-back techniques are the most appropriate form of fire control on the islands. The use of sea water from a helicopter borne fire bucket is undesirable as salt water significantly inhibits vegetation regeneration.

4. There is no immediate requirement for firebreak construction on any of the islands, with the exception of a cleared area around the Enderby Island Research Station for the protection of buildings and equipment. If a need is seen for firebreak construction in the future, flora surveys of the area will be undertaken prior to construction to ensure that no species which are rare or in need of special protection are affected. The controlled use of fire to construct cleared firebreaks should be used as an alternative to chemical sprays or removal of vegetation.

5. The staff in the Dampier Port Authority control tower on East Intercourse Island have a commanding view of the Dampier Archipelago and have been requested to inform CALM in Karratha of any fire occurring on the islands. The public will be permitted to use only gas cooking equipment. Open camp fires on the nature reserves will be prohibited.

5.2 Control of Introduced Plants

5.2.1 Objectives

1. To preserve the natural flora assemblages on the islands.

2. To prevent the introduction of exotic plants to the islands

3. To control and, where appropriate, eradicate plants not native to the islands, wherever these occur.

5.2.2 Rationale

Several species of introduced plant already occur on the islands. These, in particular the grasses, are capable of spreading rapidly and competively excluding native species once the soil has been disturbed. With the increasing use of the islands for recreational and industrial purposes the spread of existing species and the introduction of other species is possible unless precautionary steps are implemented.

5.2.3 Management Strategies

1. A survey of all the islands subject to this plan will be undertaken to determine the extent and distribution of introduced plant species.

2. Departmental personnel will ensure that introduced plant species are not spread onto, or around, reserves during the course of research projects or management operations. Similarly, industrial use of the reserves will be subject to environmental hygiene conditions which prevent the spread of exotic species onto the islands.

3. Eradication of introduced species will be attempted. In particular the Buffel Grass *Cenchrus ciliaris* in the vicinity of the old airstrip on Rosemary Island will be eradicated, as this species has the potential to spread throughout the idland, as it has done on other island nature reserves and the mainland. Other occurrences of this grass will also be controlled.

4. In co-operation with the Agricultural Protection Board, the Prickly Pear infestations on East and West Lewis Islands will be monitored to determine the effectiveness of the recent biological control attempts. Until the Prickly Pear has been eradicated, the islands close to East and West Lewis island will be monitored for fresh outbreaks.

5. Conditions for occupancy for leaseholders on recreation reserves which ban the introduction of exotic plants will be enforced, to prevent their spread to adjacent nature reserves.

6. The existing conditions for occupancy of the Special Lease in Norbill Bay by the North West Game Fishing Club do not include reference to the planting of exotic plant species on the lease. Palms and a Tamarisk tree have been planted on the lease. Further plantings of exotic species should be discouraged and requests for shade trees referred to CALM.

5.3 Control of Introduced Animals

5.3.1 Objectives

1. To preserve the natural faunal assemblages on the islands.

2. To prevent the introduction of exotic animals.

3. To control and, where appropriate, eradicate animals not native to the islands, wherever these occur.

5.3.2 Rationale

Introduced animal species are known to have a detrimental effect on native fauna. The fox and feral cat have occupied the islands to the north of the Burrup Peninsula for at least 50 years and have been implicated in the decline of the rock wallaby *Petrogale rothschildi*. Other small mammal species, birds, reptiles and turtle nesting have probably also been affected by these predators. It is possible that the other introduced species on the Burrup Peninsula, the Black Rat *Rattus rattus* and House Mouse *Mus musculus*, will move north to colonise the islands, and compete with the native rodent species.

5.3.3 Management Strategies

a) Regular control of fox and cat populations will be undertaken on the northern portion of the Burrup Peninsula and adjacent islands using meat baits impregnated with lethal doses of sodium monofluoroacetate (1080). Complete eradication of these species is not possible because of the connections at low tide between the Burrup Peninsula and Dolphin Island, however populations will be maintained at acceptably low levels. Control work on the Burrup Peninsula will be undertaken in liaison with Woodside Offshore Petroleum Pty. Ltd.

b) The spread, if any, of the introduced rodents *Rattus rattus* and *Mus musculus* on the Burrup Peninsula will be monitored. Woodside Offshore Petroleum will be requested to include this in their regular fauna monitoring programs. Dolphin Island will also be monitored regularly by CALM for *Rattus* and *Mus*.

c) To prevent the further introduction of exotic fauna onto the islands subject to this plan, no pets or any other animal will be permitted to be taken onto any such islands in the archipelago.

5.4 Control of Access for Mining and Industrial Purposes

5.4.1 Objectives

1. To ensure that mining and industrial activities do not reduce the conservation values of the islands.

5.4.2 Rationale

The developments which have led to the Dampier Archipelago becoming a focus for recreational activities have also led to its use and potential use for mining and industrial purposes. It is possible that in the future Hamersley Iron Pty. Ltd. will seek to exercise their option to mine limesand and limestone from leases on the islands for the processing of iron ore. It is also possible that the islands will be subject to petroleum exploration activities in the future.

Woodside Offshore Petroleum Pty. Ltd. have made regular requests, since 1981, for the erection of temporary radio positioning base stations and navigation aids. These have always been approved subject to site inspection and conditions relating to the Wildlife Conservation Regulations. Recently permanent navigation aids have been erected on Angel and Gidley Islands. Marine navigation beacons on Rosemary and Malus Island are regularly serviced by Department of Transport and Communications.

Legendre Island is a Ministerial Reserve for Industrial Development and it is possible that further port facilities may be developed on this island in the future. This would necessitate a road connection between the Burrup Peninsula and Legendre Island, across some of the nature reserves.

5.4.3 Management Strategies

1. Any proposal for exploration, mining or industrial activity on the islands subject to this plan, will be referred to the EPA, and an Environmental Review and Management Plan sought.

2. The erection of small scale temporary facilities such as radio positioning base stations and navigation aids will be subject to regulations under the CALM Act and preceded by a joint site inspection by officers from CALM and the company involved. This inspection will include a survey for rare, endangered or geographically restricted flora, and an assessment of Aboriginal sites, if any, in the immediate vicinity of the proposed facility.

3. Approval for access for any mining or industrial purposes will require that no plants or animals are introduced to the islands through equipment and stores.

5.5 Habitat Degradation and Rehabilitation

5.5.1 Objectives

1. To prevent any further habitat degradation through public use.

2. To encourage the regrowth of natural vegetation in disturbed areas.

3. To remove rubbish and recreational structures from the islands subject to this plan.

5.5.2. Rationale

Habitat degradation diminishes the conservation values of the islands in several ways. It can alter the vegetation structure and hence affect the faunal composition. The removal of natural vegetation and disturbance of the soil also encourages the spread of exotic plant species and promotes erosion. Some environmental degradation has already occurred, particularly on Rosemary Island, and management programs need to ensure that this is restricted and that rehabilitation ensures the natural regrowth of vegetation.

5.5.3 Management Strategies

1. Vegetation regrowth on the old airstrip on Rosemary Island will be monitored. If the Buffel Grass in the vicinity of the airstrip is eradicated (see B 2.2.4) some local native plant species such as

Triodia spp. and *Myoporum acuminatum* will be planted to assist in the rehabilitation of the area.

2. With the exception of the service access track to the marine navigation beacon, and the NWGFC track to the airstrip (but not beyond it) all vehicle tracks on the present Rosemary Island nature reserve will be closed and vehicular use of them prohibited. No further tracks are to be constructed.

3. Except for the use of the tractor on Rosemary Island by NWGFC members on approved tracks, no vehicles will be permitted on the islands subject to this plan.

4. Areas that have been cleared of vegetation for camping sites will have public access restricted until regeneration of vegetation has occurred. No further clearing of vegetation for camping sites or collection of firewood will be permitted.

5. The derelict remains of shacks and camping shelters that occur on some of the islands subject to this plan will be removed. No permanent structures are to be erected on the islands, except at the departmental research facility on Enderby Island.

6. Rubbish from either recreational or other use of the islands, must not be left on the islands. Every effort will be made to encourage the public to remove their rubbish and the Shire of Roebourne and Hampton Harbour Boat and Sailing Club requested to erect and maintain large rubbish bins at boat launching ramps in Dampier, Karratha and Wickham. The NWGFC will be requested to remove rubbish, which has accumulated over the years, from the reserve adjacent to their lease in Norbill Bay.

7. Areas zoned for public use in this management plan will be regularly monitored for habitat degradation and rehabilitation operations conducted where necessary. Special attention will be paid to sand dunes adjacent to popular recreation beaches.

5.6 Research and Monitoring

5.6.1. Objectives

1. To utilise the islands as a resource for research into coastal tropical semi-arid ecosystems (both marine and terrestrial).

2. To obtain information relevant to the current and future management of the islands.

5.6.2 Rationale

Research provides information on species requirements which is essential for their effective management, while monitoring studies enable the success or otherwise of management programs to be assessed. Some research and monitoring studies have been initiated on the nature reserves, for example biological survey, requirements of the rock-wallaby and utilisation of turtle nesting beaches, however the successful management of the islands depends on these studies being continued and expanded. Other studies, such as those into the most appropriate fire regime for the islands, have yet to be initiated. Research into archeological and historic values should also be regarded as an integral part of the management of the islands.

5.6.3 Management Strategies

1. All research programs on the islands, whether undertaken by CALM personnel or others, are to be covered by appropriate permits issued by the Department. Any fauna removed from the islands under permit for research purposes will not be returned.

2. Priority will be given to research into the most appropriate fire regime to maintain the existing flora and fauna of the islands. Special attention will be given to the effects of different burning regimes on vegetation and vegetation succession.

3. The status of the rock wallaby and other small mammal populations will be continually monitored, and study made of the population

biology of these species with special attention on the effects of different fire regimes.

4. Surveys will be conducted on the distribution of the rare and poorly collected flora, and of the distribution of exotic plant species in the archipelago. The spread of exotic plant and animal species will be monitored.

5. Scientific collection of those flora species presently undescribed or in need of taxonomic revision should be encouraged.

6. Control techniques for exotic plants and animals will be developed ensuring minimal effect on non-target species. Close liaison with the Research Branch of the Agriculture Protection Board, will be maintained with regard to the control of foxes and feral cats in the Dampier Archipelago. Monitoring the effect of baiting programs will be continued.

7. Utilization of the islands by marine turtles and seabirds for breeding will be continually monitored, particularly with respect for disturbance resulting from public and industrial use of the islands. Long term tagging studies of marine turtles in the archipelago will continue.

8. Rehabilitation operations undertaken on the islands will be monitored at regular intervals.

9. Recreational use of the islands and the environmental effects of that use will be monitored.

10. Research relating to Aboriginal and historic sites on the nature reserves by the relevant Government departments and institutions will also be encouraged.

6.0 MANAGEMENT OF ABORIGINAL AND HISTORIC SITES

6.1 Objectives

1. To locate and protect all Aboriginal sites and objects on the islands subject to this plan and to comply with the Aboriginal Heritage Act.

2. To locate and protect all historic sites on the islands.

6.2 Rationale

Many significant Aboriginal and historic sites are known on the nature reserves. CALM is obliged to conform with the Aboriginal Heritage Act (1972-1980) which protects Aboriginal sites and objects. Very little published information is available on Aboriginal sites in the archipelago, however many sites are known to the local community and to CALM personnel. Several of the historic sites have significant cultural value and are listed on the National Estate Register.

6.3 Management Strategies

1. The W.A. Museum will be encouraged to undertake surveys of Aboriginal sites and objects on the islands.

2. Aboriginal sites already known will be reported to the W.A. Museum Registrar of Aboriginal Sites.

3. To ensure that departmental management practices do not damage Aboriginal and historical sites and objects, locations of these should be known by department staff. Departmental staff should also receive training on the requirements and their obligation under the Aboriginal Heritage Act.

4. The W.A. Museum, and Roebourne Aboriginal groups will be consulted about the care, use of, and access to Aboriginal sites and objects.

5. Information on historic sites and, where appropriate, information concerning the Aboriginal occupation of the islands will be featured in the interpretive processes for the management of the islands (see 7.3.3 b) and c)).

6. Visitation to Aboriginal and historic sites will be monitored.

7.0 MANAGEMENT FOR PUBLIC USE

Management for public use of the islands covered by this plan will be based on zonings for particular use, the development of guidelines for public use and an emphasis on interpretive measures. Environmental education is considered an essential part of management.

7.1 Management Zonings

7.1.1 Objectives

1. To provide for a pattern of public use that does not diminish the values of the islands.

7.1.2 Rationale

Islands presently nature reserves have been used by the public for the past 20 years or so for camping, day trips, and construction of shacks, and this practice in some areas has contributed to degradation of the environment. No public shacks now exist on the nature reserves. However as camping and daytrip activities increase, so does the potential for increased environmental degradation and disturbance to the vegetation and fauna (particularly nesting seabirds and turtles).

Portions of the islands subject to this plan are suitable for camping and daytrips and provision is made in this plan for these activities. However the erection of permanent structures is excluded because of their tendency to concentrate public use and increase environmental degradation. The visual impact of permanent structures on beaches is also not consistent with the objectives for conservation reserves.

7.1.3 Management Strategies

The islands will be zoned for various degrees of public access.

These zones are:

a) Special Conservation Zone (No public access at anytime).

b) Conservation Zone with some passive recreation (Daylight access only).

c) Recreation Zone (Daytrips and camping permitted).

The zonings relevant to each island nature reserve are shown in Table 6 and Figure 3.

a) Special Conservation Zone - No public access at any time

These will be Prohibited Areas throughout the year under the CALM Act (1984) section 62(1), and have been designated primarily to protect sea bird nesting sites.

Some of the inland areas of islands have been designated as such to protect the burrow nesting Wedge-tailed Shearwater colonies. Their nesting burrows are readily collapsed if walked on and hence damage to the burrows and breeding success can occur even during the non-breeding period. Many of the smaller islands and rocks in the archipelago are also covered by this zoning as they are nesting sites for non burrowing sea birds. Several tern species nest on the shorelines just above high water mark and are readily disturbed by the public intrusion. Walking near or through these sites results in increased predation of eggs and young by Silver Gulls when the adult terns are flushed from their nests. Also nests usually consist only of a scrape in the sand and the camouflaged eggs and chicks are often difficult to detect, and may be squashed. Because some of the tern species shift nesting location from year to year this zoning may have to be implemented temporarily in other areas as the need arises.

This zoning may also be invoked where rehabilitation operations are being undertaken, and where, on advice from the W.A. Museum, Aboriginal sites of significance are known to exist.

Access by permit to island or parts of islands designated Special Conservation Zone will be possible for legitimate industrial purposes associated with the safe operation of commercial marine activities in the waters of the Dampier Archipelago, for example the temporary installation of radio positioning stations. This access must be requested by the company concerned and will be supervised by CALM personnel (see also Section B 2.4.3).

b) Conservation Zone - Daylight access only

These areas will be Limited Access Areas under the CALM Act (1984) section 62(1) and have been designated:

1) to protect important turtle nesting beaches and to prevent disturbances to nesting turtles, and

2) to prevent possible vegetation degradation to the inland areas of the islands through camping activities.

Hence this zoning allows for daylight recreational access to the important turtle nesting beaches and the inland areas of most of the islands.

Access for industrial purposes will be as above for the Special Conservation Zone and Section B 2.4.3.

c) Recreational Zone - Daytrips and Camping Permitted

These areas will be Recreational Areas for Specified Activities under the CALM Act (1984) section 62(1) and have been designated to allow public enjoyment of the islands without diminishing their conservation values. Unrestricted day access and camping for up to five (5) nights will be permitted on:

- all the beach areas (up to 50 m inland) of Angel, Gidley and Dolphin Islands and Collier Rocks
- all the beach areas, except the two western most beaches, of Enderby Island
- Norbill Bay, Rosemary Island
- Marney Bay, Malus Island
- the south facing beach of Goodwyn Island
- the south east facing beach of Eaglehawk Island
- the eastern beach of Hauy Island
- the south tip of Delambre Island (up to a distance of 100 m north on either the east or west side of the island).

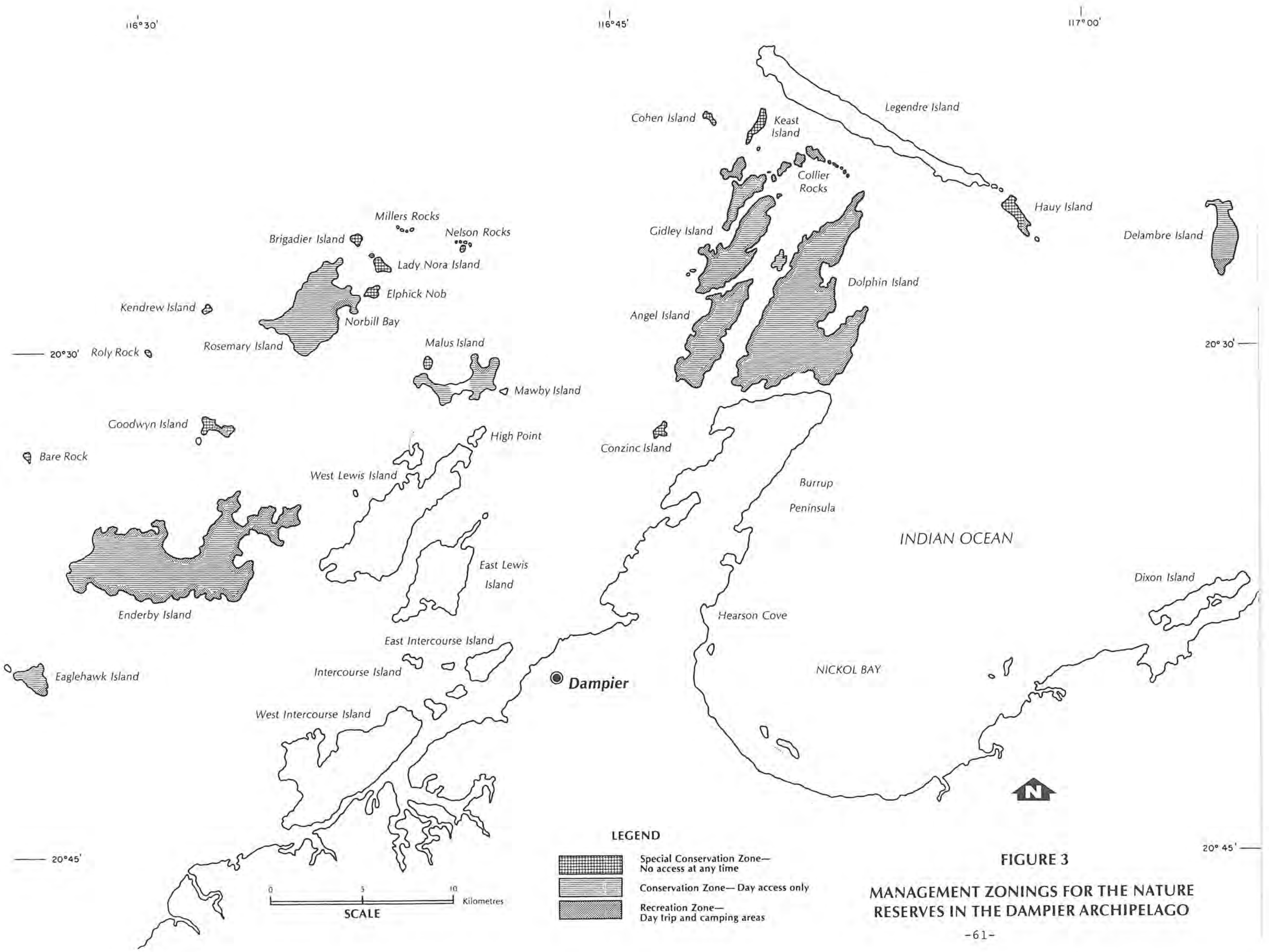

FIGURE 3

MANAGEMENT ZONINGS FOR THE NATURE RESERVES IN THE DAMPIER ARCHIPELAGO

TABLE 6 Dampier Archipelago nature reserves: zonings for public use.

Zone A: No public access at any time.
Zone B: Daylight access only.
Zone C: Daytrips and camping permitted.

ISLAND	ZONING	
	Beaches	Remainder of Island
Angel	C	B
Bare Rock	A	A
Brigadier	A	A
Cohen	A	A
Collier Rocks	C	B
Conzinc	A	A
Delambre	southern tip C) remainder B)	B
Dolphin	C	B
Eaglehawk	SE beach C) remainder B)	B
Elphick Nob	A	A
Egret	A	A
Enderby	W beaches B) remainder C)	B
Gidley	C	B
Goodwyn	S beach C) remainder A)	A
Hauy	E beach C) remainder A)	A
Keast	A	A
Kendrew	A	A
Lady Nora	A	A
Malus (part)	Marney Bay C) remainder B)	B
Mawby	A	A
Millers Rocks	A	A
Nelson Rocks	A	A
Rosemary	Norbill Bay C remainder B	B
Tozer	B	B
Wilcox	B	B

All day trip and camping activities will be subject to the Guidelines for Public Use (see 7.2 below).

7.2 Guidelines for Public Use

7.2.1 Objectives

1. To ensure public use does not diminish the conservation values of the islands.
2. To inform the public of the guidelines governing their use of the islands.

7.2.2 Rationale

The nature reserves were established primarily for their conservation values and Wildlife Conservation Regulations (1982) exist to protect these values, while providing for access to the reserves by the public. Similar protection will be afforded under the CALM Act and Regulations should the islands become a national park. The public also need to be aware of the protection afforded to Aboriginal sites by the Aboriginal Heritage Act (1972-1980) and to historic sites by the proposed Heritage Places (WA) Act, presently before Parliament. As some of the historic sites are listed on the National Estate Register, they are protected from some activities under the provisions of the Australian Heritage Commission Act (1976).

7.2.3 Management Strategies

1. Provisions of the Wildlife Conservation Act 1950 and the CALM Act 1984 will apply to the reserves, viz:

    a) Day visits and camping for up to 5 nights will be permitted in the appropriate areas (see 4.1 Management Zonings).

    b) No permanent structures are to be erected.

    c) Flora and fauna of the reserves, including intertidal marine species may not be killed, disturbed, or removed from the reserves except for scientific or education purposes,

authorised by permit. (Note that shell collecting in the intertidal zone is thus prohibited).

d) Rocks and soil may not be removed or disturbed for campsites, or any other purpose except by permit.

e) Dogs, cats or any other animal are not to be taken onto the reserves.

f) Plants are not to be taken to, or planted on the reserves.

g) All offal, refuse, rubbish and litter is to be removed and returned to the mainland, not burnt or buried on the reserve.

h) No vehicular transport is to be used on the reserves, except with the written approval of the Executive Director.

i) Cooking with gas equipment only is permitted. Open fires and the use of reserve vegetation for fires is prohibited.

j) Firearms are prohibited on the reserves.

2. The protection afforded to Aboriginal and historic sites under the provisions of the Aboriginal Heritage Act (1972-1980) and the proposed Heritage Places (WA) Act respectively, will be made clear to the public.

3. The NWGFC which operates on Rosemary Island during the winter months, will be requested to continue their surveillance of public use of Norbill Bay.

4. Regular patrols of the islands by the District Wildlife Officer and other CALM personnel with the appropriate authority will be maintained to ensure that the public use guidelines are not breached.

5. Public use of the reserves will continue to be monitored.

7.3 Interpretation

7.3.1 Objectives

1. To provide the public with information relevant to management of the islands subject to this plan.

2. To increase public awareness and appreciation of the values of the islands.

7.3.2 Rationale

Management of the islands will be enhanced if the public users are informed of management strategies such as those relating to island status, zoning and public use guidelines. Increasing public awareness of the conservation values will also assist management.

7.3.3 Management Strategies

Several methods of informing the public will be adopted.

a) Departmental Reserve Signs

Reserve signs of modular pine log construction and conforming to the CALM sign standards will be erected on beaches most often visited by the public. These will give the island name and use symbols to demonstrate restrictions on open fires and pets on the reserves. No camping symbols will be used in the appropriate areas. Positive symbols such as those depicting walking, photography and fishing will also be displayed. Signs indicating the use zoning of the beach or island will also be erected.

b) Information Boards

Once this management plan has been accepted in its final form, information boards will be erected at the boat ramps in Dampier, Karratha and Wickham. These will show a plan of the Dampier Archipelago with island reserve status and the management zonings of this plan. Information boards will also be situated at the boundaries of management

zonings to indicate to the public why the zoning was created and restrictions imposed (for example at turtle and seabird nesting locations). Historic and Aboriginal site information boards will also be erected, where appropriate.

c) Management Brochures

Separate brochures will be produced in the early stages of the term of the management plan. These include:

- a brochure summarising the management zonings of the islands and guidelines for public use
- a brochure summarising the natural, historic and archeological values of the reserves
- a brochure containing guidelines for observing fauna such as nesting turtles and seabirds together with notes on the biology of these species
- brochures containing check lists of the flora and fauna of the reserves.

These brochures will be displayed in the CALM and Department of Marine and Harbours offices in Karratha and distributed to tourist and marine charter operators in the region. Shack owners on the recreation reserves will also be provided with copies.

d) Newspaper Articles and Public Relations

Articles on points of interest relating to the islands and information on management operations undertaken will be offered regularly to local newspapers and mining company magazines.

Every opportunity will be taken by CALM personnel to speak to the public through seminars etc. on the management of the islands.

e) Environmental Education

Some fauna is accessible and can be used to promote nature conservation without detrimental effects. Sites such as active Osprey nests can be approached at certain times and photographed unsupervised with no harm

to the nesting birds. If demand exists, it could be possible to arrange supervised visitors to turtle nesting beaches and Wedge-tailed Shearwater rookeries. Controlled access to other seabird nesting sites is also possible.

The Department's research station on Enderby Island will be used for organised nature studies by interested groups such as the Nickol Bay Naturalist Club and school biology classes.

Information regarding historic and, where appropriate, Aboriginal sites will be included in environmental education programs.

8.0 PLAN IMPLEMENTATION AND REVISION

Once adopted this management plan will be implemented by CALM within the framework of available public resources. It is proposed that the status of plan implementation be reviewed annually by CALM regional and branch personnel. Where it is considered that management practice is not in accordance with the plan, steps will be taken to amend management practice or, alternatively, revise the plan.

The management plan will remain in force for a period of 10 years expiring in 1999. Amendments may be made to the plan within this period. In the event of the plan being revoked before expiry, a new plan will be substituted in accordance with the provisions of the CALM Act.

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