The Value Of Western Australian Islands As Biological Reservoirs And The Development Of Management Priorities

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Abstract

Many of Western Australia's 3 400 islands have high nature conservation values. Of particular importance are those which harbour relictual populations of mammals, some of which are now restricted to islands and others of which are endangered on the mainland. In addition, islands contain endemic taxa and distinct populations; they provide breeding places for 29 species of seabird, 20 of which breed only on islands, and for seals and turtles. An examination of the values of islands has led to the development of three categories of management priorities. The highest category includes four islands - Barrow, Bernier and Dorre - which protect mammalian species now extinct on the mainland.

INTRODUCTION

Off the Western Australian coastline are a great number of continental islands. If an island is defined as any feature above high water mark shown on a 1:100 000 map (Department of Land Administration, W.A.) then there are 862 named islands with another 2 562 still to receive the attention of the nomenclature authorities.

In relation to islands the Western Australian coast can be conveniently divided into 15 zones (Fig. 1, Table 1). Only two of these, A and I, are devoid of offshore islands; the coastline of both is comprised of extensive limestone cliffs which drop abruptly into comparatively deep seas.

ISLAND ORIGINS

Most Western Australian islands were separated from the mainland by rising sea levels from 8 000 to 14 000 years ago. The oldest substantial island appears to be Salisbury Island in the Recherche Archipelago (Burbidge *et al.* in press) (channel depth 82 m) which was separated *ca.* 14 000 years BP. Most other islands have channel depths of >50 m and appear to have been separated 8-11 000 years BP. Some cays, accumulations of sand or coral rubble on reefs, are of more recent origin.

ISLAND VALUES

In common with many similar continental islands elsewhere in the world, Western Australian islands possess a number of general nature conservation values:

1. They provide examples of mainland ecosystems cut off by rising sea-levels during the Pleistocene, modified by various influences such as the effects of the surrounding area (eg salt spray), changing climates, loss of species due to reduced area, immigration and so on. Such islands have been the subject of a variety of scientific studies relating to biogeographic theory.

2. Most Western Australian islands, unlike the continent they were derived from, have suffered little or no impact from either Aboriginal or European man. Many Kimberley and some Pilbara islands have been occupied or visited by Aboriginal people, who in this part of Australia possessed the ability to travel across small areas of the ocean via rafts (Abbott 1980) South of the Pilbara the only evidence of Aboriginal occupation on islands predates separation. Some islands, especially the larger ones, have been affected by European and Asian use (Table 2), and often this has had major impacts. The fact that most islands have not been used means that they have not suffered introductions of herbivores such as the rabbit, sheep and goat, or predators such as the Red Fox, Feral Cat or Black Rat.

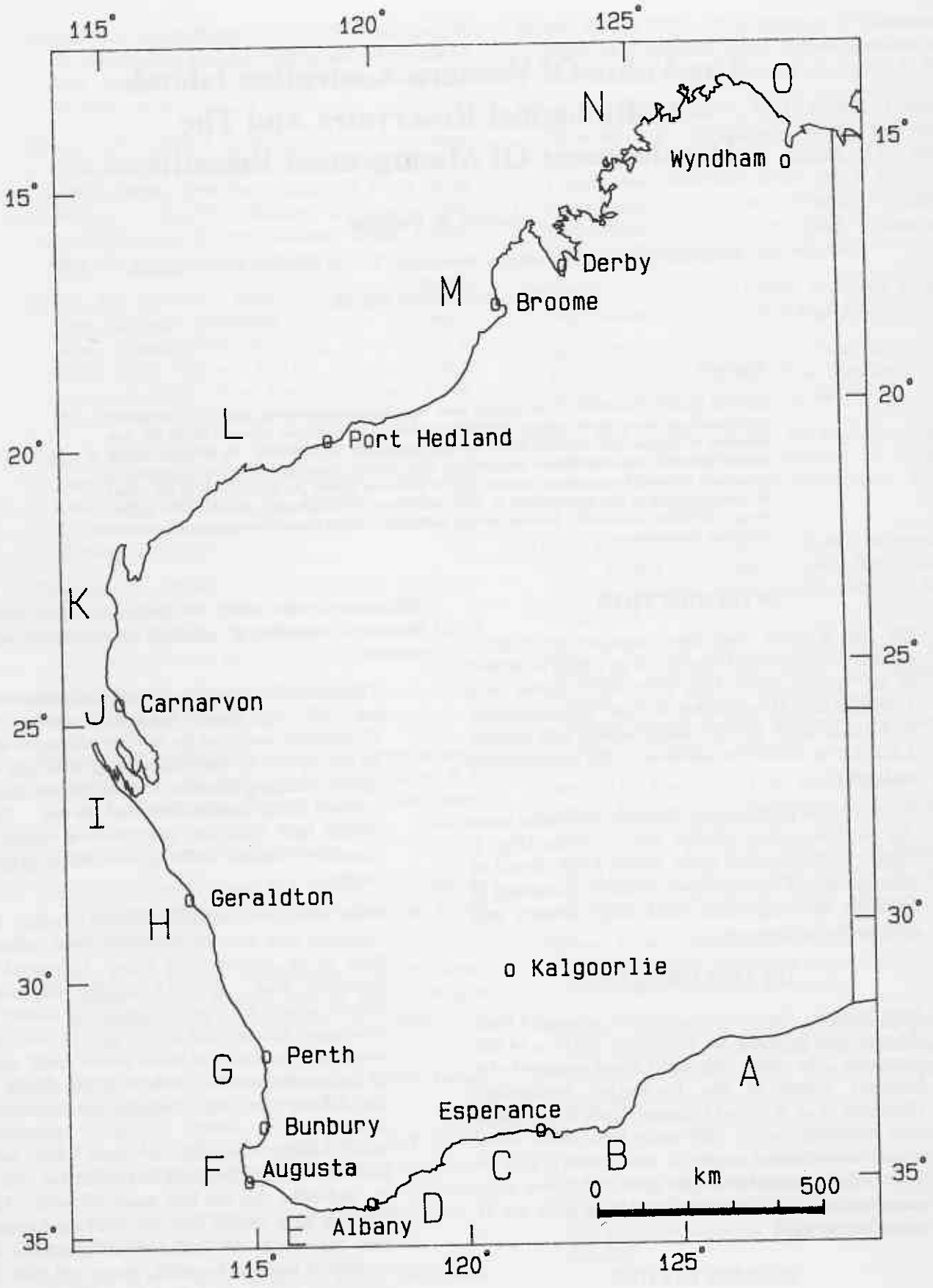

Figure 1.
Island zones in Western Australia, see Table 1.

Table 1
Western Australian Coastline and Islands (see Fig 1)

Coastal Zone	Geology	No of Islands	Comments
A	-	Nil	-
B	migmatite, limestone	many	Recherche Archipelago - mammals, seals, seabirds
C	migmatite	few	-
D	migmatite	few	mammals, seals, seabirds
E	migmatite	few	seals, seabirds
F	limestone, migmatite	few	seabirds
G	limestone	few	mammals, seabirds
H	limestone, cays	many	Houtman Abrolhos - mammals, seabirds
I	-	nil	-
J	limestone, sand	many	Shark Bay - mammals, seabirds, turtles
K	sand	few	-
L	limestone, meta-igneous, sand	many	Pilbara - mammals, seabirds, turtles
M	sand	few	Lacepedes - seabirds, turtles
N	sandstone, basalt	many	Buccaneer and Bonaparte Archipelagos - mammals, turtles, seabirds
O	sandstone, sand	few	seabirds, turtles

Table 2
Some Western Australian Islands Affected by Man

Island(s)	Use/impact	Effects
Woody (Recherche)	introduction of *Rattus rattus*	extinction of *Rattus fuscipes*
Garden	timber cutting, recreation, naval base	minor
Rottnest	recreation, over-burning, military base	major changes in vegetation, disappearance of seabird colonies, and some land birds
Houtman Abrolhos (various islands)	(a) presettlement wrecks	(a) extinction of sealion colonies, introduction of rats
	(b) guano mining	(b) extinction of seabird colonies,introduction of cats
	(c) fishermen's settlements	(c) introduction of rabbits, mice
Dirk Hartog	pastoral station, introduction of sheep, goats, mice	extinction of CWR mammals, erosion
Faure	pastoral station, introduction of sheep, goats	erosion, overgrazing
Bernier	introduction of goats	erosion, overgrazing
Thevenard	tourist resort	minor
Boodie	introduction of *Rattus rattus*	decline and extinction of *Bettongia lesueur*
Barrow	oil field	minor
Varanus (Lowendals)	oil facilities	minor
Monte Bellos	(a) introduction of cats, *Rattus rattus*	(a) extinction of CWR mammals
	(b) nuclear weapons testing	(b) erosion
Dolphin	arrival of fox from mainland	decline of Rothschild's Rock-wallaby
Depuch	arrival of fox from mainland	extinction of Black-footed Rock-wallaby
Bedout	introduction of *Rattus rattus*	?extinction of some seabird colonies
Lacepedes	introduction of *Rattus rattus*	?extinction of some seabird colonies
Adele	introduction of *Rattus exulans*	none known
Sir Graham Moore	introduction of pig	not documented

3. Islands are used by marine species such as seals, seabirds and turtles as breeding places free from the interference such activities often receive on the mainland.

In addition, Western Australian islands have some particular values:

1. Some contain relictual populations of mammals once widespread on the Australian mainland but which are now either very rare or have disappeared there. Main (1961) and Main and Yadav (1971) have discussed the distribution of macropod marsupials on islands off Western Australia. Table 3 is developed from their data while Table 4 shows the proportion of macropods represented on islands when compared with the adjacent mainland. Species in other mammal groups also have island populations.

2. Many other plants and animals occur on islands where they are protected from deleterious mainland influences. Only one vertebrate species is known that is naturally restricted to an island - the skink *Ctenotus lancelini*, which occurs on the 7.6 ha Lancelin Island 120 km north of Perth. However, many other vertebrates have evolved distinctive island forms, some of which have received taxonomic recognition. Examples are given in Table 5.

3. Some 29 species of seabirds breed on over 200 Western Australian islands. Most (20) breed only on islands. One species, the Lesser Noddy *Anous tenuirostris*, has its only breeding stations in Australia at the Houtman Abrolhos where there are two colonies, one on Pelsaert Island and the other on the adjacent Morley and Wooded Islands (Fuller and Burbidge 1981). The only other colonies, of a different subspecies, are in the Seychelle Islands (Serventy *et al.* 1971).

4. Apart from the seabirds and the endemic subspecies, two other species of birds breed only on islands - these are the Western Australian subspecies of the Cape Barren Goose (*Coreopsis novaehollandiae grisea*), which nests on islands in the Archipelago of the Recherche, and the Rock Parrot (*Neophema petrophila*), which nests on islands from Shark Bay southward. Several other species nest predominantly on islands, e.g. White-breasted Sea-eagle, Osprey, Reef Heron and Beach Curlew (or Thick-knee).

5. The Western Australian population of the New Zealand Fur Seal breeds only on islands between Cape Leeuwin and the Recherche Archipelago.

Table 3
W.A. Islands with Macropods

Name	Area (ha)	Macropod
Simpson	60	Macropus robustus
Westall (Combe)	100	Petrogale lateralis hacketti
Wilson	130	Petrogale lateralis hacketti
North Twin Peaks	280	Macropus eugenii
Salisbury	340	Petrogale lateralis lateralis
East Wallabi	360	Macropus eugenii
Dixon	530	Macropus robustus
West Wallabi	600	Macropus eugenii
Borda	605	Petrogale concinnus
Bald	780	Setonix brachyurus
Boodie	780	*Bettongia lesueur
Wollaston	850	Petrogale sp.
Depuch	880	*Petrogale lateralis lateralis
Mondrain	930	Petrogale lateralis hacketti
Hermite	1 010	*Lagorchestes conspicillatus
Middle	1 090	Macropus eugenii
Rosemary	1 130	Petrogale rothschildi
Garden	1 170	Macropus eugenii
Rottnest	1 550	Setonix brachyurus
Katers	1 780	Petrogale burbidgei
Enderby	3 000	Petrogale rothschildi
Dolphin	3 200	Petrogale rothschildi Macropus robustus
Uwins	3 300	Petrogale sp.
Bernier	4 430	Lagorchestes hirsutus Lagostrophus fasciatus Bettongia lesueur
Dorre	4 640	Lagorchestes hirsutus Lagostrophus fasciatus Bettongia lesueur
Darcy	4 800	Petrogale sp.
Boongaree	4 880	Petrogale burbidgei
Bigge	17 190	Petrogale burbidgei
Augustus	17 950	Petrogale concinnus
Barrow	22 250	Petrogale lateralis lateralis Bettongia lesueur Lagorchestes conspicillatus conspicillatus Macropus robustus isabellinus
Dirk Hartog	54 630	*Lagostrophus fasciatus *Bettongia lesueur

*now extinct

Except for small colonies at the base of cliffs along the Great Australian Bight, the Australian Sea-lion breeds only on islands, from the Beagle Islands southward.

Table 4
Macropods On W.A. Islands

Area	No Of Macropods On Islands	No Of Macropods Adjacent Mainland	%	No Of Islands With Macropods	Max Island Size (ha)
SOUTH WEST	3	12	25%	11	1 550
SHARK BAY	3	6	50%	3	54 630
PILBARA	5	6	83%	9	22 250
N.W. KIMBERLEY	2	8	25%	8	17 950
W.A.	10	21	48%	31	54 630

Table 5
Examples Of W.A. Island Vertebrate Populations Which Have Been Described As Separate Taxa

GROUP	TAXON	ISLAND
Mammals	Macropus robustus isabellinus	Barrow
	Lagorchestes conspicillatus conspicillatus	Barrow
	Petrogale lateralis hacketti	Westall, Wilson, Mondrain
	Isoodon obesulus nauticus	Daw
	Isoodon auratus barrowensis	Barrow
Birds	Coturnix varia scintillans	Houtman Abrolhos
	Malurus leucopterus leucopterus	Dirk Hartog
	Malurus leucopterus edouardi	Barrow
Reptiles	Ctenotus lancelini	Lancelin
	Ctenotus angusticeps	Airlie
	Ctenotus pantherinus acripes	Barrow
	Egernia stokesii stokesii	Houtman Abrolhos
	Egernia stokesii aethiops	Baudin (Shark Bay)
	Egernia pulchra longicauda	Boullanger, Whitlock, Escape, Favourite
	Aprasia rostrata rostrata	Hermite

Table 6
Western Australian Islands With Native Mammals And Exotic Predators

Island	Area (ha)	Predators	Mammals	Mean Adult Body Wt (g)	Status
Dirk Hartog	54630	cat	Lagostrophus fasciatus	1800	extinct
			Bettongia lesueur	1500	extinct
			Sminthopsis dolichura	14	stable
			Pseudomys albocineres	31	stable
			P. hermannsburgensis	12	stable
Hermite	1010	cat	Lagorchestes conspicillatus	3000	extinct
			Isoodon auratus	450	extinct
Depuch	880	fox	Petrogale lateralis	3700	extinct
Dolphin	3200	fox	Macropus robustus	23500	stable
			Petrogale rothschildi	5250	declined
			Dasyurus hallucatus	525	stable
			Zyzomys argurus	45	stable

6. Four species of marine turtle breed along the Western Australian coastline from Shark Bay northward. Data on island use are far from complete but it appears that almost every island with a beach north of North West Cape is used to some extent. Known islands of special importance include the Muiron Islands, Barrow, the Lowendals, the Monte Bellos, the Dampier Archipelago, the Lacepedes and Browse.

DEVELOPING PRIORITIES FOR MANAGEMENT

With a large number of island nature reserves in addition to a large area of mainland National Parks, Nature Reserves and Conservation Parks, Western Australia has made a major commitment to nature conservation. However, a small human population means that few resources can be allocated to management and therefore the development of priorities assumes great importance.

How can we develop priorities for both research and operations for island nature reserves in Western Australia? There are number of ways of approaching this question.

TERRESTRIAL MAMMALS

Recent research by Burbidge and McKenzie (1983, and in press) has shown that declines and extinctions of mammals on mainland Western Australia is restricted to those species which have mean adult body weights between 35 g and 4.2 kg, termed the Critical Weight Range (CWR). Disturbances on islands have also affected species within the CWR, eg the introduction of predators (Table 6). Thus it can be assumed that islands that contain species within the CWR (Table 7) are going to become increasingly important and management to prevent the introduction of predators, or to eradicate them if introduced, is vital. Already some CWR mammals are totally restricted to islands (Table 8), and the

Table 8
Australian Mammal Species In CWR now Restricted to Islands

Species	Islands
Dasyurus viverrinus	Tasmania
Perameles bougainville	Bernier, Dorre
Bettongia lesueur	Bernier, Dorre, Barrow
Bettongia gaimardi	Tasmania, Bruny
Lagostrophus fasciatus	Bernier, Dorre
Thylogale billardierii	Tasmania and 16 Tasmanian islands
Pseudomys praeconis	Bernier
Leporillus conditor	Franklin

Table 7
W.A. Terrestrial Mammals In CWR On Islands

Tachyglossus aculeatus	Bigge
Dasyurus hallucatus	Dolphin, Caffarelli, Hidden, Koolan, Augustus, Unwins, Boongaree, Bigge, Wollaston, Carlia
	Parantechinus apicalis
	Boullanger, Whitlock
Antechinus flavipes	Michaelmas, Middle, Doubtful
	Isoodon obesulus
	Daw
Isoodon macrourus	Saint Andrew
Isoodon auratus	Middle, Barrow, Augustus
Perameles bougainville	Bernier, Dorre
Petaurus breviceps	Augustus
Trichosurus arnhemensis	Barrow
Wyulda squamicaudata	Boongaree, Bigge
Bettongia lesueur	Bernier, Dorre, Barrow
Lagorchestes conspicillatus	Barrow
Laporchestes hirsutus	Bernier, Dorre
Lagostrophus fasciatus	Bernier, Dorre
Petrogale lateralis	Salisbury, Mondrain, Westall, Wilson, Combe, Barrow
Petrogale burbidgei	Bigge, Boongaree, Katers
Petrogale ?sp.	Uwins, Wollaston, Darcy
Peradorcas concinna	Augustus, Borda, Hidden, Long
Macropus eugenii	Middle, North. Twin Peaks, Mondrain, Garden, East Wallabi, West Wallabi
	Setonix brachyurus
	Bald, Rottnest
Hydromys chrysogaster	Barrow, Hermite
Melomys burtoni	Sir Graham Moore, Melomys
Conilurus penicillatus	Conilurus
	Mesembriomys macrurus
	Wollaston, Carlia, Uwins
Zyzomys woodwardii	Bathurst, Irvine, Augustus, Darcy, Bigge, Katers, Middle Osborne, Osborne, Boongaree, Borda
Pseudomys praeconis	Bernier
Pseudomys nanus	Barrow
Rattus fuscipes	Salisbury, Mondrain, Chatham, Bald, East Wallabi, West Wallabi
Rattus tunneyi	Middle Mangrove, Weld, West Lewis, Legendre, Enderby, Boongaree, Saint Andrew.

proper management of these islands - Bernier, Dorre, Barrow, in Western Australia, Franklin in South Australia, and Tasmania - is of paramount importance. Islands that contain the only island population of a CWR mammal are more important than those which protect species occurring on two or more islands. For Western Australia only, additional islands in this category are Bigge (*Tachyglossus aculeatus*), Michaelmas (*Antechnus flavipes*), Daw (*Isoodon obesulus*) and Saint Andrew (*Isoodon macrourus*). To these should be added Boullanger and Whitlock (*Parantechinus apicalis*) since they are joined at low tide.

ENDEMIC TAXA

Islands with endemic taxa, eg Lancelin, Dirk Hartog, Barrow, Airlie, some islands in the Houtman Abrolhos and Baudin Island in Shark Bay, must be given high priority.

SEABIRDS

Among the more than 200 seabird nesting islands a few stand out. In some cases seabirds have very few breeding stations in Western Australia (Table 9), and these colonies need to be monitored and managed if necessary. Some islands with large colonies or with many breeding species are also important, eg Pelsaert, Sandland and Buller.

Table 9
Seabirds With Few Western Australian Breeding Colonies

Species	Island(s)
Masked Booby	Bedout, Adele
Brown Booby	Bedout, Adele, 2 islets in Lowendals, Lacepedes, White
Lesser Frigate-bird	Bedout, Adele, Lacepedes
Short-tailed Shearwater	Figure of Eight
Black-faced Cormorant	Middle (Recherche), Lion
Red-tailed Tropic-bird	Sugarloaf Rock, Pelsaert
Lesser Crested Tern	Bedout
Sooty Tern	Pelsaert, Wooded, Morley, Alexander
Common Noddy	Pelsaert, Bedout
Lesser Noddy	Pelsaert, Wooded, Morley

SEALS

The New Zealand Fur Seal suffered a massive decline from over-hunting last century and only now seems to be recovering. Any island with a colony of this species should be monitored. Islands of special importance are Salisbury (Archipelago of the Recherche (Burbidge *et al.* in press) and Middle Doubtful Island near Bremer Bay (Abbott 1979).

TURTLES

Islands of special importance have been listed above. The priority at present is to find out which islands are used, and to document migration patterns and any harvesting which might be taking place outside Australia.

DISTURBANCE

Most islands which are being or have been disturbed need management. Some of the disturbances of the past can be removed, eg by control of rats, rabbits, cats and foxes, and some of the disturbances of the present can be managed so as to minimise impact and prevent loss of species (eg Butler this publication). Islands subject to disturbance which are of value must be managed.

CONCLUSIONS

From the above I have developed three orders of management priority (within a priority islands are listed alphabetically):

1. Extremely valuable

   Barrow, Bernier, Dorre.

2. Very high value

   Adele, Airlie, Baudin, Bedout, Bigge, Boullanger, Browse, Buller, Daw, Dirk Hartog, Middle Doubtful, Figure of Eight, Lacepede Islands, Lancelin, Morley, Pelsaert, Saint Andrew, Salisbury, Sandland, White, Wooded and turtle beaches in the Dampier Archipelago, Lowendal Islands, Monte Bello Islands, and Muiron Islands.

3. High value

   Augustus, Bathurst, Bald, Boongaree, Borda, Carlia, Chatham, Darcy, Dolphin, East Wallabi, Enderby, Garden, Hidden, Irvine, Katers, Legendre, Long (Bucaneer Archipelago), Melomys, Middle (near Barrow), Middle (Recherche Archipelago), Middle Mangrove, Middle Osborne, Mondrain, North Twin Peaks, Rottnest, Sir Graham Moore, South West Osborne, Uwins, Weld, Westall, West Lewis, West Wallabi, Wilson and Wollaston.

Islands within these categories which are subject to disturbances require immediate or ongoing management. These include Adele, Airlie, Barrow, Boodie, Dirk Hartog, Lacepede Islands, Varanus

(Lowendal Islands), Dolphin, Garden, Middle (near Barrow), Rottnest, Sir Graham Moore and West Wallabi. Islands - Boodie, Hermite and Depuch - could be added to Category 3 if populations of exotic mammals could be eradicated and the indigenous mammals reintroduced.

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