SOUTH COAST TERRESTRIAL AND MARINE RESERVE INTEGRATION STUDY

A collaborative project between CALM Marine Conservation Branch and South Coast Region

Project No: N713 - National Reserves System Cooperative Program
Environment Australia

PROGRESS REPORT: MRIP/SC - 04/1997

Prepared by J G Colman
Marine Conservation Branch

March 1997

Marine Conservation Branch
Department of Conservation and Land Management
47 Henry St
Fremantle, Western Australia, 6160

ACKNOWLEDGEMENTS

Direction
- Kieran McNamara - Director, Nature Conservation Division.
- Dr Chris Simpson - Manager, Marine Conservation Branch (MCB), Nature Conservation Division.

CALM collaboration
- Jeremy Colman Project Leader, MCB.
- Kelly Gillen, Nature Conservation Officer, South Coast Region.
- Gilles Monty - CALM Volunteer, MCB.
- Heidi Oswald - CALM Volunteer, MCB.
- Emma Parkes - CALM Volunteer, MCB.

External collaboration
- Dave Deeley & Kevin Bancroft, Estuarine Health Indicators Project, Murdoch University, WA.
- Dr Hugh Kirkman, CSIRO Division of Fisheries and Oceanography, WA.
- Dr Graham Edgar, Zoology Department, University of Tasmania.

Funding and resources
- The project is funded by a grant of $63,000 from the Environment Australia (formerly the Australian Nature Conservation Agency - ANCA) Reserve Systems Unit, under the National Reserves System Cooperative Program (Project No: N713).
- Resources including scientific supervision, technical assistance, logistical support and instrumentation are being provided by the MCB.
- Resources including scientific and technical input, administrative assistance and logistical/operational support are being provided by CALM's South Coast Regional Office in Albany.

DISTRIBUTION LIST

South Coast Terrestrial and Marine Reserve Integration Study. Progress Report: MRIP/SC - 04/1997

Environment Australia:	Reserve Systems Unit, Biodiversity Group
Advisory Committee:	Dr Paddy Berry, Western Australian Museum
	Geoff Bott, Department of Environmental Protection (DEP)
	David Deeley, Estuarine Health Indicators Project, Murdoch University
	Dr Ian Eliot, Geography Department, University of Western Australia
	Kelly Gillen, CALM South Coast Region
	Dr Hugh Kirkman, CSIRO Division of Fisheries & Oceanography
	Dr Paul Lavery, Ernvironmental Management Department, Edith Cowan University
	Guy Leyland, Western Australian Fisheries Industry Council (WAFIC)

Kieran McNamara, Director, Nature Conservation Division, CALM
Dr Chris Simpson, Manager, Marine Conservation Branch, CALM
John Watson, Manager, South Coast Region, CALM

This report may be cited as:

Colman J G (1996). South Coast Terrestrial and Marine Reserve Integration Study. Progress Report MRIP/SC - 04/1997. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

Copies of this report may be obtained from:

Marine Conservation Branch
Department of Conservation and Land Management
47 Henry St.
Fremantle, Western Australia, 6160
Ph: 61-9-432 5100
Fax: 61-9-430 5408

CONTENTS

SUMMARY

This report details progress achieved in the South Coast Terrestrial and Marine Reserve Integration Study from 1/01/97 to 31/03/97.

This project is being coordinated by the Marine Conservation Branch (MCB) of the Department of Conservation and Land Management (CALM) as part of the MCB's Marine Reserve Implementation Programme (MRIP), and is being conducted in collaboration with CALM's South Coast Region in Albany.

The primary objective of the project is to facilitate a regional classification of the marine environment along the south coast of Western Australia between Broke Inlet and Israelite Bay, according to ecological, economic and cultural criteria, and to establish an information base for proposed marine reserve areas identified in the Wilson Report. The project will also provide recommendations that will facilitate the integrated management of adjacent terrestrial and marine reserves and will ensure that the potential impacts of terrestrial and estuarine ecosystems upon their marine counterparts are understood prior to the creation of any marine reserves.

PROGRESS AGAINST PROJECT SCOPE ITEMS

1. Provide an overview of the nature conservation, recreation, aesthetic and economic values of potential marine reserves and associated terrestrial reserves along the south coast of Western Australia between Broke Inlet and Israelite Bay.

A statewide review of the marine environment of Western Australia, entitled "*A Representative Marine Reserve System for Western Australia* - Report of the Marine Parks and Reserves Selection Working Group, 1994" (CALM, 1994: known as the Wilson Report) identified a number of marine areas, offshore from existing terrestrial reserves, along the south coast that were considered as suitable candidates for possible incorporation into the state system of representative marine reserves. Within the revised geographical boundaries defined for the present study (Broke Inlet to Israelite Bay) the Wilson Report identified nine potential marine reserves and broadly reviewed the tenure, geomorphology, marine flora and fauna and recreational attributes of these areas (CALM, 1994). There are a total of 18 terrestrial reserves associated with these potential marine reserves areas (Table 1).

Table 1: Potential marine reserves and associated terrestrial reserves within the study area

No.	Potential Marine Reserves	Associated Terrestrial Reserves
1	Broke Inlet	D'Entrecasteaux National Park
2	Walpole/Nornalup Inlets	Walpole-Nornalup National Park
3	William Bay	William Bay National Park
4	West Cape Howe	West Cape Howe National Park
5	King George Sound/Princess Royal Harbour	Michaelmas Island Nature Reserve Breaksea Island Nature Reserve Mistaken Island Nature Reserve Seal Island Nature Reserve
6	Cape Vancouver - Bald Island	Two People's Bay Nature Reserve Waychinicup National Park Mt Manypeaks Nature Reserve Bald Island Nature Reserve
7	Fitzgerald Biosphere Reserve	Fitzgerald River National Park Doubtful Islands Nature Reserve Glasse Island Nature Reserve
8	Stokes Inlet/Shoal Cape	Stokes National Park
9	Recherche Archipelago	Woody Island Nature Reserve Recherche Archipelago Nature Reserve

A review of the information available on the nature conservation, recreation, aesthetic and economic values of these nine marine areas and their associated terrestrial reserves has been completed. A draft overview of data for the terrestrial reserves is included as Appendix I. This review consists of a broad overview of physical/biological resources, cultural/historical values, social/economic usage and management issues in existing coastal terrestrial reserves and is limited to resources and activities that could influence integrated management of estuaries/inlets and of the nearshore marine environment adjacent to these reserves. The review also considers the current and potential impacts on terrestrial flora and fauna from activities that gain access to water-based resources through terrestrial

reserves. This information will be combined with an overview of the potential marine reserves in the Final Report of this study.

Reference database

A comprehensive reference database has been compiled to collate all published literature and unpublished reports covering the marine, estuarine and terrestrial environments of the south coast of Western Australia. This database currently consists of 211 annotated records.

Marine wildlife review

The overview of the marine environment included an extensive review of the marine wildlife resources of the south coast. This review collates information available for pinnipeds, cetaceans and seabirds across the study area, reviews research carried out on the New Zealand fur seal, Australian sea lion and southern right whale populations, and lists inventories of species distribution and stranding events.

2. On the basis of 1 above, select areas for more detailed study of the range of issues facing the integration of terrestrial and marine reserves in the region.

In addition to assessing the various values of the proposed marine reserves and associated terrestrial reserves the study is concentrating on the relationship between physical processes in the terrestrial reserves and their hinterlands and potential impacts on the adjacent marine environment. On the basis of the preliminary reviews of information and in line with the objectives of the original project proposal it was decided that the study will focus on the Fitzgerald Biosphere Reserve and adjacent marine environment. This area largely encompasses the range of issues facing the integration of terrestrial and marine reserves in the region.

3. Liaise with other relevant management organisations and the local community on the aims of the project and its methodology.

An informal consultative process has been employed to facilitate liaison with relevant management organisations and the local community. Contacts have been established with a number of external state government departments within Western Australia, both to obtain information on the terrestrial and marine environments along the south coast and also to inform them of the aims and methodology of the project, including: the Fisheries Department, the Department of Transport, the Department of Environmental Protection, the Water and Rivers Commission, the WA Tourism Commission, and the WA Museum. Dissemination of information on the project is further facilitated through the project Advisory Committee. Details of the project have been supplied to a NSW National Parks and Wildlife team currently working on developing and assessing integrated management strategies using the Solitary Islands and Jervis Bay Marine Parks as case studies.

An overview of the project was presented at a meeting of the Shire of Jerramungup held in Bremer Bay on 15 March 1997. The selection of the Fitzgerald Biosphere Reserve as a study area and the objectives and methodology of the marine field survey were discussed at this meeting, which was attended by shire councillors, key local community members and government department representatives from both Albany and Perth. The local community and key user groups will be further informed about the project through the publication of a comprehensive article in local newspapers across the south coast. This article will describe project objectives, methodologies, and likely outcomes and will include a summary of the findings of the marine field survey.

4. Compile all existing data on the natural values of the study areas.

Data on the natural and conservation values of the Fitzgerald Biosphere Reserve has been compiled from a number of sources, including the South Coast Region Management Plan (CALM, 1992), Fitzgerald River Management Plan (CALM, 1991) and a number of other sources. Further information on the terrestrial ecosystem has been obtained from CALM South Coast Regional staff in Albany and Ravensthorpe, including details of the development of an integrated vegetation management plan for the zone of cooperation (see Appendix II), and a project that examined the conservation values of the buffer/transition zone of the Biosphere Reserve (Saunders, 1996).

Information on the natural and conservation values of the estuaries and coastal inlets of the Fitzgerald Biosphere Reserve (Wellstead and Hunter River Estuaries, Kelly's Creek, Gordon, Boondalup, St Mary's, Fitzgerald, Dempster, Hamersley and Culham Inlets) has been compiled from Hodgkin & Clark (1987, 1990) and from the review of the

estuaries carried out by the Marine and Freshwater Research Laboratory at Murdoch University (see Appendix III for details of the draft document), plus a number of other sources. The limited information available on the natural values of the marine environment adjacent to the Biosphere Reserve has been compiled from the Wilson Report (CALM, 1994) and a number of other sources. This data will be complemented by information on the conservation values of nearshore benthic habitats acquired during the field survey.

5. Map, classify and ground-truth major benthic habitats in the study areas.

Mapping and classification of the major benthic habitats has been carried out for the majority of the coastline between Broke Inlet and Israelite Bay by Dr Hugh Kirkman, CSIRO Division of Fisheries. Benthic habitats have been divided into eight broad categories or types:

Dense seagrass
medium seagrass
patchy seagrass
sparse seagrass
Bare sand
Flat platform reef
heavy limestone reef
Granite reef

Broad ground-truthing has been carried out for deep water features and islands of the Recherche Archipelago, and for the coast from Two People's Bay near Albany to the western end of the cliffs of the Great Australian Bight. The relevant digital data sets has been sourced through the Coastal Resource Atlas at the Western Australian Department of Transport (DOT), and transferred to the marine GIS currently being established at the MCB office in Fremantle. Preliminary maps have been produced showing benthic habitats for the whole of the south coast. Benthic habitats of the area adjacent to the Fitzgerald Biosphere Reserve are shown in Appendix IV. Additional ground-truthing of this area was carried out during the field survey from 7-21 March 1997 (see details below). Ground-truthing of deep water benthic habitats in Esperance Bay, adjacent to Mondrain Island in the Recherche Archipelago and at a number of locations from Hopetoun to Albany was carried out using a drop-down video camera deployed from the vessel STS Leeuwin, during an eco-adventure tour along the south coast from 10-21 February 1997.

The benthic habitats of the inshore marine environment from Denmark to Albany, including the areas adjacent to the William Bay and West Cape Howe National Parks, have not been mapped or classified.

6. Prepare listings of the flora and fauna of the marine and terrestrial components of the study areas.

Listings of the flora and fauna of the terrestrial reserves between Broke Inlet and Israelite Bay have been compiled from existing Management Plans and from databases at the WA Museum. Particular attention was focused on the Fitzgerald Biosphere Reserve. Full listings of both marine and terrestrial flora and fauna will be provided in the Final Report of the project.

Terrestrial Flora

Fitzgerald River National Park is dominated by open to very open mallee and scrubland. With 1748 plant species identified so far, including 75 endemics the Park it is one of the richest flora conservation areas in WA (CALM 1991). As well as having a high species richness the park also has a high proportion of endemic, geographically restricted and rare species, 16 of which are declared rare flora.

The vegetation around the inlets in the Fitzgerald has been described in some detail by Hodgkin & Clark (1987, 1990). Outside the areas around the inlets the coastline is predominantly cliff backing onto open mallee and scrubland. A list of priority flora (endemic and possibly rare or known to be rare) is given in the Fitzgerald River National Park Management Plan (CALM 1991).

Terrestrial Fauna

A listing of terrestrial fauna (vertebrate and invertebrate) has been obtained from the data base at the WA Museum for areas along the south coast including the Fitzgerald River Biosphere Reserve. The park has 22 species of native mammal (7 of which are declared rare), 184 species of bird (3 declared rare and 2 in need of special protection) 41

species of reptile, 12 species of frog and four species of inland fish (CALM 1991). The large size of the park and the lack of wide spread habitat degradation enhances its value as an important species protection site.

Marine Flora and Fauna

A field survey was undertaken from 7-21 March 1997, along the coast adjacent to the Fitzgerald Biosphere Reserve. The survey, a systematic and quantitative investigation of the major benthic habitats from Starvation Boat Harbour to Groper Bluff, was carried out to examine marine biota in nearshore waters.

The coastline adjacent to the Fitzgerald Biosphere Reserve is a high energy environment with heavy swells. The open ocean shores, south-facing headlands and beaches are exposed to strong wave action, and most of the bays are wide and open to prevailing winds and swells. On the basis of geomorphological features and wave exposure, the coast can be divided up into 3 major distinctive coastal types:

- Limestone shores, with narrow reefs and platforms parallel to the shore, (Starvation Boat Harbour to Hopetoun);
- Wide bays with sandy beaches and shallow shelving seabed. These areas are generally protected from the prevailing south-westerly swell (Hopetoun to the Doubtful Islands);
- Granitic or gneissic headlands, exposed to open ocean swells, with steep wave-swept slopes and small lunate bays, boulder fields on the less-exposed eastern sides of headlands, and offshore reefs with steep or vertical walls (Doubtful Islands to Groper Bluff).

These distinctive coastal types are repeated all along the south coast and provide a variety of habitats for marine fauna and flora. The limestone reefs at the eastern end of the survey area are characterized by low profile reef that is easily covered in sand and does not have a heavy growth of seaweeds, and higher profile reef with a cover of kelp or other macro-algal species. The more sheltered central region of the survey area is characterized by extensive seagrass meadows beyond the surf zone, and areas of coarse-grained bare sand. The western end of the survey area is characterized by steep rock walls dropping off to as much as 40 m before reaching a sandy sea floor. The upper sections of these walls (to 30 m or so) are usually dominated by macro-algae, but in deeper water dense communities of sponges, ascidians and cnidaria have been reported.

A quantitative survey was undertaken, with sampling at 39 sites between Starvation Boat Harbour and Groper Bluff. At each site the following were surveyed:

- the abundance of large fishes and smaller cryptic fishes;
- the abundance of macro-epibenthic invertebrates (specimens >10mm in size);
- the percentage cover of macro-algae and seagrasses;
- the biomass of seagrasses.

A combination of visual censuses, quadrat sampling and benthic video transects were employed to maximize the amount of data gathered within the short duration of the survey. A list of the sampling sites is included as Appendix V

Flora

At least 77 species of macro-algae have been identified from quantitative sampling at granite and limestone reef sites. Sampling in seagrass meadows generated percentage cover and biomass data for 10 species of seagrass.

Fauna

Initial analysis of quantitative data and samples taken from both reef and seagrass sites has identified at least 83 species of fishes, 27 species of echinoderms, 18 species of molluscs, 24 species of crustaceans and 40 species of sponges.

7. Classify seaward-draining catchments associated with each study area on the basis of land-use and degree of alteration to the naturalness of surface and groundwater systems which enter the marine environment.

The seaward-draining catchments of the south coast between Broke Inlet and Israelite Bay have been identified and the catchment characteristics have been described as part of the estuaries review (see Appendix III for details of the draft document). This review includes a description and classification of estuaries and coastal lagoons of the Fitzgerald Biosphere Reserve.

8. Identify interactions and impacts between the marine and terrestrial components of the study areas for each catchment (including physical and biological processes and land-use aspects).

To be completed. Results will be presented in the Final Report.

9. Compare the results obtained in 8 above for the different catchment types identified in 7 above associated with each study area.

To be completed. Results will be presented in the Final Report.

10. Use the results of 1 to 9 above to refine existing recommendations for potential marine reserves in the region, and to identify key management issues.

To be completed. Recommendations will be presented in the Final Report.

11. Prepare reports on the above scope items in accordance with the reporting schedule.

This Progress Report is the second in the revised project payment and reporting schedule accepted by the Reserve Systems Unit of Environment Australia in January 1997 (see Appendix V).

REFERENCES

CALM, 1991. Fitzgerald River National Park Management Plan 1991-2001. Department of Conservation and Land Management, Perth, Western Australia.

CALM, 1992. South Coast Region Regional Management Plan 1992-2002. Department of Conservation and Land Management, Perth, Western Australia.

CALM, 1994. A representative marine reserve system for Western Australia. Report of the Marine Parks and Reserves Selection Working Group. Department of Conservation and Land Management, Perth, Western Australia.

Hodgkin, E.P. & Clark, R. 1987. An inventory of information on the estuaries and coastal lagoons of South-Western Australia. Estuaries of the Shire of Ravensthorpe and the Fitzgerald River National Park. Environmental Protection Authority of Western Australia. Estuarine Study Series No. 7, July 1990.

Hodgkin, E.P. & Clark, R. 1990. An inventory of information on the estuaries and coastal lagoons of South-Western Australia. Wellstead Estuary. Estuaries of the Bremer River. Environmental Protection Authority of Western Australia. Estuarine Study Series No. 1, June 1987.

Saunders, A. 1996. Conservation value of Fitzgerald Biosphere Reserve buffer/transition zone, Phases I-IV. CALM/ANCA SCAP Project #4473. Unpublished report, August 1996. Department of Conservation and Land Management, Perth, Western Australia.

APPENDIX I

Overview of Terrestrial Reserves

South Coast Terrestrial and Marine Reserve Integration Study

Overview of terrestrial reserves

DRAFT

Emma Parkes
March 1997

CONTENTS

1. INTRODUCTION

The following review is a broad summary of physical/biological resources, cultural/historical values, social/economic usage and management issues in coastal terrestrial reserves between Broke Inlet and Israelite Bay. It covers resources and activities that may influence the integrated management of estuaries/inlets and of the near shore marine environment adjacent to reserves.

Each issue, resource or activity has been considered separately with a brief description. Key sites associated with particular issues have been highlighted. All references used while collating this information have been entered on to the South Coast Marine Data Base, held at CALM Marine Conservation Branch, with a brief description of the content of each paper or report.

2. A REVIEW OF PHYSICAL/BIOLOGICAL RESOURCES

2.1 COASTAL LANDSCAPES AND AESTHETIC VALUES

The South Coast region is renowned for its outstanding flora, spectacular landscapes and beautiful and varied coastline. The region contains areas of undisturbed coastline with a diversity of landscape features including cliffs, beaches, reefs, offshore islands, headlands and mountain peaks. The coastline is dominated by hard granitic and gneissic headlands surrounding curved sandy beaches. The soils in the region are either unconsolidated sands or thin skeletal soils on granite and limestone headlands and cliffs. A narrow botanical district runs along the coastal strip, where sandplains with scrub and mallee heath occur. Tallerack (*Eucalyptus tetragona*) is a characteristic species. Mallees particularly *E.redunca* and *E.incrassata* occupy valleys. Banksia scrub is also a feature.

All rivers in the region discharge into inlets most of which are semi-permanently or permanently closed to the ocean. Virtually all rivers in the region have high salinity and after heavy rain fall sediment loads are also high. There is evidence that many of the inlets are silting up quite rapidly.

Fauna of the area include Western grey kangaroo, southern brown bandicoot, yellow footed antechinus, bush rat, honey possum, dugite, tiger snake, bardick, whistling kite, nankeen kestrel, Port Lincoln parrot, western rosella, elegant parrot, grey fantail, red wattle bird, New Holland honeyeater, kookaburra, moaning frog and banjo frog. A listing of terrestrial vertebrates and invertebrates for the south coast study region has been obtained from the fauna data base at the WA Museum (Natural History Department).

2.2 REVIEW OF FLORA AND FAUNA ON OFFSHORE ISLAND NATURE RESERVES

Island fauna varies with size, topography and situation of the island, vertebrate species commonly found on islands include, Australian sealion, New Zealand furseal, fleshy footed shearwater, great winged petrel, little penguin, pied oyster catcher, sooty oyster catcher, and death adder.

The following island nature reserves are included in the study area:-
Shelter Island
Mistaken Island
Seal Island
Chatham Island
Michaelmas Island
Breaksea Island
Bald Island
Glasse Island
Doubtful Islands

Investigator Islands (Rocky Islets)
Woody Island

Islands of the Recherche Archipelago

Hood Island
Sandy Hook Island
Remark Island
Mondrain Island

For the majority of the above sites there is limited information available. CALM officers visit whenever possible to make observations but detailed flora and fauna studies have only been conducted at a few sites. The information below is taken from CALM file records. Shaughnessy's (1990) report on NZ furseals and Gales (1990) report on Australian sealions have been consulted to identify important breeding and haul-out sites.

Mutton Bird Island (Shelter Island) - Evidence of use as a seal/sealion haul out site. Burrows show evidence of use by little penguins. Fauna includes, brown falcon, rock parrot, king skink, sooty oyster catcher.

Mistaken Island - Fauna includes little penguin, sooty oyster catcher, osprey, king skink, rock parrot, Pacific gull, silver gull, little pied cormorant. There has in the past been a rabbit problem on the island, this now seems to be under control, there has also been a problem with the introduced plant Taylorina (*Psoralea pinnata*) which is periodically removed.

Seal Island - No information found

Chatham Island - Haul out site for NZ fur seals, the rare fern *Asplenium obtusatum* (shore spleenwort) grows on the island.

Michaelmas Island - Fauna includes sooty oyster catcher and Pacific gull. Little penguin, fleshy footed shearwater and great winged petrel are all thought to breed on the island.

In the mid 80s a tour operator was keen to place a small jetty on the island to allow access for visitors transported on his companies boats, this was turned down by CALM.

Breaksea Island - Important haul out site for both Australian sealions and NZ furseals. An important historical site (see historical/cultural review section). Considerable work has been done on the Island and lists of both flora and fauna are available (Wolfe 1994). Major impacts have been caused by both introduced weeds and feral animals (rabbits).

Bald Island - Haul out site for both NZ furseals and Australian Sealions. Possible breeding site for little penguin, great-winged petrel and white faced storm petrel. Fauna observed includes, quokka, Australian goshawk, Australian raven, silver gulls, crested terns, grey fantails. The island is a translocation site for the rare noisy scrub bird (Abbott 1981, Storr 1959).

Glasse Island - Regular haul out site for Australian sealions and NZ furseals, possible breeding site for crested terns and little penguins. Other fauna observed, Pacific gull.

Doubtful Island - Has a problem with the invasive plant Boxthorn which requires an ongoing eradication programme. It is an important haul-out and breeding site for Australian sealions and NZ furseals. The fleshy footed shearwater nests on the island. Other fauna observed include rock parrot, stubble quail, sooty oyster catcher, Pacific gull, little penguin, king skink, silver gull, sea eagle.

Investigator Islands (Rocky Islets) - Breeding site for Australian sealions and NZ furseals. Other fauna observed include, sooty oyster catcher, bridled tern, rock parrot, crested tern, white breasted sea eagle, king skink.

Woody Island - Is at present the only island in the Recherche to which there is any public tourist access. Both day and overnight visitors are brought to the island by a local tour operator.

ISLANDS OF THE RECHERCHE ARCHIPELAGO NATURE RESERVE

Middle Island - Access on Middle Island has become an issue as visitors have been degrading the foredune by crossing it to reach the lake. CALM propose to install a boardwalk across the dune to provide a route for visitors and halt the erosion. There is no tour operator with access to the island, it is visited by fishermen/ yachtsmen and private boat owners. Tourism development on the island is not being encouraged although proposals have been put forward.

A description of the islands cultural resources, history and brief descriptions of flora and fauna is given in Bindon (1996).

Cull Island - Has problems with both goats and boxthorn.

Remark Island - Fauna include, little penguin, great-winged petrel, fleshy footed shearwater, Pacific gull, sooty oyster catcher, little black cormorant and king skink (Lane 1982).

Hood Island - Haul out site for NZ fur seals. Breeding fauna includes, little shearwater, great-winged petrel, Cape Barren goose (Tingray 1982).

Sandy Hook Island - The island has a sandy beach and is in close proximity to Esperance making it accessible and at risk from disturbance by visitors. Breeding birds include, little penguin and fleshy footed shearwater (Tingray 1982).

Mondrain Island - Fauna includes, little penguin, fleshy footed shearwater, Pacific gull, Cape Barren goose, sliver gull, Caspian and crested tern, sooty oyster catcher, king skink and rock wallaby (Abbott 1981).

There are several other islands in the south coast region proposed as nature reserves these include :- Migo, Richard's, Stanley, and Cheyne Islands.

2.3 LISTING OF THE TERRESTRIAL FLORA AND FAUNA OF THE FITZGERALD RIVER NATIONAL PARK

2.3.1 Flora

Fitzgerald River National Park is dominated by open to very open mallee and scrubland. With 1748 plant species identified so far, including 75 endemics the Park it is one of the richest flora conservation areas in WA. (CALM 1991). As well as having a high species richness the park also has a high proportion of endemic, geographically restricted and rare species, 16 of which are declared rare flora.

The vegetation around the inlets in the Fitzgerald has been described in some detail by Hodgkin (1987 and 1990). Outside the areas around the inlets the coastline is predominantly cliff backing onto open mallee and scrubland. A list of priority flora (endemic and possibly rare or known to be rare) is given in the Fitzgerald River National Park Management Plan (CALM 1991).

2.3.2 Fauna

A listing of terrestrial fauna (vertebrate and invertebrate) has been obtained from the data base at the WA. Museum for areas along the south coast including the Fitzgerald River Biosphere Reserve. The park has 22 species of native mammal (7 of which are declared rare), 184 species of bird (3 declared rare and 2 in need of special protection) 41 species of reptile, 12 species of frog and four species of inland fish (CALM 1991). The large size of the park and the lack of wide spread habitat degradation enhances its value as an important species protection site.

3. REVIEW OF CULTURAL/HISTORICAL RESOURCES

Areas of Aboriginal and European cultural importance occur on many lands managed by CALM.

3.1 ABORIGINAL SITES IN COASTAL AREAS, ESTUARIES/LAGOONS AND ON OFFSHORE ISLANDS

Aboriginal people have occupied the south-west of WA for at least 40000 years. Numerous Aboriginal sites have been identified in the region. A complete listing of all Aboriginal sites in the coastal region has been obtained from the Department of Aboriginal Affairs, this information gives site locations, and a brief description of the type/importance of the site. A variety of different types of site are known these are both ethnographic and archaeological. Most archaeological sites are artefact scatters on the coast or islands or associated with estuaries and water courses. Several of the sites found exhibit material that pre-dates sea level rise. References covering archaeological finds on the south coast are entered in the data base, a large proportion of the work on the south coast has been carried out by the WA. Museum (Dortch et al.).

3.2 EUROPEAN SITES IN COASTAL AREAS, ESTUARIES/LAGOONS AND ON OFFSHORE ISLANDS

European coastal and maritime sites include those used as whaling and sealing stations, fishing sites and coastal aids to navigation such as light houses. A listing and description of all known shipwrecks off the south coast has been obtained from the WA Maritime museum. During the early 1800s whaling and sealing were widely practised activities. A record and assessment of Albany's maritime sites concentrating on terrestrial sites including whaling stations, jetty's etc. is given in a chronological record of the maritime heritage of the area by Wolfe (1994a). Sites of the major bay whaling stations in the south coast region have been found at the following locations, Middle Island, Doubtful Island Bay, Two Peoples Bay, Barker Bay, Torbay, Cheyne Beach, Cape Arid, and Cape Riche, other sites which are likely to have been used as whaling sites include Duke of Orleans Bay and Waychinicup Inlet (McIlroy 1987). The remains of the whaling station at the Middle Island site are described by Pearson (1988) in a report on an archaeological survey of some islands in the Recherche.

Eclipse Island Lighthouse - The lighthouse was first built in 1926 it is now automated. The Eclipse building at the Albany Residency museum displays the old optic from the light house with information on the history of the site. A description of the lighthouse and the island including flora and fauna is given in Scott (1988).

Breaksea Island Lighthouse - The old light was built in 1858, new light in 1902. The Point King and Breaksea Island lighthouses were the second set of lighthouses built in WA. The Albany maritime heritage museum have an ongoing project on Breaksea Island to restore the buildings on the island, this is a long term community project, details are given in Wolfe (1994), at present the project is suffering from lack of funding.

4. A REVIEW OF SOCIAL AND ECONOMIC USAGE

4.1 RECREATIONAL WATER-BASED ACTIVITIES

The primary issue with all water-based activities is access to the coast, how this is gained and whether the coastal environment is being degraded as a result. User conflict is also an important issue. John Watson (1982) produced a summary of water based recreational activities in south coast National Parks. The Water and River Commission (Waterways Commission) produced a review of recreational usage of water bodies in Busselton and Walpole (Madden 1995), which highlights the Walpole-Nornalup inlet as the major recreational centre in this area. Information on recreational activities has been sourced from National Park management plans and gathered from local user groups and CALM staff. The Albany Harbours draft planning stratergy (Albany harbours planning group 1997) details water based activities within the harbours area.

4.1.1 Recreational fishing

Recreational fishing is a popular pastime throughout WA and the south coast is no exception. The most common activity in many of the National Parks along the coast is fishing (Two Peoples Bay, Waychinicup, Fitzgerald, Stokes, Cape Le Grand, Cape Arid and William Bay). Local residents and visitors to the area use many sites along the coast including beaches, cliffs, headlands and inlets. Beach fishing is popular with species caught including herring, shark, skipjack and tailor. During late summer and early autumn salmon can be caught from some beach sites. Rock fishing generally produces groper, while fishing in the inlets produces black bream. Fishing from small boats launched from the coast is also popular.

No data on numbers of people recreational fishing, sites frequented or on species and numbers of fish caught is available for the south coast. A review of recreational fishing produced by the Australian bureau of statistics (1987) contains some data on recreational fishing but no figures specific to the south coast region. Local recreational fishing advisory committee members have been contacted with the conclusion that data on levels of recreational fishing would be extremely difficult and time consuming to collect. A recent review of recreational fishing made some recommendations specific to the south coast, suggesting that priority areas for recreational fishing should be established (The recreational fishing advisory committee of WA. 1990).

Conflict between recreational and commercial fishers often causes problems particularly in south coast inlets (eg. Culham, Hammersley and Stokes Inlets). Recreational fishers often feel fish stocks are being depleted by commercial fishermen operating under very different restrictions.

4.1.1.1 Access for recreational fishing

The majority of fishing sites within coastal National Parks are accessed by vehicle many by four wheel drive tracks. Vehicle access to fishing spots can have adverse impacts on the environment. If vehicles leave existing roads and tracks it encourages others to follow leading to a profusion of tracks and associated erosion problems particularly in

sandy soils and dune systems. Keeping fishers to recognised and maintained tracks is important to prevent erosion of fragile dune systems and the spread of disease (*Phytophora*). In some areas foot access only may be allowed to remote fishing spots in zones of high conservation value. Fishermen often camp at fishing sites particularly when in more remote areas, this can lead to problems as fires are often lit, rubbish and discarded tackle may not be removed.

4.1.1.2 Spearfishing

Spear guns are not allowed in (or through) National Parks. Outside National Park land spearfishing is not permitted when diving on SCUBA only being permitted when free diving. It not at present a common activity on the coast.

4.1.1.3 Marroning

Occurs on some of the rivers in the south coast area (for example Deep, Walpole and Frankland in Walpole-Nornalup National Park, Waychinicup river). Marroning is regulated by the fisheries department with the help of CALM staff who assist in patrolling the area during declared and closed seasons. Marroners can cause problems along river banks, disturbing and degrading riverside vegetation, lighting camp fires and causing a fire hazard in sensitive areas. There are also problems with new tracks being created to access new areas.

4.1.2 Boating

4.1.2.1 Yachting

Several inlets along the coast provide good sites for yachting, there are active yachting clubs based at Albany Harbour, Denmark, Nornalup Inlet, Broke Inlet, Walpole Inlet, and Esperance. Albany Harbours and Sound are the most used areas with 60-70 yachts.

4.1.2.2 Canoeing

Canoeists frequent several of the rivers in the coastal area, problems are caused when people stop to camp beside rivers, causing degradation of fragile riverside vegetation and risk of fire. River banks are often steep providing few suitable camping spots. Particular problems have occurred along the Kalgan river near Albany.

4.1.2.3 Power-boating

The main users of power boats are fishermen and divers although some pleasure craft also visit the coastal area. There are several problems associated with boat use. Access - boat launching sites are limited and can therefore become congested, areas around launching sites can become degraded. Few fixed mooring sites exist so boat users have to anchor potentially causing damage to benthic habitats (seagrass, reef etc). Visitors arriving at CALM managed sites by boat will not have the benefit of any information provided within the park.

4.1.2.4 Water and jet-skiing

These activities have all the problems associated with power boating above with the added problem of noise and disturbance. Noise from jet-skis and high powered boats can be intrusive for other coast users, this can be a problem at Middleton Beach, Albany and within the Albany harbour area. Jet-skiing is however not really popular in this area.

4.1.3 Surfing and sailboarding

4.1.3.1 Surfing

There are several sites along the south coast popular with surfers (Golden gates beach in West Cape Howe National Park, Mandalay Beach in Walpole-Nornalup National Park). Problems can occur where there is conflict between surfers and other beach users particularly where surfers camp on the beach or where car parking is limited. Erosion can also be caused by surfers accessing the beach over dunes by foot and by vehicle

4.1.3.2 Sailboarding

Sailboarding although not common on the south coast is growing in popularity particularly in some of the inlets (Walpole-Nornalup, Albany harbour and sound) which provide good conditions for sailing. Although not a problem at present increased numbers of sailboards could result in conflict with other beach users and access problems as discussed above.

4.1.4 Swimming/Diving

4.1.4.1 Swimming/Wading

Popular at many sites along the coast, no particular problems other than those associated with access and safety.

4.1.4.2 Snorkelling/Scuba Diving

There are several sites along the coast that are considered excellent for snorkelling and scuba diving (Shelley and Dusky beaches in West Cape Howe National Park and Shoal Cape area in Stokes National Park for example). As well as sites that can be accessed from the coast, divers use boats to reach more isolated areas. The South coast diving club is very active and has a considerable membership. There are also charter boat operators running diving trips from both Albany and Esperance. These operators take divers in addition to other tourists (whale watching, site seeing etc) as numbers of tourist divers visiting the area are not high enough to sustain a diving operation alone. The Esperance dive operator takes groups to a numbers of sites within the Recherche Archipelago and occasionally to the wreck of the Sanko Harvest. The most popular site for the Albany dive operators are the Cheynes III and the SS Cheynes whaling ships. Les Bail (Albany tour operator) is proposing to buoy local dive sites with fixed concrete moorings. A dive operator working out of Bremer Bay (Fishing boat harbour) is starting up this year (1997).

4.1.5 Wildlife Observation

4.1.5.1 Whale watching

Commercial whale watching started in Albany in 1989 and has been growing since. The industry is based around the migration of the Southern right whales which remain in south coast waters for several months over the winter. Humpback whales are also seen in the region during the winter period. Most tours are run from Albany, taking place inside the sheltered waters of King George Sound. As the number of boats operating whale watching tours has increased problems have occurred with several boats jostling for position around a single group of whales. There is now a code of practise in place to guide operators in conduct around the whales. Operators have tried whale watching trips in other areas, one boat worked out of Hopetoun last year (1996) but did not have great success. A license has been granted to an operator working out of Bremer Bay for the 1997 season. Whale watching from land based sites is very popular, Point Ann in the Fitzgerald River National Park being the major land based site in the region, the site is equipped with a small information centre and a whale watching platform.

All operators carrying out whale watching trips are required to have a license from CALM for whale interaction. As well as interaction licenses for whale watching tours, licenses for photographic study are regularly granted (3-4 each year).

4.1.5.2 Seal watching

Seal watching generally takes place as part of another activity rather than a trip on its own. Whale watching tours will also view seals. Mackenzie Marine carry out seal watching tours on route to Woody Island on regularly operating tourist trips. Until this year whale tour operators have not been required to carry a seal interaction license this is now a requirement and all operators have to apply for both whale and seal interaction licenses.

4.1.5.3 Seabird Watching

Bird watching is generally not an intrusive activity and causes few problems. Seabirds are promoted by several operators who conduct general charters particularly those who operate outside the whale watching season. There are a few problem areas where disturbance or potential disturbance to seabirds is being caused; the little tern colony at William Bay, the Pelicans on Green Island, the Little penguin colony on Mistaken Island and the hooded dotterel nesting on the sand bar at Bremer Bay beside a vehicle access route to the Doubtful Islands

4.2 LAND-BASED ACTIVITIES

The most popular land based activity along the south coast is probably site seeing particularly in West Cape Howe, Torndirrup, Waychinicup, Fitzgerald and William Bay National Parks, other activities are listed below.

4.2.1 Beach Activities

4.2.1.1 Beach driving 4WD

Several of the water-based activities discussed above require access to and along the beach by four wheel drive. There are two main issues associated with 4WD vehicles . The first is physical damage to the environment, damaging vegetation, causing erosion, disturbing wildlife and spreading disease. The second is conflict with other user groups

where peace and tranquillity is disturbed by vehicles, and visitor safety is put at risk. These issues are tackled in coastal parks by management of access, keeping tracks maintained, closing unsuitable areas to vehicles and providing information to vehicle owners. Outside National Parks beach driving and access to the coast can be a greater problem, as these areas are often not managed.

4.2.1.2 Boat launching

Discussed above under boating

4.2.1.3 Beach Camping

Beach camping is often associated with water-based recreation, surfing, fishing etc. and is carried out at a number of CALM sites. Problems include access (as discussed above), degradation of vegetation, erosion, lighting fires and leaving rubbish.

4.2.1.4 Squatters Camps

There are several areas along the coast with shacks and squatters camps. Some camps are legal, some have lease agreements and some are illegal. Within National Parks these camps are dealt with in the respective management plans. On vacant crown land there are many illegal camps.

4.2.2 Land-based sports

4.2.2.1 Hang gliding

One of the premier hang gliding sites in WA is located near Shelley Beach in West Cape Howe National Park, sites in Torndirrup National Park are also popular. Sporadic use is also made of other areas in the coastal region. Hang gliders camp at Shelley Beach in numbers as high as 40-50 in peak season. All glides are registered with the Hang gliding association of WA. The association has approval to use specific sites under agreed conditions and site use is then managed by the Hang Gliding association.

4.2.2.2 Rock Climbing

Major coastal rock climbing areas are located at West Cape Howe National Park where the climbing is renowned at a national level, height, aspect and quality of climb are all thought to be exceptional, other popular sites include Torndirrup and Waychinicup and some less frequently used sites along the Fitzgerald coastline. All climbers are asked to adhere to the Climbing Association of WA's 'Code of climbing ethics'.

4.2.2.3 Sand Boarding

Not thought to be a major problem, there are occasional reports of sand boarding at Two Peoples Bay Nature Reserve.

4.3 COMMERCIAL ACTIVITIES

4.3.1 Fishing

The Fisheries Department of WA annual report (Fisheries department WA. 1996) provides data on south coast fisheries, considering each species and fishing method separately. The fisheries that affect CALM's coastal reserves are those that require access through CALM managed land to reach sites on the coast and estuaries. The fishers involved include abalone divers, rock lobster fishermen, estuarine fishermen, and various inshore fishers in search of salmon, mulies, shark etc. These coastal and estuarine fisheries have been described and assessed in a recent WA. fishing industry report (Wright In press), which gives a very good description of coastal fisheries in the area. Permits are issued for access through and camping on CALM managed lands. Fishing camps can often be large and can cause conflict with other park users therefore special provisions restricting fishing activity have been made at some sites. The South coast regional management plan (CALM 1992) shows a table detailing the number of permits for each fishery issued in each of the CALM managed coastal reserves. Commercial fishing takes place at many sites along the coast. Further details of catch returns and numbers of fishers are available from the Fisheries Department of WA. annual data report.

Problems with commercial fishing include access, user conflict with recreational fishers and other park users, conflict with seals. Salmon beaches and estuaries are the main areas of conflict.

There is some concern about the state of south coast fisheries, the Mulie (pilchard) industry for example is each year going further from shore to catch the same quantity of fish, little is known about what effect removal of large quantities of small fish is having on seabirds and other animals further up the food chain.

3.3.1.1 Fisheries By-Catch

Cetaceans

Dolphins are caught in the purse seine fishery becoming trapped in nets. There is a reporting scheme requesting fishermen to report any dolphins pulled in as by-catch. There is partial compliance with the scheme, some fishermen reliably report dolphins caught where as others never report by-catch. The scheme has provided some useful information on species present.

Fleshy footed shearwaters

Shearwaters are taken illegally in the purse seine fishery they can get caught up in the nets or are taken by exasperated fishermen overwhelmed by their numbers.

3.3.1.2 Fisheries and Seals

Seals are reported as a problem is several fisheries, principally the gill net fishery in Albany harbours, also in the herring trap fishery and the salmon fishery. The gill net fishery used to complain about bull sealions being the major problem, now more reports of damage by furseals are received. CALM issues damage licenses to scare seals off, fishers in Albany harbour, Cheynes Bay, Doubtful Island Bay and Dillon Bay have licences. There is certainly a problem with seals being shot, and in some instances (eg. Bald Island) it is possible that this is preventing the re-establishment of a breeding colony.

4.3.2 Aquaculture

Aquaculture sites on the south coast are slowly increasing in number. Sites of all south coast aquaculture developments are being obtained from the Fisheries Department and the Department of Transport who declare mooring release areas around all marine aquaculture developments (still awaiting information from both Fisheries and DoT). The Albany Harbours draft planning stratergy (Albany harbours planning group 1997) considers areas suitable for further aquaculture developments within the Albany Harbour area. One major concern is the potential for whales to become entangled in aquaculture plots, this has already occurred on two occasions when degree of entanglement was not serious and the whales freed themselves.

4.3.3 Tourism

Tourism is a major industry in many areas on the south coast, with many coastal towns relying in part on visiting tourist trade. Tourist activities on CALM managed lands include coach tours, 4WD off road ‘safari’ types tours, and active adventure tours. With increasing facilities and activities for tourists more people are coming to the region. CALM keeps figures for numbers of vehicles entering parks in the south coast region (South Coast Region visitor figures 1993/94).

5. A REVIEW OF MANAGEMENT ISSUES

5.1 COASTAL REHABILITATION

Since the early 1980s, a major effort has taken place within coastal national parks and at Two peoples bay nature reserve to rehabilitate blowouts and other erosion caused by poor location of facilities and footpaths near the coast. Major projects have occurred at William Bay National Park, Torndirrup National Park (numerous sites), Two peoples bay nature reserve, Fitzgerald river National Park, Stokes National Park, Cape le Grand National Park (numerous sites) and Cape Arid National Park. Careful coastal, planning is necessary to prevent repeated erosion problems, access is again a major issue.

5.2 AERIAL DEPOSITION OF SOIL TO THE MARINE ENVIRONMENT

Large quantities of soil are deposited to the marine environment in many areas along the coast. Dan Carter (Min of Ag Albany) made estimated soil moving in two major wind erosion events as being in the order of millions of tonnes (Carter 1995). In the Gascoyne region seabed cores have been taken showing a considerable amount of terrestrial dust in marine deposits no similar work has been done on the south coast. The wind erosion problem is thought to be most severe east of Albany to Esperance with hot spots around the Bremer Bay area. Erosive winds causing most dust events are north westerlies, blowing dust straight out to the ocean.

5.3 ACCESS TO ESTUARINE/MARINE ENVIRONMENTS

Access is an issue associated with many recreational and commercial uses of coastal areas (as discussed above).
Access to the coast can be either by foot, 2WD, 4WD or by boat. Riverine, estuarine and coastal environments are fragile and susceptible to erosion particularly from the impacts of vehicles, and boats. Access to the coast has to be controlled to prevent creation of new tracks risking erosion and spread of disease which is a major issue. CALM aims to provide a range of access to the coast whilst ensuring that park and other users are not adversely affected. Access is probably the most difficult management issue that coastal parks face, it can at least be addressed in National Parks, greater problems occur on shire reserves or vacant crown land where access is uncontrolled.

5.4 VISITOR SAFETY

In addition to dangers inherent in any natural area, the southern coastline presents some particular potential safety problems for visitors. Potential hazards include; cliffs, 'king waves' and heavy swells in the ocean, driving on narrow 4WD tracks and fire danger. Arrangements for co-operation between CALM, the police and the State Emergency service in the Albany area are detailed in an inter-agency agreement which is revised annually. Rescue equipment is held by the state emergency service. CALM maintains some equipment at Torndirrup National Park which is the area with the highest level of accidents due to the rugged nature of the coastline and the high level of visitor use. The Occupier Liability Act requires a very high level of safety awareness on all CALM managed lands. Staff are regularly trained in safety management, regular safety audits are carried out and clear safety warnings are displayed at visitor sites.

Several 'high risk' recreational activities are carried out in the area, these include rock climbing, hang gliding, surfing and diving. Accidents associated with adventure activities are low in comparison to accidents among general visitors. This probably reflects the small numbers of people undertaking these activities and the degree of training and safety measures required by some skills.

5.5 COMMUNITY LIAISON AND EDUCATION

Most National Parks and several reserves of the South Coast region have a high public profile for both local residents and tourist visitors. There are excellent opportunities to promote an awareness of conservation, land management and natural systems and processes in both the local community and visitors. All CALM personnel in the region have some involvement with community education and interpretation work, through provision of information to visitors, informal contact with visitors and talks to community and school groups.

A network of interpretive trails has been established at key sites throughout the region, with a regional guide book to the heritage network (Sandiford 1988). A range of other publications on recreation facilities and activities and technical information is available from Departmental offices and ranger out stations throughout the region.

Community involvement - there is statutory provision for public participation in the preparation of management plans. In addition to this CALM aims to co-operate with local communities and establish projects of mutual interest.

Examples of community involvement in the south coast region include :

- Staff involvement on local tourist committees
- Advice about landscaping, tree planting and assistance to bodies such as "Greening Australia"
- Co-operation with schools, eg. on Arbor day and through provision of work experience
- Public workshops, seminars and talks to interested groups
- Involvement with various advisory committees, 'Friends of the park' and volunteer groups
- Involvement with land conservation district committees and catchment management advisory groups
- Liaison with bush fire brigades
- The Friends of West Cape Howe National Park
- Specific projects which have run in Fitzgerald River National Park included ;

The 'community-CALM link project' which involved Calm staff working with residents in the area around the national park. The Fitzgerald river national park association and CALM have jointly established a number of walks and produced associated interpretive publications. The association also runs the Twertup field centre which is an old house located in the north-western part of the park. The center is run on a volunteer basis and provides courses including; botany, geology, ornithology etc. It is used by Universities, schools, independent organisations and as a research centre.
The Fitzgerald biosphere project committee is interested in education and research in the broader context of the park and adjacent lands, promoting the biosphere concept to result in better land management practices particularly on agricultural land.

5.6 MARINE MAMMAL STRANDING PLANNING

A departmental plan dealing with strandings is being produced. At present strandings on the south coast are dealt with by the regional office on a case by case basis using a team of staff and experienced volunteers such as the West Whales group.

5.7 OILSPILL CONTINGENCY PLANNING

The state wide DoT contingency plan covers the south coast area, in addition to this each major harbour has its own contingency planning.

5.8 OCEAN DISCHARGES

The Department of Environmental Protection control the licensing of industrial discharges. Discharges into Albany harbour (Princess Royal Harbour), licensed by the DEP include, Albany spinning mills, Vital foods, Princess Royal Seafood's and CSBP who discharge via a drain. Every coastal town has waste water treatment. All towns have secondary treatment, some (Denmark at present and others to follow) have secondary treatment with nutrient removal and then soakage into the ground.

5.9 COASTAL RECREATIONAL FACILITIES

Many recreation sites used by day and over night visitors have been established on the coast. These are often at the end of old fishing tracks associated with scenic sites, beaches or headlands. Establishment of recreational and particularly camping sites on the coast has led to problems. Many sites are on fragile soils that erode easily such as consolidated sands. Camping often focuses on small stands of melaleucas which provide shade. Many of these stands have been stripped for fire wood or damaged by vehicles. Once vegetation is damaged, sandy soils are exposed and readily erode. Coastal sites therefore have to be managed according to their fragility, some are closed to vehicle access, some are for day access only etc.

A list of the major recreational sites with facilities is provided in Appendix I.

5.10 AGRICULTURE

In the south coast region agricultural development has replaced native vegetation with shallow rooted annual crops and pasture. Crop production requires extensive cultivation, fertilisation and chemical spraying for disease, pest and weed control. River catchments in areas cleared for broadscale agriculture usually show signs of stress with increased nutrients, increased siltation and increases in salinity, this is in turn effecting the health of south coast estuaries.

5.0 REFERENCES

Abbott I. (1981). Seabird Island No. 106 - Mondrain island, Archipelago of the Recherche, WA. Corella 5(3):60-61.

Abbott I. (1981). Seabird Islands No. 108 - Bald Island, Western Australia. Corella 5 (3) : 64-65.
Description, location, ornithological history, breeding seabird status all briefly described.

Albany harbours planning group (1997). Albany harbours planning stratergy - draft. BSD consultants.

Australian Bureau of Statistics (1987). Recreational fishing in WA. Australian bureau of statistics catalogue No. 7602.5.

Bindon P. (1996). Report on a visit to Middle Island Recherche Archipelago, February 1996. Anthropology Department WA Museum. Community report No. 1996/1.

CALM (1991). Fitzgerald river national park management plan 1991-2001. Department of CALM, management plan No.15.

CALM (1992). South Coast regional management plan 1992-2002. Department of CALM, management plan No.24.

Carter D. (1995). Storm - Wind erosion on the south coast. Journal of Agriculture, Vol 36 No.3.

Fisheries Department of WA. (1996). State of fisheries (1994-1995).

Gales J.N (1990). Abundance of Australian Sealions *Neophoca cinerea* along the southern Australian coast, and related research. Report to CALM, the South Australian National Parks and Wildlife service and the South Australian wildlife conservation fund.

Hodgkin E.P., and Clark R. (1987). Estuaries and coastal lagoons of south western Australia - Wellstead estuary. Estuarine study series, No.1. EPA, Perth, WA.

Hodgkin E.P., and Clark R. (1990). Estuaries and coastal lagoons of south western Australia - Estuaries of the shire of Ravensthorpe and the Fitzgerald River National Park. Estuarine study series No.7. EPA, Perth, WA.

Lane S.G. (1982). Remark Island, Archipelago of the Recherche, WA. Corella 6 (3) :65-66.

Madden S. (1995). Recreational usage of water bodies in Busselton and Walpole. Waterways Commission.

McIlroy J. (1987). Nineteenth century bay whaling stations in Western Australia. National trust for WA.

Pearson M. (1988). The archipelago of the Recherche - Historical ans archaeological reconnaissance. Heritage Commission.

Recreational advisory committee of WA. (1990). The future for recreational fishing - summary of issues for community discussion.

Sandiford L. (1988). Rugged mountains, jewelled sea. Explore the living history of the south coast from Eucla to Albany. Department of CALM.

Scott N. (1988). Eclipse Island Lighthouse. Albany Residency Museum.

Shaughnessy (1990). Distribution and abundance of New Zealand furseals in WA. Report to CALM.

South coast region visitor figures CALM (1993/94).

Storr G.M. (1959). Notes on Bald Island and the Adjacent Mainland. Zoology Department, University of Western Australia.

Tingray A. and Tingray S.R. (1982). Sandy Hook Island, Archipelago of the Recherche, WA. Corella 6 (3) :63-64.

Tingray A. and Tingray S.R. (1982). Hood Island, Archipelago of the Recherche, WA. Corella 6 (3) :59-60.

Watson J.R. (1982). Water-based recreation in national parks on the south coast of western Australia. Recreation Australia 2,24-29.

Wolfe A. (1994). The Breaksea Island Lighthouse - Site particulars and history. Wolfe and associates heritage consultants.

Wolfe A. (1994a). The Albany maritime heritage survey (1627-1994). Wolfe and associates heritage consultants, for the heritage council of WA.

Wright G. (In press). Fishing for a living. The estuarine and beach fisheries of the WA. south coast. WA Fishing industry council.

APPENDIX I

Major recreational sites in the south coast region from west to east.

Boat Harbour West - recreational site west of William Bay
William Bay - Swimming and recreation site with boat launching facilities
Denmark (Wilson Inlet) - Boat launching and recreational facilities
Ocean Beach - Boat launching and recreational facilities
Rudyard Beach (Wilson Inlet) - Caravan park, chalets, recreational facilities
West Cape Howe - National Park facilities
Torbay (Cosy Corner) - Commercial fishing camp, recreational site, camping, boat launching, moorings
Mutton Bird Island - Fishing, swimming, boat launching
Frenchman's Bay - Boat launching and beach facilities
Albany - Town, accommodation, tourist attractions and numerous facilities
Two Peoples Bay - Recreational facilities within the Nature Reserve
Waychinicup - Camping, fishing swimming, day use, marroning in the river
Cheynes Beach - Township with caravan park, fishing, boat launching
Cape Rich - Boat launching, camping
Reef Beach - South Coast Recreational Fishermen's Associations shack
Fisheries Beach (Bremer Bay) - New development fishing boat harbour, recreational facilities
Point Ann - Day use whale watching platform and recreational facilities
St. Mary's - Campsite for Point Ann
Point Charles - Campsite
Two mile beach - Campsite
Hopetoun - Jetty, shops, caravan park etc
Esperance - Town, tourist attractions and numerous facilities
Cape Le Grand - Beach, day use National Park site
Lucky Bay - Campsite in the National Park
Duke of Orleans Bay - Holiday camp, boat launching

APPENDIX II

Fitzgerald Biosphere Reserve Zone of Cooperation
Development of an Integrated Vegetation Management Plan

FITZGERALD BIOSPHERE RESERVE ZONE OF COOPERATION
DEVELOPMENT OF AN INTEGRATED VEGETATION MANAGEMENT PLAN

THE PROJECT:

Unesco's Man and the Biosphere program designated the Fitzgerald River National Park and immediate buffer envelope as one of 12 Australian Biosphere Reserves in 1978. Biosphere reserves typically are areas of terrestrial or coastal ecosystems which have a core area of land large enough (and protected) to ensure that they are sustainable and in balance with the human land uses in the modified landscape of the surrounding buffer. Biosphere reserves should combine functions of conservation (of landscapes, ecosystems and genetic diversity) and development which is ecologically and culturally sustainable and receive logistic support in research and education. The "zone of cooperation" within the Fitzgerald Biosphere Reserve is that area of land (including remnants of natural vegetation) surrounding the national park where human activity (namely farming) takes place in a manner which should be compatible with long term protection of the core. This zone stretches from Bremer Bay, north to Jerramungup, east to Ravensthorpe and Hopetoun and encompasses the catchments of all the rivers that flow through or around the FRNP.

This project aims to develop a plan to manage the remnant vegetation within the zone of cooperation to the mutual benefit of both the ecosystems of the national park and the ongoing activities of the farming community. This will be achieved through the development of strategies to identify and protect remnants of the greatest conservation significance and which will contribute most to landcare goals by preventing or delaying the increase of salinity and erosion by wind or water.

Revegetation to prevent soil erosion and salinity and the protection and establishment of vegetated corridors linking larger areas of habitat will be a priority.

THE PROCESS:
PHASE I
(SEPTEMBER 1996 - MARCH 1997)

The CSIRO Leeuwin Centre in consultation with the Project Officer (providing ground truthing) is preparing maps (from Landsat Images) of remnant vegetation in the biosphere reserve showing clearing history and change of condition resultant from lack of protection (fencing). These images will be vital in demonstrating the changes that have occurred in the zone of cooperation and the need for protection of the remaining remnants.

The CSIRO will also prepare a salinity map showing those areas which are most likely to become saline (as a result of clearing) which will indicate those remnants which will be of low priority for protection due to processes already underway.

Using recent work of Angas Hopkins (CALM Wildlife Research Centre) which identified those vegetation types that are poorly conserved, and the vegetation maps of Beard and Newby, remnants in the biosphere will be identified and privatised and verified by ground truthing. A remnant vegetation map already digitised with land tenures will be overlain with the current biosphere boundary, and catchment boundaries.

Using a text node facility on the GIS a data base can be established for each remnant to record vegetation type, condition, fencing etc, some of this data is already available from survey work carried out by various groups and through several different fencing schemes. Access and collation of existing data will greatly help future planning. Data from Angela Sanders' fauna habitat surveys (funded by ANCA) will be used in assessing remnants, providing information for location of revegetation and determining value of corridor links.

Special attention will be focused on publicising the relevance/benefits of conserving remnant vegetation and establishing revegetation to the long term survival of the farming community - much has been done to show how the maintenance of deep rooted native vegetation will prevent or help to control the spread of erosion and salinity but the message must still be kept to the fore, especially in the biosphere reserve zone of cooperation where activity in the upper catchments may have impact 50km or more away in coastal estuaries within the national park.

Phase II will see the appointment of an Ecologist to ensure that the priorities and ecological principles for native vegetation management identified in Phase I (above) are incorporated into farm and catchment management.

FUNDING: ENVIRONMENT AUSTRALIA

Project Officer: Chris Robinson (Consultant Botanist) CALM Albany, tel: (098) 424 500; fax: 417 105
email: chrisr@calm.wa.gov.au

APPENDIX III

Review of Estuaries and Catchments

South coast terrestrial and marine reserve integration study

A review of estuaries and their catchments between Broke Inlet and Israelite Bay

DRAFT

K.P. Bancroft, D.M. Deeley and E.1. Paling

Report to the
Marine Conservation Branch,
Nature Conservation Division,
Department of Conservation and Land Management

Marine and Freshwater
Research Laboratory

Marine and Freshwater Reseach Association,
Murdoch University

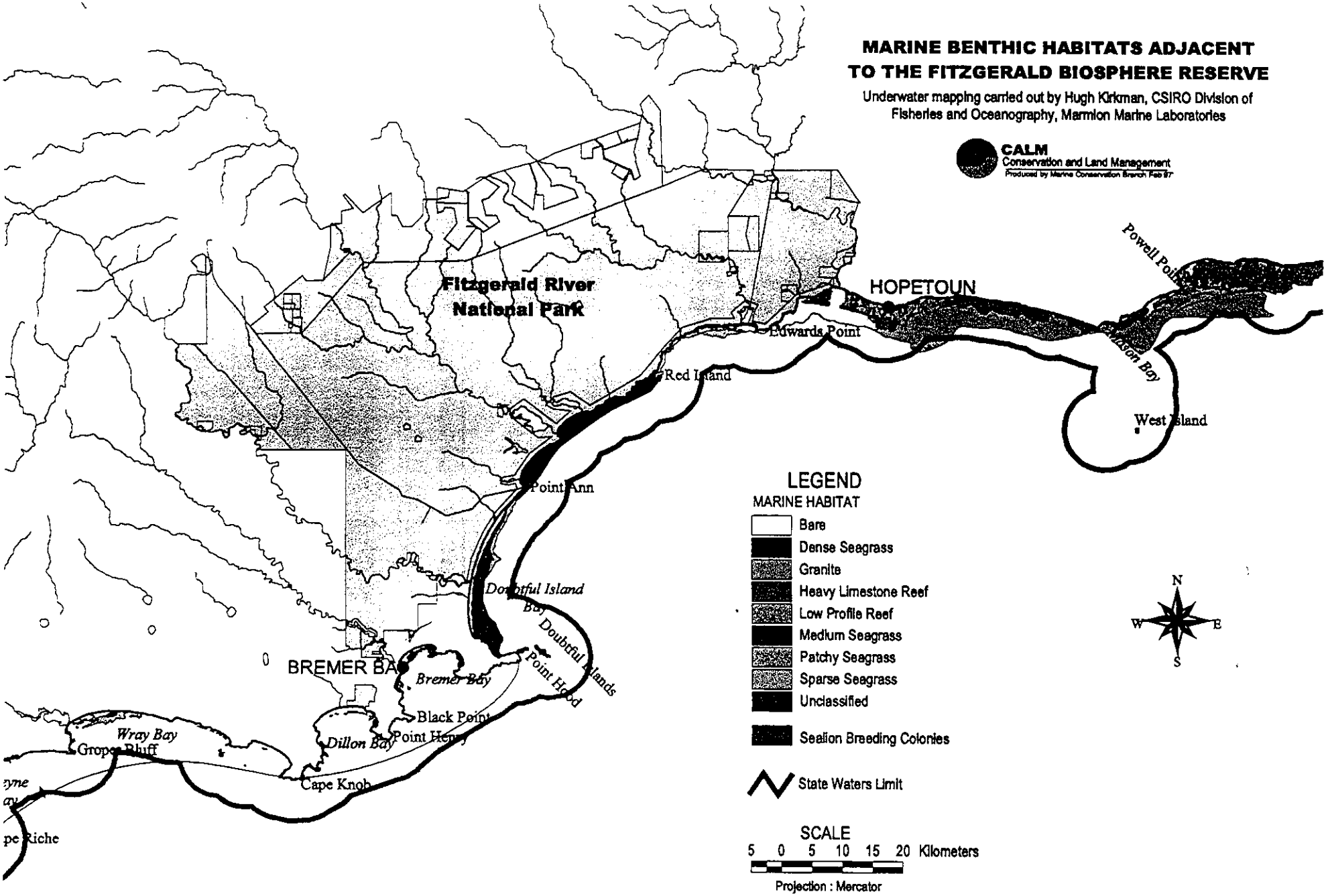
Report No MAFRA 97/xx

March 1997

Table of Contents

APPENDIX IV

Marine Benthic Habitats adjacent to the Fitzgerald Biosphere Reserve


MARINE BENTHIC HABITATS ADJACENT
TO THE FITZGERALD BIOSPHERE RESERVE
Underwater mapping carried out by Hugh Kirkman, CSIRO Division of
Fisheries and Oceanography, Marmion Marine Laboratories
CALM
Conservation and Land Management
Produced by Marine Conservation Branch Feb 97
Fitzgerald River
National Park
HOPETOUN
Powell Point
Edwards Point
Red Island
Point Ann
West Island
Doubtful Island
Bay
Doubtful Islands
Point Hood
BREMER BAY
Bremer Bay
Black Point
Point Henry
Dillon Bay
Wray Bay
Cape Knob
LEGEND
MARINE HABITAT
Bare
Dense Seagrass
Granite
Heavy Limestone Reef
Low Profile Reef
Medium Seagrass
Patchy Seagrass
Sparse Seagrass
Unclassified
Sealion Breeding Colonies
State Waters Limit
N
W
E
S
SCALE
5 0 5 10 15 20 Kilometers
Projection : Mercator

APPENDIX V

Fitzgerald Field Survey - Sampling Sites

Site No.	Site Name	Date	Latitude	Longitude	Habitat Description	Quantitative Sampling
F1	Hopetoun	7/3/97	33°57.372 S	120°06.608 E	limestone reef	Y
F2	Seal Island	7/3/97	33°57.599 S	120°07.600 E	limestone reef	Y
F3	Red Island	8/3/97	34°02.200 S	119°46.858 E	granite reef	Y
F4	Red Island	8/3/97	34°02.200 S	119°46.858 E	granite reef	Y
F5	Doubtful Is. West	8/3/97	34°22.539 S	119°34.217 E	seagrass meadow	Y
F6	Doubtful Is. Beach South	9/3/97	34°22.955 S	119°32.454 E	seagrass meadow	Y
F7	Doubtful Is. Beach Middle	9/3/97	34°22.610 S	119°32.219 E	seagrass meadow	Y
F8	Peppermint Beach North	10/3/97	34°22.680 S	119°28.400 E	granite reef	Y
F9	Peppermint Beach North	10/3/97	34°22.807 S	119°28.729 E	seagrass meadow & limestone reef	Y
F10	Peppermint Beach South	10/3/97	34°24.028 S	119°28.704 E	granite reef	Y
F11	Peppermint Beach South	10/3/97	34°23.985 S	119°29.040 E	seagrass meadow	Y
F12	Glasse Is.	11/3/97	34°25.375 S	119°24.641 E	granite reef	Y
F13	Bremer Bay West	11/3/97	34°25.336 S	119°23.524 E	seagrass meadow	Y
F14	Black Point East	11/3/97	34°27.389 S	119°24.663 E	granite reef	Y
F15	Black Point West	11/3/97	34°27.296 S	119°24.184 E	granite reef	Y
F16	Little Boat Harbour	12/3/97	34°28.170 S	119°21.628 E	granite reef	Y
F17	Little Boat Harbour	12/3/97	34°28.125 S	119°21.640 E	seagrass meadow	Y
F18	Little Boat Harbour	12/3/97	34°28.014 S	119°21.741 E	seagrass meadow	Y
F19	Stream Beach	13/3/97	34°29.695 S	119°17.008 E	granite reef	Y
F20	Stream Beach	13/3/97	34°29.580 S	119°16.908 E	seagrass meadow	Y
F21	Doubtful Is. Middle	14/3/97	34°22.483 S	119°36.466 E	granite reef	Y
F22	Investigator Is.	15/3/97	34°04.578 S	120°52.064 E	granite reef	Y
F23	Red Island Point	16/3/97	34°01.617 S	119°46.889 E	granite reef	Y
F24	Point Ann	17/3/97	34°10.284 S	119°35.242 E	granite reef	Y
F25	Point Charles Bay	17/3/97	34°09.616 S	119°34.889 E	granite reef	Y
F26	Doubtful Is. Middle	17/3/97	34°22.335 S	119°36.241 E	granite reef	Y
F27	House Beach	17/3/97	34°21.581 S	119°31.164 E	seagrass meadow	Y
F28	Whalebone Point	18/3/97	34°21.891 S	119°31.597 E	granite reef	Y
F29	Tooregullup Beach	18/3/97	34°21.174 S	119°30.460 E	seagrass meadow	Y
F30	Point Hood Reef	18/3/97	33°57.078 S	119°34.635 E	granite reef	N
F31	Bremer Bay Point	18/3/97	34°23.799 S	119°24.391 E	granite reef	Y
F32	James Cove	18/3/97	34°22.394 S	119°26.835 E	limestone reef	Y
F33	Glasse Is.	19/3/97	34°25.375 S	119°24.641 E	granite reef	N
F34	Gordon Point	19/3/97	34°27.715 S	119°24.514 E	granite reef	Y
F35	Waterfall Cove	19/3/97	34°28.367 S	119°16.371 E	granite reef	Y
F36	Waterfall Cove	19/3/97	34°28.516 S	119°16.466 E	seagrass meadow	Y
F37	Horatio Is.	20/3/97	34°30.365 S	119°17.283 E	granite reef	N
F38	Port Jackson Cove	20/3/97	34°31.064 S	119°15.911 E	granite reef	Y
F39	Cape Knob	20/3/97	34°31.921 S	119°15.178 E	granite reef	Y
F40	Groper Bluff	21/3/97	34°30.017 S	118°54.504 E	seagrass meadow	Y
F41	Wray Bay West	21/3/97	34°30.017 S	118°54.504 E	granite reef	Y
F42	Wray Bay East	21/3/97	34°27.852 S	118°57.421 E	granite reef	Y

APPENDIX VI

Project Scope Items and Payment/Reporting Schedule

NATIONAL RESERVE SYSTEM PROGRAM

PROJECT TITLE: South Coast Terrestrial and Marine Reserve Integration Study

PROJECT NUMBER: N713

ORGANISATION: Department of Conservation and Land Management

SCOPE:

1. Provide an overview of the nature conservation, recreation, aesthetic and economic values of potential marine reserves and associated terrestrial reserves along the south coast of Western Australia between Denmark and Israelite Bay.
2. On the basis of 1 above, select areas for more detailed study of the range of issues facing the integration of terrestrial and marine reserves in the region.
3. Liaise with other relevant management organisations and the local community on the aims of the project and its methodology.
4. Compile all existing data on the natural values of the study areas.
5. Map, classify and ground truth major benthic habitats in the study areas.
6. Prepare listings of the flora and fauna of the marine and terrestrial components of the study areas.
7. Classify seaward-draining catchments associated with each study area on the basis of land-use and degree of alteration to the naturalness of surface and groundwater systems which enter the marine environment.
8. Identify interactions and impacts between the marine and terrestrial components of the study areas for each catchment (including physical and biological processes and land-use aspects).
9. Compare the results obtained in 8 above for the different catchment types identified in 7 above associated with each study area.
10. Use the results of 1 to 9 above to refine existing recommendations for potential marine reserves in the region, and to identify key management issues.
11. Prepare reports on the above scope items in accordance with the reporting schedule.

PAYMENT AND REPORTING SCHEDULE:

Total amount for this contract: $63,000

Date Due	*Report/Payment type*	*Amount*
15 March 1996	Work Schedule/Initial	$43,000.00
15 December 1996	Progress	$5,000.00
31 March 1997	Progress	$5,000.00
30 August 1997	Draft Final/Nil	$0.00
30 September 1997	Final	$10,000.00

Director
AUSTRALIAN NATIONAL PARKS AND WILDLIFE SERVICE

DIRECTOR OF NATIONAL PARKS AND WILDLIFE
30286
Official

....
Signature

Barton Coyne
....
Full Name

Executive Director (or delegate)
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Chris Simpson
....
Signature

Chris Simpson
....
Full name