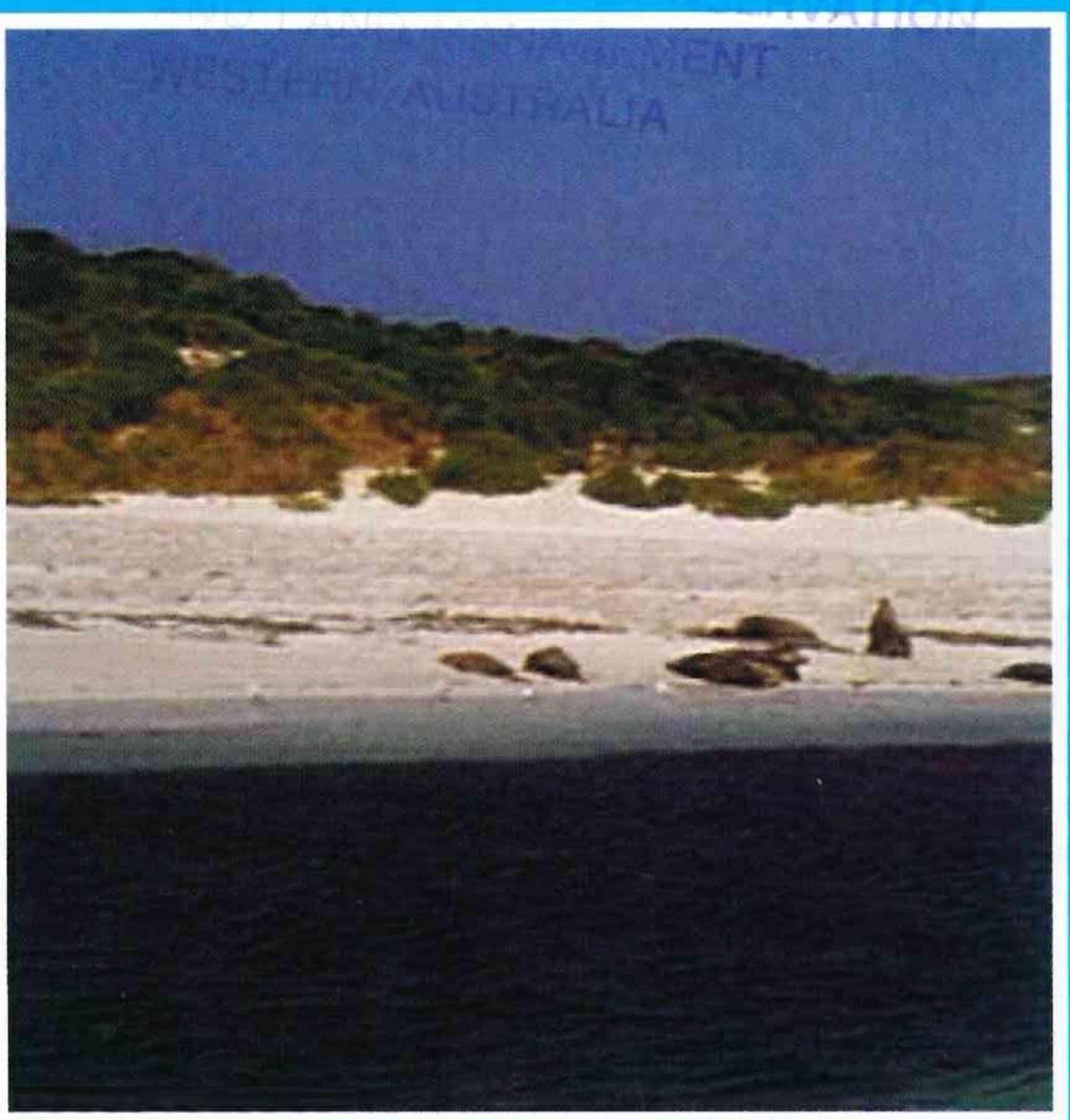
Carnac Island Nature Reserve

Draft Management Plan

2001



Conservation Commission
WESTERN AUSTRALIA

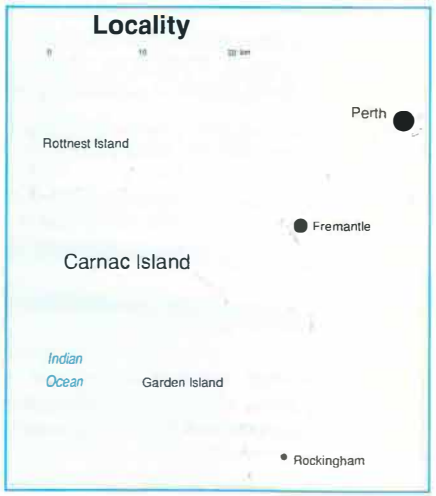
DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

INTRODUCTION

PLANNING AREA

Carnac Island is an "A Class" Nature Reserve encompassing approximately 19 ha. It is located 10 km south-west of Fremantle, WA (see Fig 1). The Nature Reserve extends to the low water mark and includes the main island as well as Shag, Flat and South West Rocks (See Fig 2). The waters beyond low water mark are not part of the Nature Reserve. However the Marine Parks and Reserves Selection Working Group (Department of Conservation and Land Management 1994) proposed that the Shoalwater Islands Marine Park be extended northward to include the waters around Carnac Island.

Figure 1



MANAGEMENT DIRECTIONS AND PURPOSE

CORPORATE MISSION AND VISIONS

The Department of Conservation and Land Management (the Department) manages nature reserves according to the legislative specifications of the *Conservation and Land Management Act 1984* (Conservation and Land Management Act), the *Wildlife Conservation Act 1950* (Wildlife Conservation Act), the *Fish Resources Management Act 1994* (FRM Act), and the policies of the Department of Conservation and Land Management and the Conservation Commission of Western Australia. The Department's decision making and subsequent management is further guided by the principles included in its Corporate Plan (2000-2005), in which the following mission statement is found:

"In partnership with the community, to conserve Western Australia's biodiversity, and manage the lands and waters entrusted to us, for the appreciation and benefit of present and future generations."

The Department's primary objective in the management of nature reserves, as defined in s56 of the Conservation and Land Management Act is to:

"Maintain and restore the natural environment and to protect, care for, and promote the study of indigenous flora and fauna, and to preserve any feature of archaeological, historic or scientific interest".

The vision for Carnac Island Nature Reserve (CINR) is:

"In the year 2011, the flora and fauna, habitats and refuge value of the CINR will be in the same or better condition than in the year 2001. The local community will consider the island an important natural asset".

LEGISLATIVE FRAMEWORK

Legislation

Nature reserves are declared under the Conservation and Land Management Act, vested in the Conservation Commission and managed by the Department of Conservation and Land Management in accordance with the Act. The Wildlife Conservation Act provides legislative protection for flora and fauna across the State's lands and waters.

Existing Tenure

Carnac Island has had "A Class" reserve status since 1963 when Cockburn Sound Location 692 was reserved for the purpose of recreation and conservation of fauna. The Reserve was gazetted as "Carnac Island Wildlife Sanctuary" in 1972 (A Class Reserve No 26646), and later, in 1979, was made a Nature Reserve and renamed "Carnac Island Nature Reserve". The purpose of the Reserve has, however, remained as recreation and conservation of fauna.

MANAGEMENT PLANNING PROCESS

Under s33 (3)(b) of the Conservation and Land Management Act certain operations, called 'necessary operations', and can be carried out when there is no management plan. For nature reserves, these necessary operations are defined as those required to protect or preserve persons, property, conservation values, or for the preparation of a management plan. Interim Management Guidelines for CINR have been approved as a necessary operation required to protect its conservation values. The Interim Management Guidelines provide provisional management direction until public consultation has been undertaken and a management plan is approved. This Draft Management Plan for CINR ('the Plan') identifies the reserve's key values and outlines strategies to protect those values. Once public comments have been received on the Plan it will be revised and submitted to the Minister for the Environment for approval.

MEASURING PERFORMANCE

The Department's Corporate Plan 2000-2005 reflects its responsibilities and details strategies for fulfilling these responsibilities. The success of this management plan will be determined by measuring progress against relevant aspects of the following strategies included in the Corporate Plan:

- Recover threatened flora, fauna and ecological communities.
- Protect biodiversity from threatening processes, agents and activities, including feral animals, weeds, dieback and other exotic diseases, salinity and inappropriate fire regimes.
- Plan, develop and manage all parks, recreation areas, facilities and services so as to maintain in perpetuity the values of natural areas managed by the Department.
- Provide and sustain a range of safe nature-based recreation opportunities, facilities and visitor services that are compatible with conservation and recreation requirements.
- Improve community knowledge of biodiversity conservation issues and awareness, understanding and support for the Department's activities, services and policies.

In assessing the success of the Plan, Key Performance Indicators (KPIs) will be used to gauge the extent to which the Plan has contributed to fulfilling the Department's responsibilities, and, at a lower level, the extent to which specific objectives of the Plan have been achieved. Measuring success in this way enables managers to assess and modify their management approach if/as necessary.

MANAGING THE NATURAL ENVIRONMENT

GEOLOGY AND GEOMORPHOLOGY

Carnac Island is thought to have formed as a result of the large fluctuations in sea level that occurred with successive periods of glaciation and deglaciation. The associated exposure of broad areas of continental shelf to wind erosion is thought to have created extensive parallel dune systems which subsequently hardened to form limestone, part of which now makes up Carnac Island. The various limestone features that have gradually formed over years of exposure to weathering processes are fragile. Collapses of these limestone structures may be exacerbated or caused by human activities and can be a safety hazard. Management strategies to prevent such occurrences are incorporated into this Plan.

NATIVE PLANTS AND PLANT COMMUNITIES

The vegetation of Carnac Island is typically low and dominated by salt tolerant species. A recent study investigating long-term change in the flora of Carnac Island revealed changes in the floristic composition of the Island over time (Abbott *et al* 2000). The flora of Carnac Island has been documented relatively regularly since 1951 allowing changes to be assessed. The most dramatic changes occurred between 1975/6 - 1995/6 when there was a 37% reduction in the number of species. Since 1951, the proportion of exotic species on Carnac Island has increased from 34% in 1951 to 63% currently. The study also revealed that a reduction in native species such as Summer-scented Wattle (*Acacia rostellifera*) and Coastal Daisy Bush (*Olearia axillaris*) had coincided with an increasing proliferation of weed species such as Ice Plant (*Mesembryanthemum crystallinum*) and Marshmallow (*Malva parviflora*). This has had the effect of causing an overall reduction in height of the Island's vegetation. Abbott *et al.* (2000) postulate several factors that may have contributed to the changes described above. The factors identified are: "nesting seabird populations, eradication of the rabbit in 1969, drought, increased salt-load from occasional cyclones in summer or autumn, and competition from increasing dominance of several weed species".

NATIVE ANIMALS AND HABITATS

The most conspicuous fauna of Carnac Island are the seabirds, Australian Sea-lions (*Neophoca cinerea*), Tiger Snakes (*Notechis scutatus*) and King Skinks (*Egernia kingii*). Bottle-nosed Dolphins (*Tursiops truncatus*) are also commonly seen in the waters surrounding the Island.

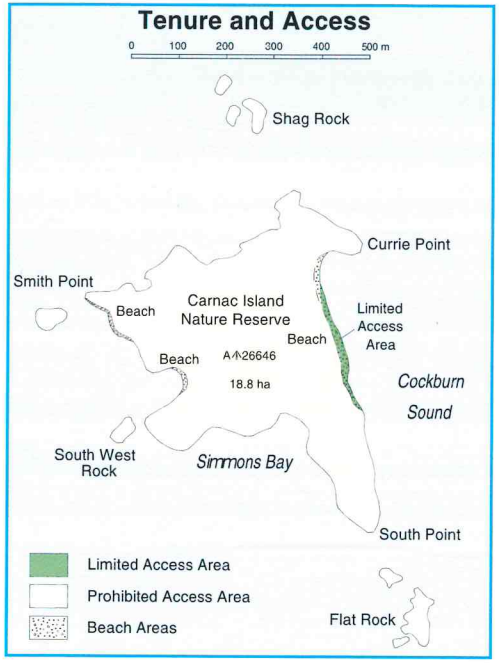
Sea-lions

Carnac Island is an important habitat for the Australian Sea-lion, a species endemic to Australia and among the rarest of the world's seal species. It is thought the Island may have once been used as a breeding site by sea-lions (Abbott *et al* 2000), but it is now used only as a haul out site for males. Another seal species, the New Zealand Fur Seal (*Arctocephalus forsteri*), is also an occasional visitor to the Island. This species, which was once close to extinction, is now becoming increasingly visible in the metropolitan area, as its population continues to recover along the south coast. In contrast, populations of the Australian Sea-lion remain low, the species having declined significantly since European settlement, primarily as a result of hunting. The Australian Sea-lion remains gazetted as 'a species in need of special protection' under the Wildlife Conservation Act.

The males of the west coast population of Australian Sea-lions occupy several islands off the Perth metropolitan area during the non-breeding season; Carnac Island is one of these. Of the five islands used in the metropolitan area, Carnac Island is one of the most important as it, along with Seal Island further to the south, is used by the greatest number of sea-lions (Gales *et al.* 1992). Sea-lion numbers on the Island show regular synchronous fluctuations. Approximately 6 months out of every 18, the males migrate north to islands off the central-west coast to breed with resident females. After this, they return to the islands off the metropolitan coast for approximately 12 months. It is thought that this spatial separation of the population, at least in part, occurs to relieve pressures on the limited food resources for females and pups (Gales *et al.* 1992). The retention of the metropolitan haul out sites is therefore important to the survival of the entire west coast population.

The north-eastern beach area of Carnac Island is of particular significance to the sea-lions. Most sea-lions haul out on the eastern beach and many of these seek the shelter offered by the embayment at its northern end (see Figure 2). The only other suitable haul out site on the island is the small and seasonal beach on the western side.

Figure 2



Human interactions with sea-lions is managed under the *Wildlife Conservation (Close Season for Marine Mammals) Notice 1998.* Although attacks on non-breeding islands are rare, a small but nonetheless potential risk to visitor safety exists and needs to be considered in the Island's management. To reduce the likelihood of attack by sea-lions and to ensure that resting sea-lions are not disturbed by human activity, it is recommended that the actions described under *Land Classification* be implemented. The education of visitors regarding controls under the *Wildlife Conservation (Close Season for Marine Mammals) Notice 1998* will also greatly assist visitor safety.

Sea-birds

Carnac Island is an important seabird-breeding island. It is used for this purpose by the Little Penguin (*Eudyptula minor*), Wedge-tailed Shearwater (*Puffinus pacificus*), Pied Cormorant (*Phalacrocorax varius*), Pied Oystercatcher (*Haematopus longirostris*), Fairy Tern (*Sterna nereis),* Caspian Tern (*Hyroprogne caspia*), Bridled Tern (*Sterna anaethetus*), Crested Tern (*Sterna bergii*) and the Silver Gull (*Larus novae-hollandiae*) (Dunlop & Storr 1981).

An increase in the number of Pied Cormorants breeding on CINR has raised some concerns regarding the potential impacts this may have on other nesting seabirds. According to Rippey *et al* (in press), increases in the numbers of Pied Cormorants is associated with marked changes in vegetation. Such changes can threaten the habitat of other seabirds using the Island for breeding and increase the rate of erosion. Monitoring of the Pied Cormorant colony will therefore be important.

The Island is noteworthy as being the only area of overlap between the breeding ranges of the Little Penguin (northern limit) and the Wedge-tailed Shearwater (southern limit) (Department of Conservation and the Environment 1983). These species are not normally found in the same range, however, at CINR both species can co-exist due to the occurrence of both tropical and temperate currents, which bring appropriate food sources into the foraging range of both species (N.Dunlop, pers.comm.).

Visitors to Carnac Island can have both direct and indirect impacts on breeding seabirds. People trampling seabird nests and burrows can increase chick mortality. In addition, humans may introduce predators, such as domestic dogs and cats, which would be devastating to a breeding colony. Weed introduction as a result of human activity can change an island's vegetation structure and in this way particular niche habitats used for nesting can be lost. The extent to which human disturbance will affect nesting seabirds varies from species to species. A discussion of these differences is included in a paper prepared by Rippey & Dunlop (unpubl.). They consider that seabirds that have a tendency to use the same nesting site for subsequent seasons are less likely to abandon breeding attempts due to intermittent disturbance by humans in the colony area. The Wedge-tailed Shearwaters are an example and have developed methods of reducing the risks associated with strong site attachment. Strategies include concealing the nest, rearing offspring in a burrow and arriving at and departing from the colony at night. These adaptations mean that human visitors present at colonies during the day rarely disrupt colony formation.

Seabirds exhibiting low nest site fidelity (such as Fairy, Caspian and Crested Terns) are likely to abandon the nesting site if disturbed during the colony formation stage. Disturbance to nesting birds is of concern as shifts in colony distribution to sub-optimal breeding habitats and delayed breeding leads to lower breeding success.

Confining human use of Carnac Island (as indicated in *Land Classification*) will avoid most of the problems associated with seabird disturbance as most breeding activity occurs in areas that will not be accessed by visitors. However, Fairy Terns and Pied Oystercatchers intermittently utilise beach areas for nesting, and since they will not sit on the nest whilst people are nearby, it is important that visitors do not approach or remain in the vicinity of the nests. The education of visitors about appropriate approach distances will be an important aspect of management of seabirds with a tendency to readily abandon nesting sites.

Additional ways to avoid disturbance to nesting seabirds also need to be communicated to visitors, and consideration should be given to the development of guidelines for visiting seabird-nesting islands. Such guidelines should include information on the prohibition of access that applies between sunset and sunrise (see *Land Classification*), and of the importance of minimising noise (eg. not operating horns, radios, or loud speakers within the vicinity of nesting seabirds).

Reptiles

Reptiles inhabiting Carnac Island include Tiger Snakes, (one of the world's deadliest snakes), and the King Skink.

Carnac Island is noted for having the most concentrated Tiger Snake population in Western Australia. As a small isolated population, the Tiger Snakes and King Skinks of Carnac Island are valuable for research into reptilian ecology and adaptation. The Island's Tiger Snakes have also been used as an important source of snake venom for scientific research. The snakes are known to feed on the common House Mouse (*Mus musculus*) and the young of nesting seabirds. Both Silver Gull and Tern chicks have been recovered from the stomachs of Tiger Snakes (Department of Conservation and Land Management file).

King Skinks on Carnac Island are an important predator of Silver Gull eggs. Injury markings on Tiger Snakes indicate that there is regular confrontation between King Skinks and Tiger Snakes.

Marine Fauna

Since CINR extends to the low water mark it also incorporates the marine fauna that inhabits the rocky shores, tidal pools and beaches of the intertidal zone. There has been little recent study of the marine fauna living on the intertidal reef platforms around the Island, however insights into these systems have been gained by studies of these environments in similar areas.

The taking of fish is permitted under the FRM Act in intertidal areas. The majority of the shoreline, however, is abutted by fragile limestone cliffs and caves which are prone to regular collapse and as access to these areas is prohibited (see *Land Classification*) people will not be able to fish from the rocky outcrops around the island. The intertidal areas are, however, likely to be used for snorkeling or fishing from a boat. Any further restrictions on fishing activities around the island will be considered at the time of the extension to the Shoalwater Islands Marine Park being implemented, or when this management plan is next reviewed.

ENVIRONMENTAL WEEDS

Unwanted plant species growing in natural ecosystems can displace indigenous plants, and this is particularly the case on disturbed sites where they compete with them for light, nutrients and water. Weeds can also have a significant adverse impact on other conservation values by altering animal habitats, harbouring pests and diseases, and creating a potential fire hazard.

One particular weed species on the Island, Boxthorn (*Lycium ferocissimum*) is an aggressive coloniser of islands and is removed by Departmental officers during their regular patrols throughout the year. It is thought that if its removal from Carnac Island is discontinued, Boxthorn would eventually dominate the vegetation, as Silver Gulls disperse its fruits (Abbott *et al.* 2000). Another species, Arum Lily (*Zantedeschia aethiopica*) may also become more common, just as it is on nearby Garden Island. Both weed species should be eradicated from the Island.

An integrated approach to environmental weed management was developed in the *Environmental Weed Strategy for Western Australia* (Department of Conservation and Land Management 1999). Since the inter-relationship between soil disturbance, weed invasion and native plants is complex, weed control should be undertaken in a strategic and integrated manner with guidance from the Environmental Weed Strategy. Rehabilitation of areas from which extensive patches of weeds have been removed is important.

PROBLEM ANIMALS AND DOMESTIC SPECIES

Rabbits inhabited the Island in abundance between 1827 and 1897, but were eradicated in 1969. Eradication of the rabbit is considered to have made a significant contribution to botanical change on the Island, with vegetation density increasing significantly after its removal.

The introduced House Mouse also occurs on the Island. Its numbers are, however, kept in check by the Island's Tiger Snake population.

Domestic animals can disturb wildlife and visitors, and introduce disease. In accordance with Department of Conservation and Land Management policy, domestic animals are not permitted in nature reserves.

FIRE

The majority of Carnac Island is believed to have escaped disturbance by wildfire for at least 5000 years (Abbott *et al*. 2000) and hence provides a valuable example of coastal vegetation that has developed without this influence. According to Abbott *et al*. (2000), the influence of Aboriginal burning practices is not seen on the Island as it is on the mainland, as Aboriginal people did not historically access Carnac Island or other offshore islands of South-west Western Australia. In 1969 a portion of the Island was burnt as part of the rabbit eradication program.

Strategies aimed at fire prevention are an important component of management of Carnac Island as fire control on islands poses particular difficulties. The relative isolation, difficult access, and strong winds presents rather unique challenges for fire control.

People lighting campfires and lightning are the most likely causes of fire on Carnac Island. Given that the feasibility of actively suppressing fires on the Island is low, fire management will rely heavily on educating visitors of the potential impacts of fire, and informing them of regulations prohibiting the deliberate lighting of fires in nature reserves.

LAND CLASSIFICATION

Managing access on the Island is critical to avoid the impact of visitors on the ecological and social values. Section 62 of the Conservation and Land Management Act provides for the classification of lands into various categories. Three classification types are proposed for Carnac Island; prohibited areas, limited access areas and temporary control areas. Prohibited areas are those which may not be entered except as authorised by the Executive Director of the Department of Conservation and Land Management, and then only to carry out those activities pursuant to the Plan. Limited access areas have conditions or limits imposed on their access. Temporary control areas are used for the purposes of public safety or the protection of flora and fauna for a period not exceeding 90 days, though it may be made more than once for the same purpose over the same area.

Human use of Carnac Island Nature Reserve has the potential to damage its key ecological values. However, the use of the land classifications as described above can ameliorate the negative impacts of human use on the Island and protect these key values. Access restrictions can also provide for safer recreation use (eg. by reducing risks of cliff collapses, snakebite).

On the basis of the above, it is recommended that visitors be confined to the southern portion of the sandy eastern beach (see Figure 2) and that access is limited to day use only. The prohibited access area of the north-eastern section of beach will be delineated with permanent field markers. Temporary control areas will be used on the Island to provide temporary or seasonal protection to fauna. For example, a temporary control area could be used on a section of beach where seabirds are nesting. The need for use of a temporary control area will be assessed on a case by case basis.

MANAGING OUR CULTURAL HERITAGE

INDIGENOUS HERITAGE

The Aboriginal name for Carnac Island is thought to be Ngooloormayup. The Nature Reserve forms part of a registered Aboriginal site (site type = mythological).

Several Nyoongar dreaming stories are associated with local coastal environments, including offshore islands such as Carnac.

In 1832 three Aborigines including Yagan, a tribal leader, were imprisoned on the Island in the care of RM Lyon and a number of soldiers for allegedly killing one of the European settlers. Their confinement lasted only a few weeks as the prisoners escaped in a stolen government stores boat.

Carnac Island Nature Reserve: Management Summary

Objective and Key Points	Strategies	Key Performance Indicators	Implementation Targets
LAND CLASSIFICATION **Objective:** To implement the *Land Classification* scheme for the Island within 6 months of implementation of the Plan. **Key Points:** • The use of prohibited and limited access areas on Carnac Island will assist in the protection of the Island's geomorphology and flora and fauna from human visitation impacts and also reduce the risks to visitor safety. • Temporary control areas can be used to provide seasonal protection to fauna.	1. Initiate appropriate notices under Section 62 of the Conservation and Land Management Act to implement the proposed land classification scheme for the Island (see Figure 2). 2. Provide appropriate information for visitors and stakeholders regarding the land classification scheme. 3. Initiate appropriate notices under Section 62 of the Conservation and Land Management Act to implement temporary control areas where deemed necessary.		• Strategy 1 within 6 months of implementation of the Plan. • Strategy 2 at the time of gazettal of the land classification notice (for stakeholders) and on an ongoing basis (for visitors and stakeholders) thereafter. • Strategy 3 as necessary throughout the life of the Plan.
GEOLOGY & GEOMORPHOLOGY **Objective:** To protect and conserve the structural complexity of the Island's geological features. **Key Points:** • Collapses of the Island's fragile limestone structures may be exacerbated or caused by human activities and can be a significant safety hazard. • Current human pressures on this value are minimal as the presence of Tiger Snakes discourages visitors from leaving the beach area.	1. Apply limited access area as per *Land Classification.* 2. Rehabilitate eroding areas as necessary. 3. Provide information for Island users about the ecological importance and fragility of the Island's geomorphology.	• No loss of geomorphological and geological complexity due to human activity.	• Strategy 1 within 6 months of implementation of the Plan. • Strategy 2 and 3 on an ongoing basis as necessary throughout the life of the Plan.
VEGETATION **Objective:** To conserve and protect indigenous plant species and communities (particularly threatened or priority species and communities), and minimise the impacts of introduced plants on the Island's values. **Key Points:** • There has been a significant increase in the proportion of exotic species in the Island's flora over time (currently 67%). • The occurrence of Tiger Snakes on CINR makes the spread of weeds via human transportation unlikely. • African Boxthorn poses a significant threat to the survival of native species on the Island.	1. Identify and protect vegetation and flora that is rare, unique or in need of special consideration. 2. Conduct surveys to record the distribution, abundance and other relevant characteristics of the Island's vegetation. 3. Establish a monitoring program for weed invasion and loss of native vegetation. 4. Apply limited access area as per *Land Classification.* 5. Provide information to Island users about the importance of the Island vegetation and potential human impacts on this. 6. Implement suitable weed removal programs in accordance with the Environmental Weed Strategy for Western Australia where weed invasion threatens the Islands' values.	• No loss of diversity or cover of native vegetation due to human impact over the life of the Plan. • No increase in the number of, or area impacted by, introduced flora species. • All new weeds that threaten the Island's values are controlled within 6 months.	• Strategy 1 and 2 within 6 months of implementation of Plan. • Strategy 3 within 2 years of implementation of the Plan. • Strategy 4 within 6 months of implementation of Plan. • Strategy 5 on an ongoing basis. • Strategy 6 as necessary throughout the life of the Plan.
RECREATIONAL USE **Objective:** To ensure that recreation activities are managed in a manner consistent with the Island's conservation purpose. **Key Points:** • The Island is a focus for recreational activities such as walking and nature appreciation. • The education of Island visitors is crucial in managing visitor behaviour on the Island.	1. Apply limited access area as per *Land Classification.* 2. Issue only 'E' Class licences to commercial tour operators. 3. Monitor visitor use patterns through the formal collection of data (eg records of visitor and vessel numbers, and types of recreational use). 4. Liase with Department for Planning and Infrastructure re establishment of 'Mooring Control Areas' if necessary to prevent disturbance to sea-lions. 5. Provide information, education and interpretation opportunities to assist visitors to appreciate and understand the natural and cultural environment.		• Strategy 1 within 6 months of implementation of the Plan. • Strategy 2 as deemed appropriate. • Strategy 3 within 6 months of implementation of the Plan and on an ongoing basis thereafter. • Strategy 4 as necessary/appropriate. • Strategy 5 on an ongoing basis.
NATIVE ANIMALS AND HABITATS **Objective:** To conserve and protect indigenous fauna on Carnac Island with an emphasis on specially protected fauna. **Key Points:** • The Island is one of the most important haul out sites for male sea- lions in the metropolitan area, and an important breeding site for seabirds. • Australian Sea-lions are listed as 'specially protected' under the Wildlife Conservation Act. • The retention of metropolitan haul out sites is important to the survival of the entire west coast population of Sea-lions. • Seabirds breeding on Carnac Island are at risk from human disturbance. • Introduced weed species can change the Island's vegetation structure, causing habitats used for nesting to be lost.	1. Apply limited access area as per *Land Classification.* 2. Classify the nesting sites of low fidelity seabird species as temporary control areas where necessary. 3. Implement strategies as per Environmental Weeds Strategy for WA as necessary/appropriate. 4. Protect native fauna from introduced predators through appropriate control regimes if/as required. 5. Establish an integrated research and monitoring program for the CINR a. Monitor the distribution and abundance of sea-lions. b. Monitor the distribution and abundance of selected seabird species as necessary (eg monitoring of Pied Cormorant colony). c. Collect and analyse data on visitor use patterns to identify actual/potential impacts on the Island's indigenous fauna. d. Undertake, and/or encourage other agencies (eg tertiary institutions) to undertake specific research projects into the impacts of visitor use on CINR; - support projects undertaken by other agencies through logistical/financial means where possible. e. Encourage fauna research to aid in Island management, including critical approach distances for nesting birds. 6. Implement changes to management regimes if the review of data obtained from research and monitoring programs reveal significant impacts on wildlife populations. 7. Support the preparation and implementation of recovery plans for any threatened fauna species that are identified on the Island. 8. Liase with Department for Planning and Infrastructure to establish "Mooring Control Areas" to protect Island fauna if necessary.	• The sea-lion population on the Island displays no significant reduction in population numbers (except that which is explained by the regular synchronous fluctuations that are associated with the northward migration for breeding purposes). • No loss of species diversity of breeding birds on the Island.	• Strategy 1 within 6 months of implementation of Plan. • Implement strategies 2-4 as necessary throughout the life of the plan. • Strategy 5 within 6 months of implementation of Plan and as necessary throughout the life of the Plan. • Strategy 6, if/as necessary after formal data review conducted within 3 years of implementation of the Plan, and as otherwise necessary throughout the life of the plan. • Strategies 7 and 8, as necessary throughout the life of the Plan.
PROBLEM AND DOMESTIC ANIMALS **Objective:** To prevent and, where possible, negate the impact of introduced animals on the Island's ecosystems. **Key Points:** • Few introduced fauna species have been recorded on the Island. • Rabbits were successfully eliminated from the Island in 1969. • Domestic animals are a potential threat to the ecological values of CINR.	1. Monitor for the presence of introduced species on the Island. 2. Implement measures to eradicate introduced species from the Island, where their impacts on ecological values are known or found to be negative. 3. Provide information for Island visitors about the impacts of introduced animals on ecological values. 4. Monitor the efficiency of control programs on target species and any effects on non-target species, and make changes to procedures if required. 5. Inform visitors as required re Department of Conservation and Land Management policy of not permitting domestic animals in nature reserves.	• No increase in the number and distribution of introduced animal species from 2001 levels.	• Strategy 1 within one year of implementation of the Plan and on an ongoing basis thereafter. • Strategy 2-5 as necessary throughout the life of the Plan.
FIRE **Objective:** To minimise the potential for accidental human-caused fire and safeguard against habitat loss as a result of fire. **Key Points:** • Carnac Island is significant in that it has escaped wildfire for thousands of years. • Frequent burning could alter the Island's vegetation structure from shrublands to grasses and weeds. This would affect the habitat available to fauna and further increase the risk of fire. • Fire control on islands poses particular difficulties and hence management strategies aimed at prevention are particularly important.	1. Provide information to Island users of the impact that fire can have on the Island values and visitor safety, and that the lighting of fires on nature reserves is prohibited. 2. Document the occurrence and effects of fires that do occur on the Island. 3. In the event of fire on the Island, undertake direct suppression response wherever possible. 4. Rehabilitate fire-affected areas where necessary.		• Strategy 1 within two years of implementation of the Plan and on an ongoing basis thereafter. • Strategy 2-4 as necessary throughout the life of the Plan.

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NON-INDIGENOUS HERITAGE

Carnac Island has served as a prison, a whaling enterprise, and a quarantine station. It was originally named Bertholet Island by French explorers in 1801, and was renamed Carnac Island in 1827 by Captain James Stirling after his first lieutenant, John Carnac. When Stirling later returned as Lieutenant Governor with the first settlers of the colony, his ship the *Parmelia* ran aground on the sand bar that runs between Woodman Point and Carnac Island. Twenty-nine passengers spent five days on the island while the ship was recovered.

One of the first two whaling enterprises in Perth waters was established on Carnac Island in 1836-37. The whalers brought and transported Perth's first church to serve as a store. The whaling station closed a few years later after the loss of several lives, damage to boats and frequent theft of their supplies.

In 1884, the State Government gazetted Carnac Island as a quarantine station for the Port of Fremantle. Although several buildings were constructed, the Island is thought to have never been used for this purpose. The Commonwealth acquired the Island for defence purposes in 1916, but transferred it back to the State in 1961 (Byfield 1989).

MANAGING RECREATION AND TOURISM

VISITOR ACCESS

Appropriate access on Carnac Island is designated through the implementation of the measures outlined in Land Classification. In addition, in order to reduce the safety risks to sea-lions and to maximise the area of beach available for haul out, the anchoring of vessels on the Island or within 10 metres of sea-lions is prohibited.

The potential for disturbance to sea-lions by vessels mooring near the prohibited access area of beach may arise. It will be necessary for the Department to liase with the Department for Planning and Infrastructure regarding the establishment of Mooring Control Areas to prevent such disturbance

RECREATIONAL USE AND OPPORTUNITIES

Carnac Island's proximity to and ease of access from the mainland makes it a popular focus for recreational pursuits, particularly on weekends and public holidays. The eastern side of the Island provides a sheltered anchorage for commercial and recreational boats. Some boats will also occasionally shelter in the bay north east of South West Rock.

Certain biological and physical features of Carnac Island, such as its relatively thick vegetation, rocky cliffs and the presence of Tiger Snakes, has imposed natural restrictions on which areas have been used for recreational pursuits. As a result, recreational activity is essentially concentrated on the sheltered eastern beach.

The eastern beach is also the favoured haul out area for the Island's sea-lion colony, and the opportunity to view these animals is a significant attraction to visitors. The area of beach on the Island varies with the natural erosion and accretion processes occurring on an annual and seasonal basis. The potential for negative impacts on sea-lions as a direct result of human use in such a limited space is exacerbated by the increasing number of visitors.

Although Carnac Island is primarily for nature conservation, passive recreational activities with manageable environmental impacts are considered to be appropriate. It is recommended that on-island recreational activities be limited to passive recreational activities such as sightseeing and wildlife observation and limited to the areas of eastern beach as described in *Land Classification*.

The education of visitors will be crucial in managing visitor behaviour on the Island. Even so, it may become necessary during the life of the Plan to place restrictions on the number of visitors to Carnac Island if visitor impacts begin to degrade the Island's ecological values. Restrictions on the number of people on commercially conducted tours are already in place (see *Commercial Operations*). A variety of restrictions on visitation in general (ie. regardless of an association with a tour party) may need to be considered if negative impacts of recreational activity become evident. Such restrictions may, for example, occur as seasonal closures of the Island, visitation through seasonally operated guided tours or prohibiting access where there are severe threats or where impacts cannot be reasonably managed.

The attraction of Carnac Island is its relatively undisturbed and undeveloped state and the visibility of its wildlife, in particular sea-lions and seabirds. Formal facilities (eg toilets, shelters) would detract from this value. Information should be included in brochures to inform visitors of the lack of facilities on the Island.

COMMERCIAL OPERATIONS

Any commercial tour operators intending to land on Carnac Island must have a commercial activity licence under the Conservation and Land Management Act and must abide by licence conditions. These include, for example, limits on the number of passengers permitted on the Island, requirements for data collection and prescribed distances to be maintained from sea-lions. These licences are not, however, permits for sea-lion interactions. There are currently 8 operators licensed to land on the Island.

Although the Department has issued some licences for boat-based interactions with sea-lions, licences allowing people to interact with them on land, or in the water, are not issued because of concerns for both the wellbeing of sea-lions and human safety from close interactions. Close interactions inevitably diminish the natural fear sea-lions have of humans and can lead to an increased risk of injury, both deliberate and accidental, to both humans and sea-lions. Licences for boat-based interactions with sea-lions do not allow for operators to land on the Island. Licences under the Conservation and Land Management Act as described previously are required for this.

Since uncontrolled commercial tourism operations may negatively impact fauna such as nesting/roosting seabirds, sea-lions and the near island benthic marine communities, it is important that a monitoring program be established to collect baseline information about the Island's natural environment. The information derived will contribute to an accurate assessment of the impacts of commercial operations and recreational users. Monitoring will be ongoing and, if the level of commercial tour activity is found to be beyond sustainable levels, appropriate action will be taken to amend the situation. Licence conditions will make provision for addressing detrimental impacts should any eventuate.

The Department of Conservation and Land Management issues two types of licences -'T' Class (no immediate limits on the number of operators) and 'E' Class (limited number of licences issued due to environmental or management issues). It is recommended that only 'E' Class licences be issued in consideration of Carnac Island's physical size and its high conservation value. These would only be issued following a public 'Expression of Interest'. Licences to access the Island will only be issued where they are consistent with the Management Plan and where they do not compromise the Island's values. Commercial operators conducting the activities on the Island will also be required to become accredited under the National Ecotourism Accreditation Program (NEAP) or an equivalent accreditation program.

VISITOR SAFETY

Factors such as difficulty of access, potential hazards from Australian Sea-lions and Tiger Snakes, and the danger of fragile and undercut cliffs present a considerable degree of risk of injury to visitors. The Department has a legal and moral responsibility to consider the personal safety and welfare of visitors to the land it manages by implementing measures that are reasonable and prudent in the context of the hazard, intensity of visitor usage and character of the site. This will be effected through the access plan as indicated in Land Classification, and the implementation of a visitor risk management program. These approaches are consistent with the Department's Visitor Risk Management Policy Statement 53.

INVOLVING THE COMMUNITY

INFORMATION, EDUCATION AND INTERPRETATION

Carnac Island Nature Reserve provides a valuable opportunity for improving community awareness about island ecosystems. An effective information, education and interpretation program is vital to achieve the goals and objectives for the management of the Island. It informs the public of the attractions and opportunities available, and assists the community to appreciate and understand the natural and cultural environments. Such programs should also foster a sense of community ownership of the Island, engender support for its management, and encourage appropriate behaviours that minimise adverse impacts on the environment.

Education and interpretation programs will concentrate on raising awareness about the Island's conservation values, potential human impacts, the land classification scheme of the Island, and the positive actions visitors can take to support Island management.

WORKING WITH THE COMMUNITY

Community involvement is an integral component of the Department's operations. The community, as groups or individuals, is encouraged to be involved in both the planning and management of many of the Department's activities, including volunteer programs. Prior to the preparation of a final management plan for Carnac Island, a community advisory committee will be established to encourage community involvement and foster community ownership. Volunteers may also be able to assist with the monitoring program.

MONITORING AND IMPLEMENTING THE PLAN

The Department and the Conservation Commission will assess the effectiveness of the final management plan for Carnac Island by regular audits. These audits assess:

1. The extent to which the implementation targets have been met.
2. The success of the Plan in delivering outcomes consistent with the Department of Conservation and Land Management's Corporate Plan 2000-2005.

The strategies outlined in the Plan will be built into the works program of the District responsible for the day to day management of CINR. Progress against the KPIs, and implementation targets will form the basis of an annual or biennial status report on Carnac Island by the District to the Corporate Executive and the Conservation Commission. Progress against KPIs and targets will also assessed by the Conservation Commission in its mid-term audit of the Plan, or as it otherwise deems necessary.

The Carnac Island Nature Reserve Management Plan will be current for a period of 10 years from the date of approval by the Conservation Commission. However, if the Plan is not revised after 10 years, it will remain in force unless it is either revoked by the Minister, or a new plan is released. Revision may be required sooner than 10 years in the light of any drastic event or the provision of improved knowledge.