DEPARTMENT OF PRIMARY INDUSTRIES AND WATER

Threatened Tasmanian Eagles

Recovery Plan 2006 - 2010

Australian Government

Tasmania

ACKNOWLEDGEMENTS

Cover photograph: Tasmanian Wedge-tailed Eagles (*Aquila audax fleayi*) juvenile male (front) and adult female on nest. © W. E. Brown and White-bellied Sea-eagle (*Haliaeetus leucogaster*) by Nick Mooney.

The listing status of all threatened species referred to in this recovery plan were correct at the time of publication.

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DISCLAIMER

This recovery plan has been prepared under the provisions of both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Tasmanian *Threatened Species Protection Act 1995* (TSP Act). While it includes two species of threatened raptor, adoption as a national recovery plan under the EPBC Act refers only to the Wedge-tailed Eagle.

Abbreviations

Wte	Wedge-tailed Eagle	Wbse	White-bellied Sea-eagle
PFRP	Private Forests Reserves Program	FPB	Forest Practices Board
NRM region	Natural Resource Management Region	DPIW	Department of Primary Industries and Water, Tasmania
TSS	Threatened Species Section, RMC, DPIW	DPIWE	Department of Primary Industries, Water and Environment, Tasmania
RMC	Resource Management & Conservation	SAC	Scientific Advisory Committee
		WEB	Author Bill Brown

CONTENTS

SUMMARY

This recovery plan for threatened Tasmanian eagles covers two species, the Wedge-tailed Eagle and the White-bellied Sea-eagle.

Current Species Status

Wedge-tailed Eagle (*Aquila audax fleayi*)

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*   Endangered
Tasmanian *Threatened Species Protection Act 1995*   endangered

Aquila audax fleayi (Condon and Amadon 1954), the Tasmanian Wedge-tailed Eagle, is endemic to the State and is known to occur in all habitats throughout Tasmania (vagrant on King Island). However, the species requires old-growth forest on sheltered sites for nesting and this, combined with territorial behaviour act to limit its breeding range and potential. The size of the population is estimated at between 1000 and 1500 individuals. A population decline is inferred due to loss of nesting habitat, nest disturbance from land clearance and other inappropriate land management practices and from unnatural mortality, including persecution. Available data indicate a high proportion of inactive nests and elevated adult mortality leading to a reduction in the mean age of the population and a subsequent reduction in breeding success.

White-bellied Sea-eagle (*Haliaeetus leucogaster*)

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*   Migratory
Tasmanian *Threatened Species Protection Act 1995*   vulnerable

Haliaeetus leucogaster (Gmelin 1788) the White-bellied Sea-eagle is distributed around the coastal perimeter and inland lakes of Tasmania. It is also distributed around the coastal perimeter of mainland Australia and extends into the interior along major river systems subject to water availability. It is also found in coastal areas from Papua New Guinea through South East Asia to India and southern China. The population in Tasmania is non-migratory and its size is estimated at less than 1000 individuals. It generally breeds within five kilometres of open water. Prime nesting habitat is found along major estuaries where residential and industrial development is concentrated, thus placing the species under pressure from habitat loss and disturbance. This species is also threatened by unnatural mortality (including persecution). Additional threats arise from recreational use of the coastal zone, from marine pollution and debris, which can cause entanglement.

Habitat Requirements and Limiting Factors

Both species have specific nesting requirements, particularly the Wedge-tailed Eagle. The Wedge-tailed Eagle requires intact mature forest situated on aspects that are sheltered from prevailing strong winds. The White-bellied Sea-eagle requires nesting sites within five kilometres of the coast or open water bodies. In each case the sites need to be relatively free from disturbance.

Overall Recovery Objective

To increase the breeding success of both eagle species by protecting nesting habitat from destruction, modification and disturbance and by minimising both the modification of foraging habitat and the occurrence of human-related mortality with the ultimate goal of an increase in the population size and stability of both species.

Specific Objectives

1. Increase the effectiveness of predictive nesting habitat models for application State-wide.
2. Increase the proportion and number of nests found prior to (rather than during) development on all tenures, including, but not restricted to forestry operations and land clearance.
3. Reduce the proportion of nests subject to disturbance.
4. Identify human-induced causes of breeding failure and mitigate against such causes.
5. Increase breeding success.
6. Increase the number and/or density of active territories.
7. Develop and apply protocols for effective eagle management during all land development.
8. Monitor the implementation and effectiveness of management prescriptions.
9. Implement prescriptive nest reserves for conserving nesting habitat.
10. Identify new threats and implement strategies for their mitigation.
11. Reduce the occurrence of eagle mortalities and injuries (in number and proportion), particularly those attributable to human activities.
12. Engage the electricity industry in reducing the proportion of eagle collisions and electrocutions.
13. Respond to inquiries for information on eagle management by affected interests and the public.
14. Undertake research into eagle biology that targets improved species management.

Performance Criteria

1. Demonstrate the effectiveness of predictive habitat models for regional application.
2. Demonstrate an increase in the proportion and number of nests found prior to land development on all tenures.
3. Demonstrate a reduction in the proportion of nests subject to disturbance.
4. Demonstrate an increase in breeding success.
5. Demonstrate an increase in the number or density of active territories.
6. Implement protocols for effective eagle management during all land development.
7. Demonstrate the effective implementation of prescriptive nest reserves for conserving nesting habitat.
8. Identify new threats and implement strategies for their mitigation.
9. Demonstrate a reduction in the occurrence of eagle mortalities and injuries (in number and proportion), particularly those attributable to human activities.
10. Identify human-induced causes of breeding failure and demonstrate effective mitigation against such causes.
11. Demonstrate an active role by the electricity industry in reducing the proportion of eagle collisions and electrocutions.
12. Respond to inquiries for information on eagle management by affected interests and the public.
13. Publish the results of research and management in a refereed scientific journal.

Actions Needed

1. **Strategic Planning**

   - Develop and Facilitate the Application of Predictive Habitat Models
   - Map and Search Strategic Areas of Habitat
   - Search for Nests Prior to Disturbance on all Land Tenures
   - Identify New Threats and Mitigation Measures Required

2. **Habitat Protection**

   - Protect all Nests on all Land Tenures
   - Review and Update Nest Management Prescriptions
   - Develop Protocols for Eagle Management Applicable to all Land Development

3. **Monitoring**

   - Maintain and Develop Databases
   - Monitor Reports of Mortality and Injury
   - Survey Breeding Success
   - Monitor the Impacts of Development

4. **Mitigation**

   - Facilitate Mitigation Measures for Mortalities and Injuries
   - Reduce Bird Mortality on Electrical Infrastructure

5. **Education and Extension**

   - Promote Eagle Conservation
   - Recover and Rehabilitate Injured Eagles

6. **Research**

   - Assess the Effectiveness of Current Management Prescriptions
   - Analyse and Prepare Data on Eagle Biology and Management for Publication
   - Investigate Eagle Breeding Dynamics

Estimated Cost of Recovery

Actions	Cost estimate	Timeframe	NRM Region
Strategic Planning			
Develop Predictive Habitat Models	$63,000	Year1-Year 5	State wide
Map and Search Habitat	$42,000	Year1-Year 5	State wide
Search for Nests	$33,000	Year1-Year 5	State wide
Identify New Threats	$10,500	Year1-Year 5	State wide
Habitat Protection			
Protect all Nests	$49,000	Year1-Year 5	State wide
Review and Update Nest Management Prescriptions	$31,000	Year1-Year 5	State wide
Develop Protocols for Eagle Management	$51,000	Year1-Year 5	State wide
Monitoring			
Maintain and Develop Databases	$51,000	Year1-Year 5	State wide
Monitor Reports of Mortality and Injury	$13,000	Year1-Year 5	State wide
Survey Breeding Success	$54,900	Year1-Year 5	State wide
Monitor the Impacts of Development	$13,000	Year1-Year 5	State wide
Mitigation			
Mitigation of Mortalities and Injuries	$13,000	Year1-Year 5	State wide
Reduce Eagle Mortality on Electrical Infrastructure	$25,000	Year1-Year 5	State wide
Education and Extension			
Promote Eagle Conservation	$26,000	Year1-Year 5	State wide
Recover and Rehabilitate Injured Eagles	$13,000	Year1-Year 5	State wide
Research			
Current Management Prescriptions	$53,000	Year1-Year 5	State wide
Analyse and Prepare Data for Publication	$37,000	Year1-Year 5	State wide
Investigate Eagle Breeding Dynamics	$53,000	Year1-Year 5	State wide

SPECIES INFORMATION AND GENERAL REQUIREMENTS

Species Descriptions

Brief species descriptions are given in Background Documentation: Threatened Tasmanian Eagles.

This Fauna Recovery Plan covers two species the Tasmanian subspecies of the Wedge-tailed Eagle, *Aquila audax fleayi* (Condon and Amadon, 1954), and the White-bellied Sea-eagle, *Haliaeetus leucogaster* (Gmelin, 1788).

Life History and Ecology

Aspects of the life history and ecology of both eagle species can be found in the Background Documentation for the Threatened Tasmanian Eagles Recovery Plan.

Previous Recovery Actions

There have been two previous recovery plans prepared and implemented for the Tasmanian Wedge-tailed Eagle viz., Gaffney & Mooney (1992) and Bell & Mooney (1999). The results of the implementation of the former plans are given in Gaffney (1993), Gaffney (1994), and Bell & Mooney (1999). The results of the implementation of the current recovery plan (1998-2003, Bell & Mooney, 1999) are provided in summary below and in detail in Background Information for the Fauna Recovery Plan: Threatened Tasmanian Eagles (hyperlink). Although the White-bellied Sea-eagle has not been the subject of a recovery plan, the nests of this species have been managed by the Nature Conservation Branch (now Biodiversity Conservation Branch) and the Forest Practices Authority with the same prescriptive measures as for Wedge-tailed Eagles, in part because the species sometimes compete for the same nests and in part because they share many aspects of breeding and conservation biology. In view of the recent listing of the White-bellied Sea-eagle under the Tasmanian *Threatened Species Protection Act 1995* as vulnerable and the similarities in management of both Tasmanian eagles, it has been decided to combine the two species within this recovery plan.

Implementation of the Wedge-tailed Eagle Recovery Plan 1998-2003

The Wedge-tailed Eagle Recovery Team (Appendix 1) oversaw the implementation of the first three years (2000 to 2003) of Wedge-tailed Eagle Recovery Plan 1998-2003. In late 2003 the recovery team was reformed and will now be known as the Threatened Eagle Recovery Team (Appendix 1), incorporating management of the vulnerable White-bellied Sea-eagle in its duties.

A predictive habitat model has been tested and successfully applied to the strategic location of nests in the Bass Forestry District and in consultancies to the forest industry. The model has also been applied to the location of nests in the vicinity of major industrial developments. Further development is required to ensure regional application. The model may be used to produce maps of potential habitat.

Since the commencement of the Recovery Plan (1998-2003) in May 2000 and up to December 2003, a total of 367 new nests have been found. There has been a progressive increase in the number of nests found prior to land development with a subsequent decrease in the number of nests located during disturbance. The forest industry has adopted the practice of using helicopters in the search of potential habitat. The Project Officer has provided training in this technique for at least 20 forest industry employees.

The vast majority of known nests occur on State Forest and private property, 47.8% and 42.7%, respectively. This is partly due to the majority of suitable eagle habitat occurring on State Forest and private land but also due to the majority of nest site searches conducted as a result of forestry activities.

The Project Officer regularly provides advice to the forest industry, developers and councils on the management of eagles. Three training seminars have been developed and presented to the forest industry on general eagle ecology, nest searching techniques and nest activity assessment.

Nine eagle nests have been secured by conservation covenant through the Private Forest Reserves Program. An additional four areas containing former nest sites have also been protected under this program. The reserves will be managed for a range of conservation values.

In the assessment of the security of nest reserves a number of management issues requiring attention were identified. These include but are not confined to use and maintenance of roads, recreational activities and firewood cutting.

All nests, located in areas subject to forestry operations, are protected in reserves. These reserves are designed during the preparation of Forest Practices Plans and are endorsed by Forest Practices Authority zoologists and TSS. The forest industry maintains databases on nest locations and reserve system.

Substantial monitoring of breeding success was conducted in the years 2000-2002. The data suggest a large proportion of territories is not occupied but that the success rate of active nests is consistent. Training provided to the forest industry has allowed the industry to assess the activity of nests and has contributed to the knowledge of breeding success.

Assessment of abundance has been found to be more effective by extrapolation from nest occupancy than from road counts. The total population for Tasmania is estimated at between 1000 and 1500 birds, derived from approximately 426 territories and a theoretical contribution of non-breeding birds of 50% to the population. The population range is calculated from the apparent territory occupancy of 54.75% and maximum territory occupancy of 90.0%.

Nest management prescriptions are continually reviewed, and as improved methods are developed they are recommended to the Forest Practices Authority for delivery via the Threatened Fauna Adviser. Protocols have been developed for the management of nests during industrial developments, some of which have been incorporated into guidelines and protocols. Prescriptions have also been developed for inclusion in the Operations Plans component of conservation covenants.

Eagle conservation issues have been actively promoted to landowners and the general public through brochures, public talks, field days, newspaper articles, television stories and Threatened Species Day.

Reports of eagle mortality and injuries have been actively investigated and information entered into a specifically designed database. Many injured eagles have been captured, brought to veterinary treatment and housed for rehabilitation. A number have made good recovery and were released successfully.

Additional Achievements

A financial package was negotiated with Duke Energy for compensation for disturbance to eagle nests during the construction of the Tasmanian Natural Gas Pipeline. Protocols were established to manage works near nests during the breeding season, which resulted in the successful fledging of eagle chicks from all three nests.

Wind Farms

Guidelines and protocols were developed for the management of eagles and eagle nests in the vicinity of wind farms. A four tiered approach was adopted to manage the potential impacts on eagles, ie. mitigation, monitoring, compensation and research. An Environmental Protection Notice can be issued under the *Environmental Management and Pollution Control Act 1994* by the Director of Environmental Management (DTAE) if environmental harm has been or is likely to be caused by the activity.

Objectives of EPBC Act

Co-operative Approach

A cooperative approach was adopted for the implementation of the previous two Wedge-tailed Eagle Recovery Plans and it is the intention of this plan to continue and extend this approach by involving interested and affected parties in the management of both eagle species throughout Tasmania.

International Environmental Responsibilities

The preparation and successful implementation of this Recovery Plan will meet Australia's international environmental obligations.

Recognition of Indigenous Peoples Roles

The cultural activities of indigenous people are unlikely to affect the survival or management of either species. There is no specific role for indigenous people to play in the management of these species except where nest sites fall on indigenous land.

Indigenous Knowledge

The original indigenous people had intricate relationships with all living things within the environment and birds formed important spiritual connections with particular Creation stories.

The *kunyaa* (wedge-tail) and *nairanaa* (sea eagle) were as important to the people as were the *yolla* (mutton-bird), the *canara* (magpie), the *toogyenna* (white-backed magpie) and the *carallo* (black jay). The Aboriginal names used to here describe the birds are not the only existing names. Various language groups had their own specific names for each species.

Contemporary Aboriginal people maintain particular connections to bird species as there still is a form of association which extends to the Wedge-tailed Eagle and White-bellied Sea-eagle.

The Aboriginal community has grave concerns about the continual and ever-growing threat to the habitat of these large and significant bird species.

International Obligations
- Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA):
    - White-bellied Sea-eagle only
- Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals):
    - White-bellied Sea-eagle only
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):
    - Wedge-tailed Eagle and White-bellied Sea-eagle

Affected Interests

Department of Primary Industries and Water (DPIW)

This is the State department responsible for administration and enforcement of the *Threatened Species Protection Act 1995*, the *Nature Conservation Act 2002*, and *Wildlife Regulations 1999*. Therefore, it is the responsibility of DPIW to manage threatened species and implement Recovery Plans. It is also this department's role to assess and set permit conditions for developments through the administration and enforcement of the *Environmental Management and Pollution Control Act 1994*.

Department of Tourism, Arts and the Environment (DTAE)

The Parks and Wildlife Service is the organisational division within DTAE responsible for the management of Tasmania's parks, reserves and historic sites as well as the Tasmanian Wilderness World Heritage Area, including the delivery of Crown Land administration. Reserves are declared under the *Nature Conservation Act 2002* that sets out the values and purposes of each reserve class and managed under the *National Parks and Reserves Management Act 2002* according to management objectives for each reserve class. In total (as at 28 April 2004), the Tasmania Parks and Wildlife Service manages 441 reserves covering 2,477,314 hectares, or about 36.38% of the area of the State.

Australian Government Department of the Environment and Water Resources (DEW)

This is the Australian Government department responsible for administration and enforcement of the *Environment Protection and Biodiversity Conservation Act 1999* and with the responsibility of protecting Australia's biodiversity (in conjunction with State Governments). They also have the vital role of approving and funding Recovery Plans.

Australian Government Department of Defence

The Department of Defence has prepared and adopted Departmental Environment Instruction No. 15/2002, which stipulates the department's obligation to comply with the *Environment Protection and Biodiversity Conservation Act 1999*. It also establishes the department's commitment to contribute to the recovery of threatened species and communities occurring on departmental lands and recognises Australian Government approved Recovery Plans for these species and communities. The document lists the threatened species found on departmental land and the actions that should be taken to assist in the recovery of these species. The Wedge-tailed Eagle is identified as a species of concern in this document and the actions targeted are; to monitor breeding success and abundance, and reduce the incidence of human induced mortality.

Forest Industry

Forestry Tasmania is responsible for managing 1.5 million hectares of State Forest on which 47.4% of existing Wedge-tailed Eagle nests occur. Of the existing White-bellied Sea-eagle nests, only 6.6% occur on State Forest. Private forest companies manage forestry activities on privately owned land. All parties involved in forestry activities have responsibilities under the *Nature Conservation Act 2002*, *Threatened Species Protection Act 1995*, *Environment Protection and Biodiversity Conservation Act 1999*, Tasmanian *Forest Practices Act 1985*, Tasmanian Forest Practices Code (Forest Practices Board, 2000). Commercial forestry operations are conducted according to the Agreed Procedures for the Management of Threatened Fauna to ensure the protection and provision for threatened species through the preparation and implementation of Forest Practices Plans. Additionally, the Tasmanian *Regional Forest Agreement 1996* identifies the Wedge-tailed Eagle as a Priority Species, for which consideration must be given in forest management.

Aquaculture Industry

The Aquaculture industry has the responsibility to ensure that the operation of fish farms does not affect White-bellied Sea-eagles by entanglement, oiling at offal pits or persecution.

Private Landholders

Approximately 42% of Wedge-tailed Eagle nests occur on privately owned land. Pastoral, cropping and other rural activities should be subject to nest management prescriptions. A number of landowners have secured portions of their land with conservation covenants for the specific protection of eagle nests, in combination with other values. Many properties are developing Game Management Plans, which need to incorporate eagle management prescriptions.

Proponents of Development

All land developments such as housing, land subdivision, land clearance, mining, major industrial developments (gas distribution) and dam construction on private and public land are subject to the *Nature Conservation Act 2002*, *Threatened Species Protection Act 1995*, *Environment Protection and Biodiversity Conservation Act 1999* and may require eagle management prescriptions.

Wind Farm Proponents

The proponents of wind farms are particularly affected by the management of these two species because of the high primary incidence of and potential for eagle fatalities and injuries from collisions with turbines. Secondary impacts from windfarms also relate to nest disturbance and the displacement of breeding pairs. There is growing level of knowledge about the response of these eagle species to wind turbines in the Tasmanian context, but much more information is needed.

Local Councils

As the bodies responsible for local area planning and development approvals, Local Councils have an obligation to implement planning provisions for threatened species management. Measures such as the requirement for surveys for threatened species and the implementation of management prescriptions will directly affect Local Government.

Non-government Conservation Organisations

There are many non-government organisations with an interest in the protection of threatened species (eg. Tasmanian Conservation Trust, Threatened Species Network, Tasmanian Wilderness Society, field naturalists clubs, Birds Australia [which includes Birds Tasmania and the Australasian Raptor Association]) and local Environment Centres.

Other Non-government Organisations

Other non-government organisations such as the Tasmanian Farmers and Graziers Association may be affected by prescriptions within this plan.

Indigenous People

Nothing in this plan prejudices the interests of the indigenous people of Tasmania and their cooperation and inclusion in this plan has been keenly sought.

Social and Economic Impacts

In the formulation of the Actions identified in this plan, potential adverse social or economic impacts have been considered. This plan aims to ensure that development within Tasmania is ecologically sustainable with respect to the management of both eagle species.

Landowners and managers have a legislative obligation to manage threatened species and biodiversity occurring on private land. The financial costs experienced by some industries in the management of eagles constitute an obligation to ecologically sustainable development and would apply in the absence of this plan. State and Commonwealth legislation and other policies determine many of these obligations.

The potential cost to windfarm proponents for mitigation and compensation for injured eagles are now identified as part of the permit requirement for operation.

If all known existing nests of both species were protected by the current endorsed management prescriptions adopted by the forest practices system (developed from Mooney and Holdsworth, 1991 and expert opinion, N. Mooney pers. comm.), the total area reserved would be approximately 20,000ha, scattered over most tenures including land already or otherwise reserved. The area of land required for the adequate protection of eagle nests is therefore insignificant by comparison to the area available for residential, agricultural, commercial or industrial uses and it is unlikely to have any adverse economic impact on a state-wide scale. Individual landowners may be affected where multiple nests or the habitat for multiple threatened species occur on one property. The financial implications may then become significant. Many nest reserves established under the Forest Practices system are incorporated into wildlife habitat strips, stream-side reserves or are on land not suitable for forestry operations. On private property (not subject to forestry operations) nests are often situated in rugged or remote terrain not suitable for agriculture. Landholders are encouraged to adopt voluntary protection measures or enter into management agreements. Provisions for compensation are available for individual landholders that are economically affected by nest protection measures. Compensation provisions are made under the *Nature Conservation Act 2002* for the refusal or amendment of Forest Practices Plans or the refusal to grant Private Timber Reserve status to land.

Biodiversity Benefits

The Wedge-tailed Eagle and White-bellied Sea-eagle are species attracting much public interest and as such are icons. Icon threatened species are important in the delivery of the biodiversity conservation message to the general public. Many other species will benefit from the awareness of the public about threatening processes and how these two species are affected by human actions.

Benefits to other species will also arise from the reservation of areas of old growth forest (eagle nest reserves). Endangered species such as the Masked Owl (*Tyto novaehollandiae castanops*), Grey Goshawk (*Accipiter novaehollandiae*) and Swift Parrot (*Lathamus discolor*) will benefit from the management of eagle species, particularly where there is overlap in preferred nesting and/or foraging habitat. Nest reserves often incorporate riparian forest that may be suitable nesting habitat for Grey Goshawks, as well as large hollow-bearing trees suitable for nesting Masked Owls. Other species advantaged include, hollow nesting birds and mammals, (parrots, owls, owlet nightjar, bats and possums), and terrestrial vertebrates and invertebrates will benefit from the provision of undisturbed old-growth forest habitat. Other raptors may also benefit through the provision of nesting habitat and maintenance of prey populations. However, due to the small size of reserves, it is likely that the available habitat of any of these species would be only slightly increased through the management of nest reserves.

Mitigation of electrocutions and collisions will benefit many bird species (including threatened species such as the Grey Goshawk, *Accipiter novaehollandiae* and Masked Owl, *Tyto novaehollandiae castanops*) by reducing the incidence of these sources of unnatural mortality.

Education of the public and landholders in the ecological role and management of eagles will extend benefits to other wildlife species through better public understanding and appreciation of wildlife generally.

DISTRIBUTION AND LOCATION

Distribution

Wedge-tailed Eagle

The Wedge-tailed Eagle is distributed throughout Tasmania with the notable exceptions of King Island and the smaller islands of Bass Strait. The species forages in all habitats from coastal dunes to mountain peaks. However, nesting habitat is generally restricted to forests of predominantly mature forest (almost exclusively eucalypt forest) on sheltered aspects. There is no known movement between Tasmania and the mainland. Figure 1 (Appendix 2) shows the currently known nest distribution.

White-bellied Sea-eagle

The White-bellied Sea-eagle has a more restricted distribution, usually occurring and nesting within 5km of the coast, estuaries or large inland lakes. They are present on most of the islands of Bass Strait and are believed to have the ability to island-hop between Tasmania and the mainland. Figure 2 (see Appendix 2) shows the distribution of known White-bellied Sea-eagle nests (not including the smaller Bass Strait islands).

Both eagle species are found across all three Natural Resource Management Regions. Although there may be some variation in the severity of threats within different regions or parts of regions, species management issues are essentially the same throughout Tasmania.

Reasons for Listing and Habitat Critical to the Survival of the Species

Wedge-tailed Eagle

The Tasmanian Wedge-tailed Eagle is listed as endangered under Schedule 1 of the **Commonwealth Environment Protection and Biodiversity Conservation Act 1999** and Schedule 3.1 of the **Tasmanian *Threatened Species Protection Act 1995**.

The Tasmanian population is listed for the following reasons;

- It has a population of less than 1000 mature individuals,
- The population may be declining,
- The population is subject to a number of identified and ongoing threatening processes,
- It occurs in a single island population, and
- It is a distinct subspecies.

Habitat critical to the survival of the Tasmanian Wedge-tailed Eagle is defined by nesting habitat (see Mooney & Holdsworth 1991, Brown & Mooney 1997), as forests of predominantly old growth trees greater than 10ha in area and occurring on sites sheltered from prevailing strong winds. Trees selected for nesting are greater than 27m in height, with few exceptions. Most nest sites have an eastern, south-eastern or southern aspect and the height of the nest is usually positioned below that of the ridge to the windward side. In north-west Tasmania, aspect plays a minor role in the positioning of nests: due to the low relief of the region, nests are instead generally sheltered by their position within the forest canopy. Although the species is capable of foraging in forest, the density of the sub-canopy and ground vegetation will influence the availability of prey. Eagle density is therefore understood to be lower in the western and south-western areas of the State (less than half that in the east), where forests tend to be lower and scrubbier.

White-bellied Sea-eagle

The White-bellied Sea-eagle is listed in Tasmania as vulnerable under Schedule 3.1 of the **Tasmanian Threatened Species Protection Act 1995** and listed under the **Environment Protection and Biodiversity Conservation Act 1999** as a Migratory species. The White-bellied Sea-eagle has been listed as a threatened taxon on Schedule 2 of the **Victorian *Flora and Fauna Guarantee Act 1988***. Its conservation status in South Australia is vulnerable. It has a range extending from Tasmania through South-east Asia to India within which no subspecies are recognised, although there is a clear cline in size from small tropical eagles to large temperate eagles.

The Tasmania population is listed for the following reasons;

- It has a population of less than 1000 mature individuals,

- The population may be declining,

- The population is subject to a number of identified and ongoing threatening processes, and

- It occurs in a single population in Tasmania.

Exchange of individuals between Tasmania and the mainland, although limited, maintains a similar gene pool (Shephard *et al.* 2005).

Again critical habitat for the survival of this species is defined by nesting habitat. The White-bellied Sea-eagle has less specific nesting requirements, though it will favour larger trees when available, especially on mainland Tasmania and large islands. Generally, this species nests in mature forests within 5km of a large water body or more rarely on sea cliffs and rock stacks. Occasionally on offshore islands, they nest in low coastal scrub where cliffs or tall trees are not available. Large estuaries and convoluted coastlines are the favoured sites for both nesting and foraging as these provide a longer interface between land and water. Density is lower on the west and south coasts, possibly due to the lack of forest sheltered from high winds.

Both species

Areas of land that contain no or few nesting sites but available prey (eg. Cape Portland) will be important survival sites for immature and other non-territorial eagles (see Hunt 2002). These two, essentially nomadic, demographic groups provide an essential buffer against adult mortality in the population (Newton 1979) but because of the large land area involved and the mobility of these birds, security of such areas can not be assured. However, it will be important to ensure through public education and monitoring that in these areas, as in all others, unnatural mortality is minimised.

In neither species are there any known regular travel routes, as breeding birds are territorial year round and immature and sub-adult birds are considered nomadic as on mainland Australia (known movements are summarised in Marchant & Higgins 1993). Movement and dispersal of non-territorial birds is poorly understood. Neither species can be divided into discreet sub-populations because, although there are island populations, free exchange with the Tasmanian mainland population occurs.

Mapping of Habitat Critical to the Survival of the Species

Wedge-tailed Eagle

High quality nesting habitat free from disturbance is one of the limiting factors governing population size and density (Bell and Mooney 1998). Eagles nesting in habitat subject to disturbance or of poor quality (ie. low forest height, exposed aspects, and forest in poor health) have lower breeding success, greater frequency of nest failures and more unused nests per territory (Mooney & Holdsworth 1991). Predictive

habitat modelling of Wedge-tailed Eagle nesting habitat has proven to be a successful means of locating nesting sites prior to land development (Brown & Mooney 1997, WEB unpublished data).

Although modelling has the ability to identify potential nesting habitat, the distribution of existing nests and prioritisation of identified habitat using regional nearest neighbour distances is required to establish critical habitat. Regularity of nest spacing is a widely recognised feature of raptor nesting behaviour (Brown 1976, Newton 1979, Olsen 1995). Current critical habitat could be mapped by assigning a 20ha buffer around each known nest. This method, however, would not represent the best reserve design and would not allow for the large number of nests that certainly exist but are not currently known. Critical habitat mapping should also provide for future nesting sites because of the dynamic nature of nests and nesting sites. Additionally, eagles may require a number of nest sites or potential nest sites within each territory to ensure that breeding is regular and successful.

Management of habitat critical to the survival of these species should aim to ensure that within each home range there are a number of existing nest sites, a number of potential sites and a number of sites that will be suitable in the future.

White-bellied Sea-eagle

Modelling of the nesting habitat of the White-bellied Sea-eagle has been conducted for the Tasman and Forestier Peninsulas and Bruny Island (Thurstans 1998) and is to be refined and verified (Thurstans pers. comm.). This modelling has not been tested in other areas.

Important Populations

The Tasmanian subspecies of the Wedge-tailed Eagle occurs only in Tasmania and as a single population. It is considered that the White-bellied Sea-eagle effectively occurs as a single population in Tasmania. The mobility of both species strongly indicates free movement throughout the State.

THREATS

Threats

Threats to the Wedge-tailed Eagle are identified in the Wedge-tailed Eagle Recovery Plan 1998-2003. Many of these threats also apply to the White-bellied Sea-eagle. The threats identified or suspected for eagles in Tasmania are shown in Table 1.

Table 1.   Threats identified and/or suspected as affecting eagle species in Tasmania.

Threat	Species	Source
Loss of habitat, specifically nesting habitat	Wte Wbse	Bell & Mooney (1999) Mooney (1988a, 1996, 1997 & 2000) Mooney & Holdsworth (1991) Mooney & Taylor (1996) Thurstans (2003)
Nest disturbance	Wte Wbse	Bell & Mooney (1999) Mooney (1986a & c, 1988a & b) Mooney & Holdsworth (1991) Mooney & Taylor (1996)

Unnatural Mortality
  Persecution
          -shooting
	Wte
	Wbse
		Mooney (1986b, 1997)
		Mooney & Hunt (1983)
		Turner & Thurstans (2000)
		WEB unpublished data

-poisoning	Wte Wbse	Mooney (1986b, 1997) Mooney & Hunt (1983) Olsen et al. (1993, wbse)
-trapping	Wte Wbse	Mooney (1997) Mooney & Hunt (1983) WEB unpublished data

Collision
        -powerlines
        -vehicles
        -fences
        -wind turbines
	Wte
	Wbse
		Bell & Mooney (1999)
		Hess (1996 & 2000)
		Mooney (1986b, 1997)
		Mooney unpublished data
		Eagle Mortality Reports, Bird and Bat Monitoring Plans, WEB unpublished data

Electrocution	Wte Wbse	Bell & Mooney (1999) Hess (1996 & 2000) Mooney (1997) WEB, unpublished data
Oiling	Wbse	J. Wiersma, unpublished data,
Entanglement	Wbse	WEB, unpublished data
Pollution	Wbse	Olsen (1995) Pirzl & Coughanowr (1997, indicate toxins likely to affect eagles)
Decline in mean age of the population	Wte	Bell & Mooney (1999)
Decline in recruitment	Wte Wbse	Bell & Mooney (1999, wte) suspected for wbse

Areas under Threat

Wedge-tailed Eagle

On a large scale, no specific areas are under particular threat, as threats are spread more or less across the entire range, but urbanised areas are avoided and many nests particularly in more populated areas are under threat. However, large-scale plantation development, particularly where native forest conversion is involved may reduce the quality of foraging habitat by reducing prey availability and subsequently reduce productivity even under current management strategies. Strategic planning for maintenance of prey availability is required.

White-bellied Sea-eagle

White-bellied Sea-eagles are concentrated in estuarine areas around Tasmania many of which are the sites of significant residential, tourist and industrial developments and recreational pursuits. These activities, acting alone or in combination, pose a potentially significant threat to the survival of this species through nest disturbance or depletion of available habitat. The absence of forest regeneration on productive coastal land depletes the potential nesting habitat necessary for future nest establishment. Intact habitat is important for replacement of nests lost to succession or abandonment (Thurstans 2003).

Both Species

There may be local population sinks created by elevated levels of risk posed by one or more threats. For example, a particular power pole may be responsible for ongoing electrocutions or individuals may systematically persecute eagles in an area, both situations resulting in a localised population sink. Land tenure of nest sites is no longer a useful guide to the level of likely threat due to the large number of potential threats acting on this species and the variety of ethics and styles involved in land management. There is also potential for wind farms to create population sinks, unless sited carefully.

Populations under Threat

Both species occur in single populations. Although there are populations on the major Bass Strait islands of both species, it is believed that there is regular exchange between these populations and mainland Tasmania. While some threatening processes will be focussed in particular areas (eg. population sinks caused by localised persecution or estuarine pollution), all threats will have flow-on effects for the entire population by reducing survivorship and/or breeding success.

RECOVERY OBJECTIVES

Recovery Objectives

The objectives of this recovery plan are to increase the breeding success and security of both eagle populations by protecting nesting habitat from destruction and disturbance, minimising the modification of foraging habitat and by minimising the occurrence of human-related mortality.

The Recovery Plan will run for five years from the date of first funding.

Specific Objectives

- Increase the effectiveness of predictive habitat models for application State-wide.
- Increase the proportion and number of nests found prior to land development on all tenures, including, but not restricted to forestry operations and land clearance.
- Reduce the proportion of nests subject to disturbance.
- Identify human-induced causes of breeding failure and mitigate against such causes.
- Increase breeding success.
- Increase the number and/or density of active territories.
- Develop and apply protocols for effective eagle management during all land development.
- Monitor the implementation and effectiveness of management prescriptions.
- Implement prescriptive nest reserves for conserving nesting habitat.
- Identify new threats and implement strategies for their mitigation.
- Reduce the occurrence of eagle mortalities and injuries (in number and proportion), particularly those attributable to human activities.
- Reduce the number of eagle collisions and electrocutions caused by wind and power structures in the energy sector.
- Respond to inquiries for information on eagle management by affected interests and the public.
- Undertake research into eagle biology that targets improved species management.

Performance Criteria

- Demonstrate the effectiveness of predictive habitat models for regional application.
- Demonstrate an increase in the proportion and number of nests found prior to land development on all tenures.
- Demonstrate a reduction in the proportion of nests subject to disturbance.
- Demonstrate an increase in breeding success.
- Demonstrate an increase in the number or density of active territories.
- Implement protocols for effective eagle management during all land development.
- Demonstrate the effective implementation of prescriptive nest reserves for conserving nesting habitat.
- Identify new threats and implement strategies for their mitigation.
- Demonstrate a reduction in the occurrence of eagle mortalities and injuries (in number and proportion), particularly those attributable to human activities.
- Identify human-induced causes of breeding failure and demonstrate effective mitigation against such causes.
- Demonstrate an active role by the electricity industry in reducing the number of eagle collisions and electrocutions.

- Respond to inquiries for information on eagle management by affected interests and the public.
- Publish the results of research and management in refereed scientific journals.

Evaluation of Success

- The following will be responsible for evaluating the performance of the recovery plan;
  - o Project Officer -Threatened Eagles,
  - o Threatened Eagle Recovery Team,
  - o Manager, Threatened Species Section (Biodiversity Conservation Branch, DPIW), and
  - o Australian Government Department of Environment and Water Resources.

Project Continuity

The implementation of this recovery plan requires the continuity of a full-time Scientific Officer and all operating costs over the life of the plan. Eagle management issues, relating to the forest industry, public inquiries, industrial developments and eagle injuries and mortalities are continually arising and require specialist knowledge and a significant time commitment for successful resolution. Eagles, being an iconic species, always attract a high level of public interest and requests for public talks are frequent. The maintenance and availability of current databases on eagles is essential for effective and efficient management of both species and requires the constant attention of a dedicated position.

Continuity is also important in the maintenance of momentum of eagle conservation actions. The capacity for this vital work to be taken-up by the State conservation agency or non-government conservation organisations is very limited.

RECOVERY ACTIONS

Summary

1. Strategic Planning

    1.1 Develop and Facilitate the Application of Predictive Habitat Models

    1.2. Map and Search Strategic Areas of Habitat

    1.3. Search for Nests Prior to Disturbance on all Land Tenures

    1.4. Identify New Threats and Mitigation Measures Required

2. Habitat Protection

    2.1. Protect all Nests on all Land Tenures

    2.2. Review and Update Nest Management Prescriptions

    2.3. Develop Protocols for Eagle Management Applicable to all Land Development

3. Monitoring

    3.1. Maintain and Develop Databases

    3.2. Monitor Reports of Mortality and Injury

    3.3. Survey Breeding Success

    3.4. Monitor the Impacts of Development

4. Mitigation

    4.1. Facilitate Mitigation Measures for Mortalities and Injuries

    4.2. Reduce Eagle Mortality on Electrical Infrastructure

5. Education and Extension

    5.1. Promote Eagle Conservation

    5.2. Recover and Rehabilitate Injured Eagles

6. Research

    6.1. Assess the Effectiveness of Current Management Prescriptions

    6.2. Analyse and Prepare Data on Eagle Biology and Management for Publication

    6.3. Investigate Eagle Breeding Dynamics

1. Strategic Planning

1.1. Develop and Facilitate the Application of Predictive Habitat Models

Predictive habitat modelling techniques are well advanced and will be developed further for application to all bioregions over the life of this Plan. Mature forest coverage in the form of PI-type mapping (vegetation mapping derived from aerial photography) is required in electronic form for the completion of the models. Forestry Tasmania and Private Forests Tasmania are the owners of PI-type data on public and private land, respectively.

Predictive habitat modelling will be further developed for White-bellied Sea-eagles. This will include expanding the coverage from the current extent (Tasman and Forestier Peninsulas and Bruny Island) to other regions. Separate models will be developed to identify prime habitat and areas with suitable topographical characteristics where rehabilitation could help to provide prime habitat in future.

The Threatened Species Section will promote the application of successful models to proponents of land development.

Funds are required to purchase data and GIS software.

1.2. Map and Search Strategic Areas of Habitat

Verification and refinement of habitat models is required for their efficient and effective application. Gaps in the known nest distribution will be identified and targeted for mapping and strategic searches. Data collected will be used as feedback into models to aid in their refinement. Nests located in undisturbed habitat will be strategically protected, (ie. management of development within 1000m of such nests will be governed by nest protection considerations as a priority). One such area will be targeted in each year of the plan.

Funds are required for technical support, for mapping, vehicle hire, and travelling allowance.

1.3. Search for Nests Prior to Disturbance on all Land Tenures

Where suitable habitat is identified, nest searches should be conducted for all land tenures prior to land development. The Threatened Species Section will provide the appropriate training, tools and advice.

In the planning of forestry operations this action will be supervised by the Senior Ecologist, Forest Practices Authority via the Forest Practices System. The Threatened Species Section will continue to provide advice to the Forest Practices Authority ecologists and the forest industry on nest management and eagle conservation. The Threatened Species Section will assess searches arising from other developments.

Funds are required for technical support, for mapping, vehicle hire and travelling allowance.

1.4. Identify New Threats and Mitigation Measures Required

Monitoring of breeding success, mortality, injuries and land development proposals will help to identifying new or potential threats to either eagle species. Disease is one such potential threat. The West Nile Virus, recently introduced into North America, has caused many raptor deaths and poses a severe threat to endangered species such as the Californian Condor (Chu et. al. 2003). A local example of an unexpected threat is the spread of Tasmanian Devil Facial Tumour Disease, which has resulted in significant depletion of the once secure Tasmanian Devil (*Sarcophilus harrisii*) population. A strategy for mitigation will be developed for each newly identified threat.

2. Habitat Protection

2.1 Protect all Nests on all Land Tenures

The Threatened Species Section will ensure the adequate protection of all eagle nests through the provision of expert advice to the Forest Practices Authority zoologists, the forest industry and private landholders. Protection of nests subject to forestry operations will be provided through the implementation of prescriptions set out in Forest Practices Plans (FPP). Under this system nest reserves are implemented and managed under the FPP and must be retained beyond the life of the FPP. The owners or mangers of private land containing nests will be referred to the Private Property Conservation Program, provided with information on eagle conservation and management and actively encouraged to provide long-term nest protection through covenants. Regeneration and restoration of nesting habitat will be encouraged on both public and private land, where possible.

Funds are required for vehicle hire and travelling allowance.

2.2 Review and Update Nest Management Prescriptions

Updating of nest management prescriptions for the forest industry will continue. SAC endorsed prescriptions, delivered via the Threatened Fauna Adviser (Forest Practices Board 2001) are reviewed and revised every five years as required under the Regional Forest Agreement. However, the Threatened Species Section conducts continual assessments of procedures and improvements are recommended to the Forest Practices Authority.

New data arising from rigorous review of the effectiveness of reserves will form the basis for improved management prescriptions. A comprehensive nest management policy is required across all land tenures, planning schemes and land management activities. The Threatened Species Section, in collaboration with other affected interests, will undertake a review of the current nest management prescriptions and their suitability for application beyond the forest industry. The outcomes of Action 6.2 will form the basis for the policy and this review.

2.3. Develop Protocols for Eagle Management Applicable to all Land Development

Land development, of any size, has the potential to disrupt breeding and/or result in the loss of nesting habitat. Disturbance may result in the effective loss of habitat. Protocols have been developed for the prevention, mitigation, monitoring and research into the impacts of developments on eagles (e.g. wind farm and pipeline construction). Protocols have also included provision for compensation for these impacts. The specific aim of compensation is to off-set the impacts with positive gains for the species as a whole (ie. applying net-gain and mitigation principles). The Threatened Species Section will provide advice on the appropriate expenditure of any compensation funds.

The Threatened Species Section will develop a comprehensive nest management policy for application across all land tenures, planning schemes and land management activities. Existing protocols need refinement to be applicable to all land development where existing planning processes do not adequately account for eagle management. Implementation of these measures is the responsibility of the project proponent under the guidance of the Threatened Species Section. Eagle management prescriptions for proposed developments will be included, where appropriate, in environmental permit conditions. The measures required will be determined by the Threatened Species Section through the Conservation Assessment Section and other sections of RMC and the Environment Division, DTAE. Results from the analysis of data collected on threatening processes will form the basis for the refinement of existing and the development of new mitigation measures. Prescriptions are required for the protection of White-bellied Sea-eagles from threats arising from the operation of fish farms (eg. nets and offal pits), tourism ventures and the subdivision of land. The latter should be controlled at the Local Government level as described below. Thurstans (2003) has highlighted the impact that lack of knowledge coupled with poor local planning can have on the viability of White-bellied Sea-eagle nests, having found 33% (10 of 30) of missing nests being due to human activities.

There is currently a lack of adequate provision for the management of threatened species at the Local Government level. Local Government is responsible for the zoning of land and the allocation of subdivision and building permits for residential and industrial developments under the *Land Use Planning and Approvals Act 1993*. It is therefore vital that they are provided with appropriate information and assisted in developing the mechanisms to assess and manage threatened eagle issues at the local level. The Threatened Species Section will provide advice and guidance on eagle management and assist in the development of threatened eagle provisions to be included in planning schemes.

Funds are required for vehicle hire and travelling allowance.

3. Monitoring

3.1. Maintain and Develop Databases

There are currently 575 confirmed Wedge-tailed Eagle nests of a total record of 746 of which some no longer exist and some are yet to be confirmed. Of the 225 White-bellied Sea-eagle nests recorded, data is limited on nest condition and accuracy; therefore many nests may no longer exist. The maintenance and availability of current databases on eagles is essential for effective and efficient management of both species. Recent data for Wedge-tailed Eagles is of a high standard but that for White-bellied Sea-eagles needs verification and updating as 30% of 83 nest records checked in 2003 were not present or documentation was inaccurate (Thurstans 2003). The status of many nests of both species needs to be reassessed and the coordinates of sites accurately recorded. Some nest locations will be assessed as part of routine surveys conducted by Forest Practices Officers and Fauna Officers. Accurate location of nests is essential for their management and aids in the refinement of habitat models. Further searching for White-bellied Sea-eagles nests is necessary because knowledge of nest distribution is incomplete and limited.

3.2. Monitor Reports of Mortality and Injury

Reports of eagle mortalities and injuries will be investigated to determine the ultimate causes. A database will be maintained on all eagle mortalities and injuries. The data will be used in the assessment of threatening processes and for directing effective mitigation. Data will be collated and analysed for publication. It is difficult to anticipate the requirements for this Action due to the unpredictable nature of these events, however, two weeks in each year has been allowed.

Funds are required for vehicle hire and travelling allowance.

3.3. Survey Breeding Success

Surveys of breeding success will be conducted in each of the five years of this Recovery Plan, with targets of 100 Wedge-tailed Eagle and 50 White-bellied Sea-eagle nests. Consecutive years of data are important for determining the natural fluctuations in breeding success of the two eagle populations and to establish meaningful trends. Data collected over consecutive years is also necessary because there is a time lag between a drop in breeding success and its eventual effect on a population (Lamberson *et al.* 1992). Surveys will aim to determine breeding success, proportion of active to inactive nests/territories, the extent and causes of breeding failure and assist in the determination of the effectiveness of nest management prescriptions. In order to achieve this, the outcome of breeding at active nests must be recorded. Therefore, surveys will be conducted twice during each breeding season, one early (Sept) and one mid to late season (Nov to Dec). It is important to target a sample of nests from isolated sites as a measure of breeding success in the absence of significant disturbance (eg. White-bellied Sea-eagle nests on off-shore islands). It is important that this survey work is conducted by trained and experienced persons to avoid undue disturbance to breeding eagles.

Additional breeding data may be available through the forest industry, which undertakes activity assessments of nests potentially affected by forestry operations. However, this data may not be of the same standard (ie. nests are generally only surveyed once each season to determine nest activity and this may not indicate nest success) and may only be suitable as supplementary data.

Road counts of both eagle species will be conducted with the aim of establishing the population structure and correlating breeding success with observations of juveniles.

The opportunity exists for the inclusion of the Commonwealth Department of Defence in the recovery of the Wedge-tailed Eagle through its Departmental Environment Instruction No 15/2002 (see above under Affected Interests). This document identifies monitoring of breeding success as and reducing unnatural mortality as Recovery Plan Actions to be pursued. The Threatened Species Section will liaise with the Department of Defence to establish a program for the department's involvement.

Funds are required for technical support, for the charter of fixed-wing aircraft, vehicle hire and travelling allowance.

3.4. Monitoring the Impacts of Development.

Surveys and on-going monitoring will be designed to target nests potentially affected by developments. These surveys may be conducted in conjunction with monitoring regimes established under Action 2.3. This investigation will aim to establish appropriate buffer distances for disturbance and so provide feedback to protocols and supporting information for future developments.

Funds are required for vehicle hire and travelling allowance.

4. Mitigation

4.1. Facilitate Mitigation Measures for Mortalities and Injuries

Investigation of the causes of eagle mortalities and injuries will identify trends in mortalities and injuries allowing the causes to be targeted for mitigation measures. Facilitation will involve negotiation with electricity distributors, landholders and wind farm proponents.

Protocols for the use of poisons are required to address primary and secondary poisoning of eagles. DPIW is responsible for the issue of poisoning permits. The Threatened Species Section will consult with relevant staff to develop protocols covering the use of poisons for vertebrate animal control, reporting and carcass removal.

Funds are required for vehicle hire and travelling allowance.

4.2. Reduce Eagle Mortality on Electrical Infrastructure

Electrocutions and collisions have been identified as the major source of unnatural mortality in eagles (proponent reports, WEB, unpublished data). Sufficient data exists on preventative and mitigation measures (Hess 2000) for there to be an immediate response from the electricity supply industry. A Public Authority Management Agreement (under Section 31, *Threatened Species Protection Act 1995*) is one mechanism to achieve cooperative protection of eagles. Such an agreement will be actively pursued by DPIW with the electricity supply industry to address the threats to eagles of electrocution and collision with electricity infrastructure. This agreement will include the active collection and recording the details of eagle incidents and identify measures required to prevent or mitigate against such events. The agreement will require the maintenance of a database on measures taken in response to each incident, identify the locations of infrastructure of potential threat and to implement a schedule for its conversion to bird-safe configurations. Infrastructure identified as an electrocution risk to eagles will be considered highest priority for implementation.

Windfarm permit conditions specify actions for monitoring and mitigating against the high incidence of eagle collision with windfarm structures. Any breach of the permit conditions may lead to the issuing of an Environment Protection Notice under EMPCA requiring the proponent to instigate a range of immediate mitigation measures including turbine shutdown procedures.

Funds are required for vehicle hire and travelling allowance.

5. Education and Extension

5.1. Promote Eagle Conservation

Promotion of eagle conservation and public education are vital in the efforts to reduce the incidence of unnatural mortality and injuries. Better public awareness increases the likelihood of injured or dead eagles and illegal activities being reported and encourages the involvement of the public in conservation efforts. The high public profile of eagles will be maintained through all forms of media (e.g. public lectures, articles for newspapers and conservation newsletters, Web sites, television and radio coverage of eagle issues, research and rehabilitation).

The 'Eagles on Farms' brochure (Anon. 1996) has proven to be an important vehicle in the dissemination of information on the ecology and importance of eagles and in promoting appropriate management practices. Updating and reprinting of the brochure will be required in Year One.

A brochure or information pack is necessary to inform amateur naturalists, tour operators and landowners about Sea-eagle nest management. Funds will be required for brochure preparation and printing. This information is particularly important for White-bellied Sea-eagles as this species has more conspicuous nests in closer proximity to urban development and uncontrolled human activities.

The Threatened Species Section will continue to contribute to training courses for the forest industry.

Funds are required for brochure preparation and reprinting.

5.2. Recover and Rehabilitate Injured Eagles

Many reports are received each year from interested and concerned members of the public, government staff, other organisations and veterinarians about injured eagles. A dedicated program will be developed to recover injured eagles, and initiate rehabilitation, where possible, and determine the causes of the incidents. The Biodiversity Conservation Branch has a network of raptor carers around the State who are essential to the successful recovery and rehabilitation of eagles. VHF transmitters will be attached to rehabilitated eagles on release to determine survival and movements, if and when the opportunity arises. Radio-tagged eagles will be monitored at regular intervals to determine the success or otherwise of rehabilitation efforts. Data may also be obtained on eagle movement and dispersal. Involvement of volunteers in tracking eagles will significantly increase the quantity and usefulness of data gathered in this way.

Funds are required for vehicle hire, travelling allowance, purchase of telemetry equipment and veterinary expenses.

6. Research

6.1. Assess the Effectiveness of Current Management Prescriptions

Management actions to aid the conservation of eagle nesting habitat in areas subjected to forestry activities have been under continual review since they were first introduced by Mooney in the late 70's. Mooney and Holdsworth (1991) studied the effects of disturbance on eagle breeding success and made recommendations that resulted in the adoption of the current reserve design. Since this work, Mooney and Taylor (1996) undertook monitoring work looking at the effectiveness of the nest reserve. However, apart from collection of anecdotal information over many years on individual nests as part of the day to day management, there has been no systematic monitoring of the effectiveness of eagle conservation management prescriptions. In the last seven years these prescriptions have been developed considerably and now include a range of protective measures, in addition to the establishment of nest reserves. Preliminary results indicate that they are being implemented (Munks *et al.* unpublished data), but further information is required on whether or not they are meeting conservation objectives.

The success of these measures must be known to determine if the current management of the species is effective and to enable the identification of aspects requiring improvement. A study of the long-term effectiveness of the minimum nest management prescriptions in maintaining nest activity and breeding success in the long-term is therefore essential. A systematic survey, based on the methods of Mooney and Holdsworth (1991, reserve size verse breeding success) and Mooney and Taylor (1996, breeding success verse disturbance category) will be designed to collect the required data. The results of these studies will provide essential input for the refinement of nest prescriptions. Many nest reserves have been in place since the recommendations of Mooney and Holdsworth (1991) were adopted by the forest industry. There has been a gradual improvement in the implementation of those prescriptions (Mooney 2000), however, generally the only minimum 10ha reserve around nest site is applied (ie. Mooney & Holdsworth (1991) recommended 20ha in total). A reserve area of 10ha intact forest was accepted, in combination with the application of disturbance buffers (500m and 1000m line-of-sight) in the breeding season. The success of these measures must be known to determine if the current management of the species is effective and to enable the identification of aspects requiring improvement. A study of the long-term effectiveness of the minimum nest management prescriptions in maintaining nest activity and breeding success is therefore essential. A systematic survey, based on the methods of Mooney and Holdsworth (1991, reserve size verse breeding success) and Mooney and Taylor (1996, breeding success verse disturbance category) will be designed to collect the required data. The results of these studies will provide essential input for the refinement of nest prescriptions.

This project would be undertaken in conjunction with Forest Practices Authority staff with support from the forest and electricity industries.

Funds are required for technical support, for vehicle hire and travelling allowance.

6.2. Analyse and Prepare Data on Eagle Biology and Management for Publication

Over the course of the previous Recovery Plan much data has been collected on various aspects of eagle biology and management. Data includes causes of mortalities and injuries, breeding success, effectiveness of disturbance mitigation, rehabilitation and behavioural observations.

There is some conjecture about the validity of the subspecific status of the Tasmanian Wedge-tailed Eagle (Marchant & Higgins 1993; Olsen 1995; Olsen in Garnett & Crowley 2000). A large collection of eagle carcasses is available for the analysis of morphometry and gender differences. There is also potential for the use of these carcasses for other studies such as genetic analysis (eg. graduate or post-graduate studies). It is important to make full use of this resource. Data on breeding success and population structure will be collated and used to prepare a robust estimate of population size.

Funds are required to employ a Scientific Officer.

6.3. Investigate Eagle Breeding Dynamics

There are a number of areas in Tasmania where the proportion of inactive nests is unnaturally high. Such occurrences are understood to be the result of historically high levels of disturbance. In these areas identification of existing and potential nesting habitat becomes difficult due to the breakdown in the reliability of nearest neighbour distances as a predictor. Disturbance of nesting eagles may result in movement to an alternative nest site and this movement may influence the nest use and breeding success of neighbouring eagles. It is not known how quickly eagles resume breeding following nest disturbance but it is likely to be strongly influenced by the availability and quality of alternative sites and the timing of disturbance. An understanding of the factors influencing movement between nest sites and the affects on neighbouring eagles will assist in improving the management of nests sites and in the location of new and alternative nests sites.

An investigation into eagle breeding dynamics particularly targeting the response of eagles to disturbance and displacement is therefore warranted.

The recent outbreak of facial tumour disease in the Tasmanian devil and the introduction of foxes may influence the eagle population size. A lowering of devil numbers may result in higher carrion abundance, which could act to increase eagle survivorship, particularly that of juveniles. However, the establishment

of foxes in significant numbers could have the opposite effect by locally reducing the range and availability of prey species.

Eagle breeding dynamics, movements and resource competition

The investigation will focus on randomly selected areas (eg. 20 x 20km) containing nesting habitat. Each area will be modelled and potential nesting habitat mapped. All nests within the area will be located by aerial searches and the breeding activity monitored over at least three successive years. Sources of disturbance will be identified and monitored and their influence on nest activity and breeding success determined. Where data are available breeding success will be compared with the abundance of prey species and native and introduced carnivores.

The lack of detailed knowledge of territory utilisation and dispersal movements of eagles in Tasmania has been recently highlighted by the efforts to mitigate against the potential impacts of major development projects (eg. wind farms). Recent advances in GPS/Satellite transmitter design allow high quality data to be collected remotely for up to three years. Funds will be sought from a sponsor to enable the purchase of telemetry equipment and satellite access for this research. Experimentation approval will be required from the Animal Ethics Committee for the capture of eagles and the fitting of harness mounted transmitters.

To address this, a study of home range size and eagle dispersal will be undertaken should a sponsor be found. The use of GPS/satellite units allows high quality data to be collected with limited fieldwork, once eagles have been captured and tagged.

Funds are required, for technical support, for vehicle and helicopter hire and travelling allowance.

Implementation of all Actions

The implementation of all Actions will require funds for the employment of a full time Scientific Officer for the duration of the plan.

MANAGEMENT PRACTICES

- Identify high priority habitat and conduct surveys for nests prior to land development.

- Establish nest reserves according to revised prescriptions.

- Conduct nest activity assessments, by the established protocols, prior to potentially disturbing activities.

- Implement breeding season buffers against disturbance of 500m and 1000m in line-of-sight to protect nests from disturbance.

- Conduct surveys to monitor breeding success and the effects of disturbance.

- Install measures to prevent or mitigate against eagle electrocutions and collisions with electrical infrastructure.

- Implement nest site rehabilitation works where appropriate.

- Provide education for the general public, landholders and industry on the biology, conservation and management of eagles.

- Implement protocols for the use of poisons to prevent primary and secondary poisoning of eagles.

- Strategic planning will be undertaken to minimise the intensity and extent of disturbance activities in territories demonstrating a prolonged history of disturbance.

DURATION AND COSTS

Project Duration

This Recovery Plan will be effective for a period of five years from the date of adoption by the Commonwealth Government after which time a review will be undertaken.

Project Budget

The estimated yearly costs of the implementation of Recovery Actions are shown in Table 2 below.

Table 2. Budget employment and operating dissection.

	Proponent funds (in kind)	Other contributor funds	NRM funds sought	Totals
Year 1				
Employment	37,300	50,000	81,476	**168,776**
Operating	8,500	250,000	80,200	**338,700**
Totals	**45,800**	**300,000**	161,676	507,476
Year 2				
Employment	37,300	50,000	84,475	**171,775**
Operating	8,700	250,000	44,800	**303,500**
Totals	**46,000**	**300,000**	129,275	475,275
Year 3				
Employment	37,300	60,000	87,473	**184,773**
Operating	8,700	250,000	44,800	**303,500**
Totals	**46,000**	**310,000**	132,273	488,273
Year 4				
Employment	37,300	60,000	87,473	**184,773**
Operating	8,700	250,000	55,300	**314,000**
Totals	**46,000**	**310,000**	142,773	498,773
Year 5				
Employment	37,300	60,000	87,473	**184,773**
Operating	8,100	250,000	52,000	**310,100**
Totals	**45,400**	**310,000**	139,473	494,873
Project Totals	**229,200**	**1,530,000**	**705,470**	**2,464,670**

RECOVERY PLAN SCHEDULE

Time Allocation

The time allocated to each Action is shown in Table 3 below.

Table 3. Time allocation for Recovery Plan Actions.

Action	Year 1	Year 2	Year 3	Year 4	Year 5
1. Strategic Planning	weeks	weeks	weeks	weeks	weeks
1.1 Develop and Facilitate the Application of Predictive Habitat Models	5	5	5	5	5
1.2. Map and Search Strategic Areas of Habitat					
1.3. Search for Nests Prior to Disturbance on all Land Tenures	2	2	3	3	3
1.4. Identify and Investigate Potential New Threats		1	1	1	1
2. Habitat Protection					
2.1. Protect Nests on all Land Tenures	3	4	4	4	4
2.2. Update Nest Management Prescriptions for the forest industry	2	2	2	2	2
2.3. Develop Protocols for Eagle Management Applicable to all Land Development	4	4	4	4	4
3. Monitoring					
3.1. Maintain and Develop Databases	4	4	4	4	4
3.2. Monitor Reports of Mortality and Injury	1	1	1	1	1
3.3. Survey Breeding Success	4	4	4	4	4
3.4 Monitor the Impacts of Development	1	1	1	1	1
4. Mitigation					
4.1. Facilitate Mitigation Measures for Mortalities and Injuries	1	1	1	1	1
4.2. Reduce Eagle Mortality on Electrical Infrastructure	2	2	2	2	2
5. Education					
5.1. Promote Eagle Conservation	2	2	2	2	2
5.2. Recover and Rehabilitate Injured Eagles	1	1	1	1	1
6. Research					
6.1. Assess the Effectiveness of Current Management Prescriptions	5	3	4	4	5
6.2. Analyse and Publish Collated Data on Eagle Biology and Management	5	4			6
6.3. Investigate Eagle Breeding Dynamics	4	5	6	6	
Annual Leave/Public Holidays	6	6	6	6	6
Total weeks	**52**	**52**	**52**	**52**	**52**

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APPENDIX 1

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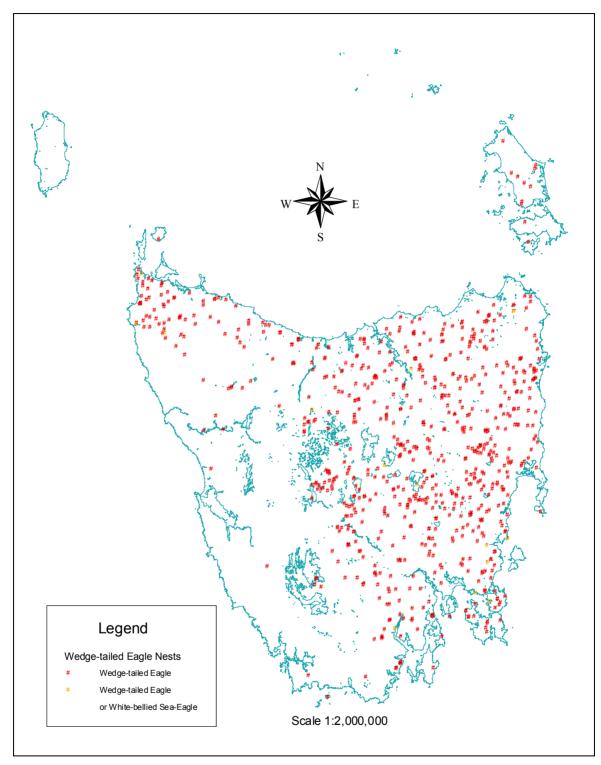   Ph: 6233 8173
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Figure 1: Distribution of known Wedge-tailed Eagle nests in Tasmania. Nests marked in orange are nests that have been used by Wedge-tailed Eagles and White-bellied Sea-eagles in different years. Large water bodies are shown.

Figure 2: Distribution of known White-bellied Sea-eagle nests in Tasmania. Nests marked in orange are nests that have been used by Wedge-tailed Eagles and White-bellied Sea-eagles in different years. Large water bodies are shown.
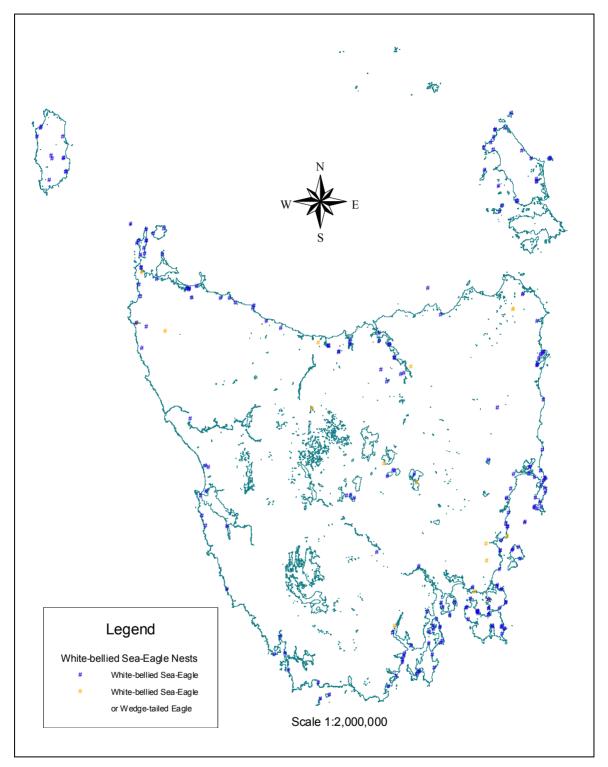
Australian Government

Department of the Environment and Water Resources

Addendum

In adopting this plan under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Minister for the Environment and Water Resources has approved the addition of the following information which is highlighted in red.

Actions Needed (pg 5)
7.   Strategic Planning
  ▪ Identify New and Mitigation Measures Required

Wind Farms (pg 8)
Guidelines and protocols were developed for the management of eagles and eagle nests in the vicinity of wind farms. A four tiered approach was adopted to manage the potential impacts on eagles, ie. mitigation, monitoring, compensation and research. An Environmental Protection Notice can be issued under the *Environmental Management and Pollution Control Act 1994* by the Director of Environmental Management (DTAE) if environmental harm has been or is likely to be caused by the activity.

Wind Farm Proponents **(pg 11)**
The proponents of wind farms are particularly affected by the management of these two species because of the high primary incidence of and potential for eagle fatalities and injuries from collisions with turbines. Secondary impacts from windfarms also relate to nest disturbance and the displacement of breeding pairs. There is growing level of knowledge about the response of these eagle species to wind turbines in the Tasmanian context, but much more information is needed.

Social and Economic Impacts (pg 12)
The potential cost to windfarm proponents for mitigation and compensation for injured eagles are now identified as part of the permit requirement for operation.

Threats (pg 12)

Collision	Wte	Bell & Mooney (1999)
-powerlines	Wbse	Hess (1996 & 2000)
-vehicles		Mooney (1986b, 1997)
-fences		Mooney unpublished data
-wind turbines		Eagle Mortality Reports, Bird and Bat Monitoring Plans, WEB unpublished data

Specific Objectives (pg 18)
  ▪ Reduce the number of eagle collisions and electrocutions caused by wind and power structures in the energy sector.

Performance Criteria (pg 19)
  ▪ Demonstrate an active role by the electricity industry in reducing the number of eagle collisions and electrocutions.

Summary (pg 20)
1.   **Strategic Planning**
        1.4. Identify New Threats and Mitigation Measures Required

1.4.   Identify New Threats and Mitigation Measures Required (pg 21)

Monitoring of breeding success, mortality, injuries and land development proposals will help to identifying new or potential threats to either eagle species. Disease is one such potential threat. The West Nile Virus, recently introduced into North America, has caused many raptor deaths and poses a severe threat to endangered species such as the Californian Condor (Chu et. al. 2003). A local example of an unexpected threat is the spread of Tasmanian Devil Facial Tumour Disease, which has resulted in significant depletion of the once secure Tasmanian Devil (*Sarcophilus harrisii*) population. A strategy for mitigation will be developed for each newly identified threat.

3.4.   Monitoring the Impacts of Development. (pg 24)

Surveys and on-going monitoring will be designed to target nests potentially affected by developments. These surveys may be conducted in conjunction with monitoring regimes established under Action 2.3. This investigation will aim to establish appropriate buffer distances for disturbance and so provide feedback to protocols and supporting information for future developments.

4.2.   Reduce Eagle Mortality on Electrical Infrastructure (pg 24)

Electrocutions and collisions have been identified as the major source of unnatural mortality in eagles (proponent reports, WEB, unpublished data). Sufficient data exists on preventative and mitigation measures (Hess 2000) for there to be an immediate response from the electricity supply industry. A Public Authority Management Agreement (under Section 31, *Threatened Species Protection Act 1995*) is one mechanism to achieve cooperative protection of eagles. Such an agreement will be actively pursued by DPIW with the electricity supply industry to address the threats to eagles of electrocution and collision with electricity infrastructure. This agreement will include the active collection and recording the details of eagle incidents and identify measures required to prevent or mitigate against such events. The agreement will require the maintenance of a database on measures taken in response to each incident, identify the locations of infrastructure of potential threat and to implement a schedule for its conversion to bird-safe configurations. Infrastructure identified as an electrocution risk to eagles will be considered highest priority for implementation.

Windfarm permit conditions specify actions for monitoring and mitigating against the high incidence of eagle collision with windfarm structures. Any breach of the permit conditions may lead to the issuing of an Environment Protection Notice under EMPCA requiring the proponent to instigate a range of immediate mitigation measures including turbine shutdown procedures.