Forty-Spotted Pardalote

Pardalotus quadraginatus

Recovery Plan 2006 - 2010

Australian Government

Tasmania

Acknowledgments

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

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Cover photo: Forty-spotted pardalote feeding on manna by D Watts
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Summary

Current Species Status

The forty-spotted pardalote is listed as endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and under Schedule 3.2 of the Tasmanian *Threatened Species Protection Act 1995*. Criteria used by the Commonwealth and Tasmanian governments for listing this species as endangered are similar and based on an area of occupancy totalling less than 500 km^2 which is severely fragmented and a continuing decline in the projected extent of habitat. A Tasmanian endemic, the forty-spotted pardalote is restricted to four main populations on offshore islands and peninsulas along the east coast. Populations are known from the south-east at Tinderbox and on Maria and Bruny Island, and also in the Bass Strait on Flinders Island. All populations, except for Flinders Island, occur in the Southern Natural Resource Management (NRM) Region. The Flinders Island population occurs in the Northern NRM Region. Estimates of the size of the population are below 4,000 individuals and the population is believed to have remained fairly stable over the decade between 1986 and 1997. The first Recovery Plan for the species was prepared in 1991 and expired in 1997.

Habitat Requirements and Limiting Factors

The forty-spotted pardalote inhabits lowland dry sclerophyll forests and woodlands that support a significant component of white gum (*Eucalyptus viminalis*) in the tree canopy layer. The species forages predominantly in white gum, which appears to be pivotal to the survival of individuals and breeding colonies. The loss, fragmentation and degradation of suitable habitat have probably caused the decline in populations. Grassy white gum forest in south-east Tasmania has been reduced by greater than 50% since European settlement and major clearing occurring along the coastal plains. Degradation of habitat on private land continues due to adverse fire frequencies and intensity, dieback and stock grazing. Invasion of habitat by aggressive and opportunistic species such as the noisy miner has followed in the wake of opening canopy cover and continuing fragmentation of dry sclerophyll forest.

Achievements of the 1991-1997 Recovery Plan

- Populations of the species and the area of known habitat were maintained.
- Additional colonies were identified on Flinders Island and at Kingston and Howden on the Tasmanian mainland.
- An area of 92 ha on Dennes Hill, Bruny Island was acquired by the Crown and proclaimed as a Nature Reserve. Dennes Hill is the most significant breeding colony on private land.
- A colony on private land at Walkers Hill on Flinders Island was acquired by the Crown through a land swap and proclaimed as a Nature Reserve.
- 280 ha of Crown Land on Flinders Island known to support the species was incorporated into the new Brougham Sugarloaf Conservation Area during the Regional Forest Agreement.

- At the beginning of the Recovery Plan 55% of the known habitat of the species was protected through reservation. During the life of the Recovery Plan a further 11% of the colonies by area were protected.
- Prescriptions for conservation of the species and its habitat were developed and incorporated into Forest Practices and Local Government planning processes.
- Several thousand white gum seedlings were grown and distributed to landowners. Plantings were undertaken in historically cleared areas of Dennes Hill Nature Reserve and experimental plots were established on cleared land and pasture on Bruny Island.
- A major publicity campaign resulted in a dramatic increase in public awareness in eastern Tasmania of the species and its plight and a subsequent Honours research project in 1999.

This Recovery Plan

Recovery Plan Objectives

- To protect and manage known colonies.
- To increase the size of the population.
- To increase the area of occupancy.
- To identify threats and quantify factors limiting expansion of colonies and colonisation of potential habitat.
- To increase public awareness and community involvement in the recovery process.
- To integrate the recovery program with other nature conservation programs.

Performance Criteria

- The area of habitat protected on private land through perpetual covenants on title and/or management agreements, or by purchase and subsequent reservation by the Crown, is increased by a target of 150 ha.
- The number of colonies protected on private land by perpetual covenants on title and/or management agreements, or by purchase and subsequent reservation by the Crown is increased by a target of 10 colonies.
- A re-survey of the existing colonies is completed and species status assessed.
- The size of the population is increased measurably - by 50 individuals.
- New colonies or localities recolonised by the species are identified.
- The area of known habitat mapped on private land is increased.
- Additional habitat available for expansion of colonies and/or recolonisation is identified.
- Thirty hectares of white gum habitat is rehabilitated adjacent to existing colonies and/or linking colonies, which will be potential habitat in the future.
- A strategy for identification, management and monitoring of white gum habitat important for nesting and/or foraging by the species is implemented.
- Threats and factors limiting expansion of the area of occupancy of the forty-spotted pardalote are identified.
- Plans for amelioration of threats or factors limiting expansion are prepared.

- Community based networks and arrangements are fostered.
- Feedback mechanisms are established (or re-established) and maintained to monitor community involvement, awareness and achievements.

Actions Needed

- Protect and manage known colonies.
- Monitor the population and habitat.
- Identify threats and factors limiting expansion of colonies and colonisation of potential habitat.
- Increase the size of the population and the area of occupancy.
- Maintain community awareness of the species and involvement in recovery actions.

Estimated Cost of Recovery

2006 prices in $000s/year

Action	**Cost Estimate**	**Timeframe**	**NRM Region**
1. Protection and Manage Known Colonies.	$73,500	Year 1-Year 5	N, S
2. Monitor Size of the total Pop'n and area of Occupancy.	$35,000	Year 1-Year 5	N, S
3. Identify Threats and Factors Limiting Expansion of Colonies and Colonisation of Potential Habitat.	$79,000	Year 1-Year 5	N, S
4. Increase Size of Population and Area of Occupancy	$38,500	Year 1-Year 5	N, S
5. Maintain Community Awareness of Species and involvement in Recovery Actions	$18,000	Year 1-Year 5	N, S
Total	**$244,000**		

Introduction

Background

The forty-spotted pardalote is listed as **endangered** on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and under Schedule 3.2 of the Tasmanian *Threatened Species Protection Act 1995*. Criteria used by the Commonwealth and Tasmanian governments for listing this species as endangered are similar and based on an area of occupancy totalling less than 500 km^2, which is severely fragmented and a continuing decline in the projected extent of habitat.

Research leading to recognition of the threatened status of the forty-spotted pardalote was conducted between 1979 and 1986 by the Tasmanian Government (Brown 1986) with funding in part from the Commonwealth Government and the World Wide Fund for Nature. A formal Recovery Plan was prepared in 1991 by the Tasmanian Government (Bryant 1991) and was funded in part by the Commonwealth Government. A National Recovery Team was established in 1992 and met annually until expiry of the Recovery Plan in 1997.

The Recovery Plan sought to secure major colonies of the forty-spotted pardalote on private land, maintain or increase the amount of potential habitat available to the species and maintain or increase the populations at or above those recorded in 1991. A major review of the recovery process in 1997 found the Recovery Plan was well conceived and the actions for recovery were well executed. Implementation of the Recovery Plan established a strong foundation for ongoing recovery of the species, particularly with regard to the security of key colonies on private land and the establishment of a committed community involvement in the recovery process.

The forty-spotted pardalote is endemic to Tasmania. It remains a flagship of the species approach to conservation in Tasmania and its recovery program has rallied community support not only for protection of this species but for the conservation of dry sclerophyll forests in Tasmania generally.

Description of the Species

The forty-spotted pardalote (*Pardalotus quadragintus*) Gould, 1838 is a small passerine measuring 9-10 cm in length and weighing approximately 10 grams. Individuals are generally olive green in colour and pale yellow around the eye, cheek and on the rump. The wings are black with characteristic white spots. The species does not exhibit any apparent size or colour dimorphism between the sexes (Woinarski 1985) however males produce a diagnostic mating call during the breeding season.

The forty-spotted pardalote can be distinguished from the co-occurring striated pardalote (*P. striatus*) and spotted pardalote (*P. punctatus*) by having no head markings, a duller body colour and shy behaviour (Threatened Species Unit 1998).

Life History

The forty-spotted pardalote is a leaf-gleaning insectivore feeding on invertebrates, manna and lerps. Manna is a sugary exudate produced by eucalypts in response to insect attack and lerp is the protective coat formed by foliage sap sucking psyllids (Woinarski & Bulman 1985). In the warmer months of the year, coinciding with the breeding season, manna may be the major food source used by the forty-spotted pardalote. Manna and lerps are high in carbohydrates and sugars and used almost exclusively by adults to feed young.

Forty-spotted pardalotes are territorial and sedentary and form loose colonies at permanently occupied sites. Nests are built in hollows of live or dead trees, stumps of logged or fallen trees and limbs, and very occasionally in holes in the ground (Brown 1986, Bulman *et al.* 1986).

The forty-spotted pardalote breeds between August and December (Threatened Species Unit 1997). Four to five eggs are laid with potential for a second clutch during the breeding period. Clutches are generally fledged by September-October. The incubation period is 16-20 days and the fledging period is approximately 25 days (Bulman *et al.* 1986). Some nest sites are re-used in successive seasons and it is likely that pairs remain together for several years (Woinarski & Bulman 1985). During the winter months there is dispersal from core colonies. Adults are thought to undertake a restricted local dispersal whereas juveniles may disperse to other areas on the Tasmanian mainland. Dispersal may be a response to a decline in food availability within core habitat during the winter months (Woinarski & Bulman 1986; Brown 1986; Dorr 1999).

Distribution and Occupancy

Three species of pardalote occur in Tasmania. The spotted pardalote and striated pardalote occur in forests and woodlands over much of Tasmania and south eastern Australia. The forty-spotted pardalote is endemic to Tasmania and restricted to four main populations on offshore islands and peninsulas along the east coast (Fig. 1a,b,c). Major populations are in the south-east on Maria Island, Bruny Island and at Tinderbox including Howden peninsula, and in the Bass Strait on Flinders Island. A small colony occurs near Hobart on the lower slopes of Mt Nelson. All populations, except Flinders Island, occur in the Southern Natural Resource Management (NRM) Region. The Flinders Island population occurs in the Northern NRM Region.

Historical distribution of the forty-spotted pardalote is thought to have been coincident with lowland forest supporting white gum *Eucalyptus viminalis* in eastern Tasmania. However most early reports note the species as being uncommon or rare (Milledge 1980; Woinarski & Bulman 1985). In the late 1800's and early 19th century the forty-spotted pardalote was recorded from the north and south of Tasmania, Flinders Island, on the east coast, inland and, apparently but not substantiated, on the central highlands (Bulman *et al.* 1986).

In 1970 forty-spotted pardalotes were recorded at Bob Smith's Gully on Flinders Island (Milledge 1980). Searches in the 1980s failed to locate the species at this site or in other potential habitat near Strezlecki National Park. A colony was discovered near Walkers Lookout in the Darling Range in 1986 (Brown 1986) and was reconfirmed in 1991 (Bryant 1997). Two further and more extensive colonies were found by Holdsworth in 1996 (Bryant 1997). Severe wild fires in 2000 swept across the eastern portion of Flinders Island including the Broughams and Darling Range colonies, and although surveys in 2005 failed to relocate the species, patches of mature white gum habitat remained intact (Bryant 2005 pers com).

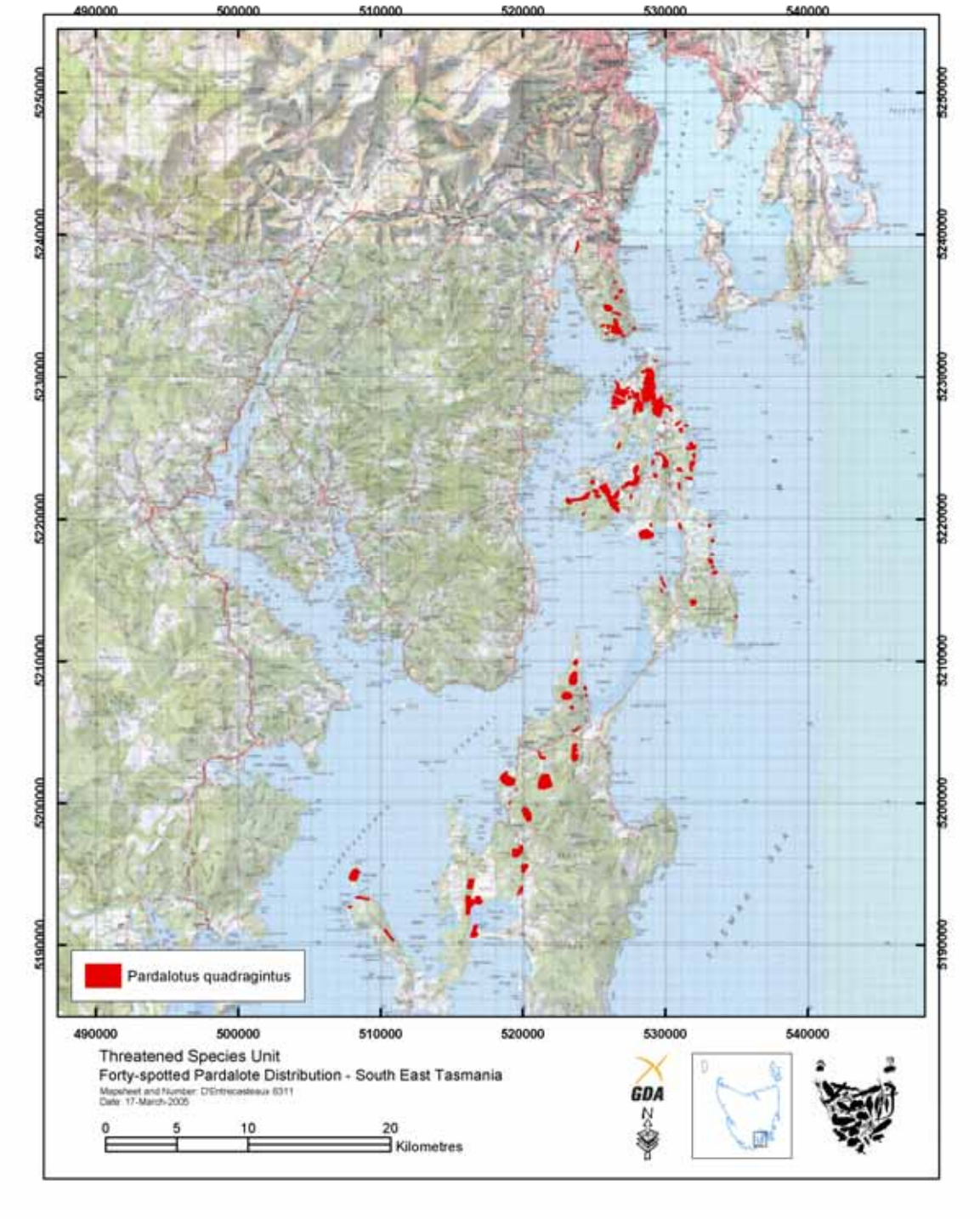

Fig. 1a Distribution of *Pardalotus quadragintus* on the Tasmanian mainland and Bruny Island

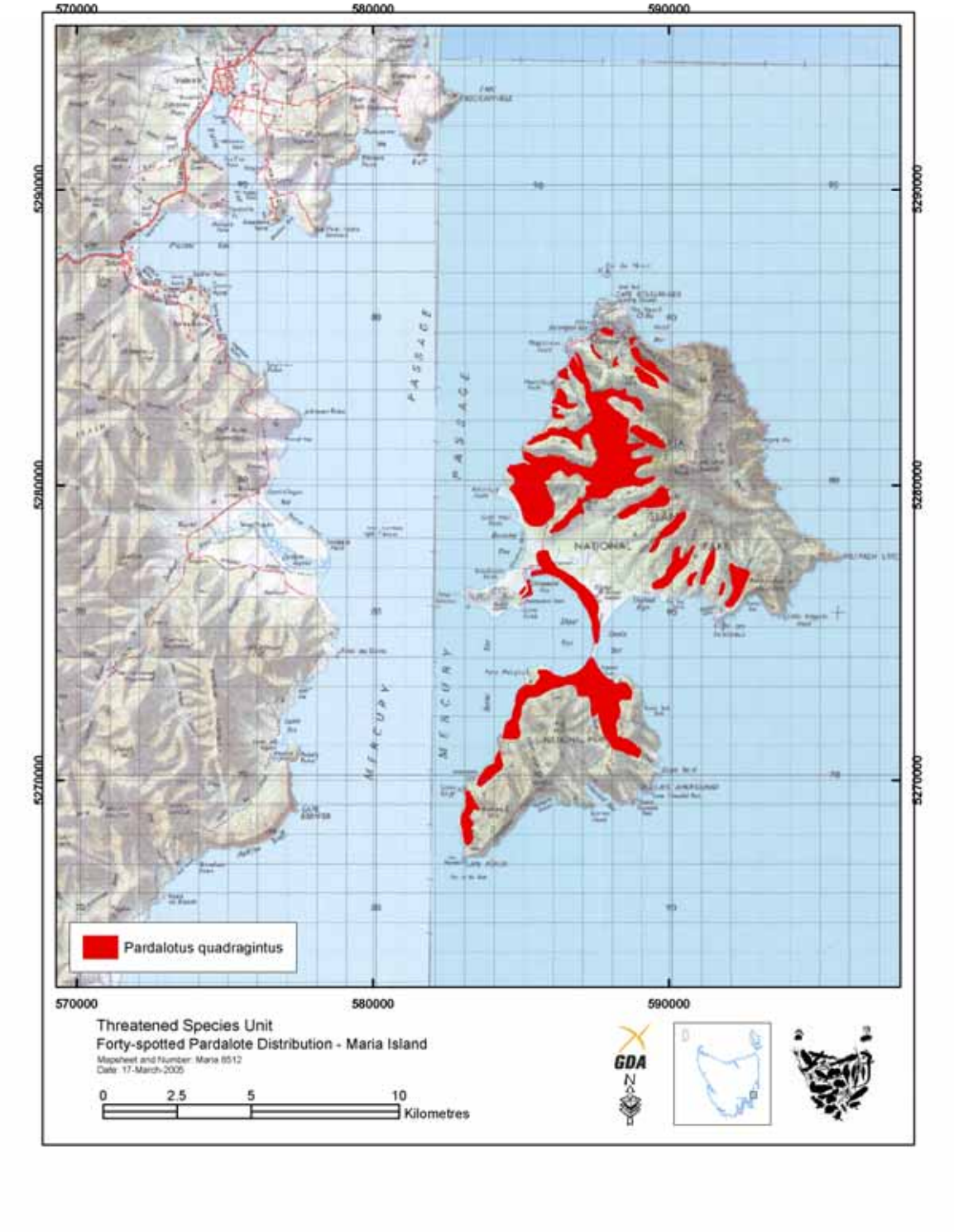

Fig. 1b. Distribution of *Pardalotus quadragintus* on Maria Island

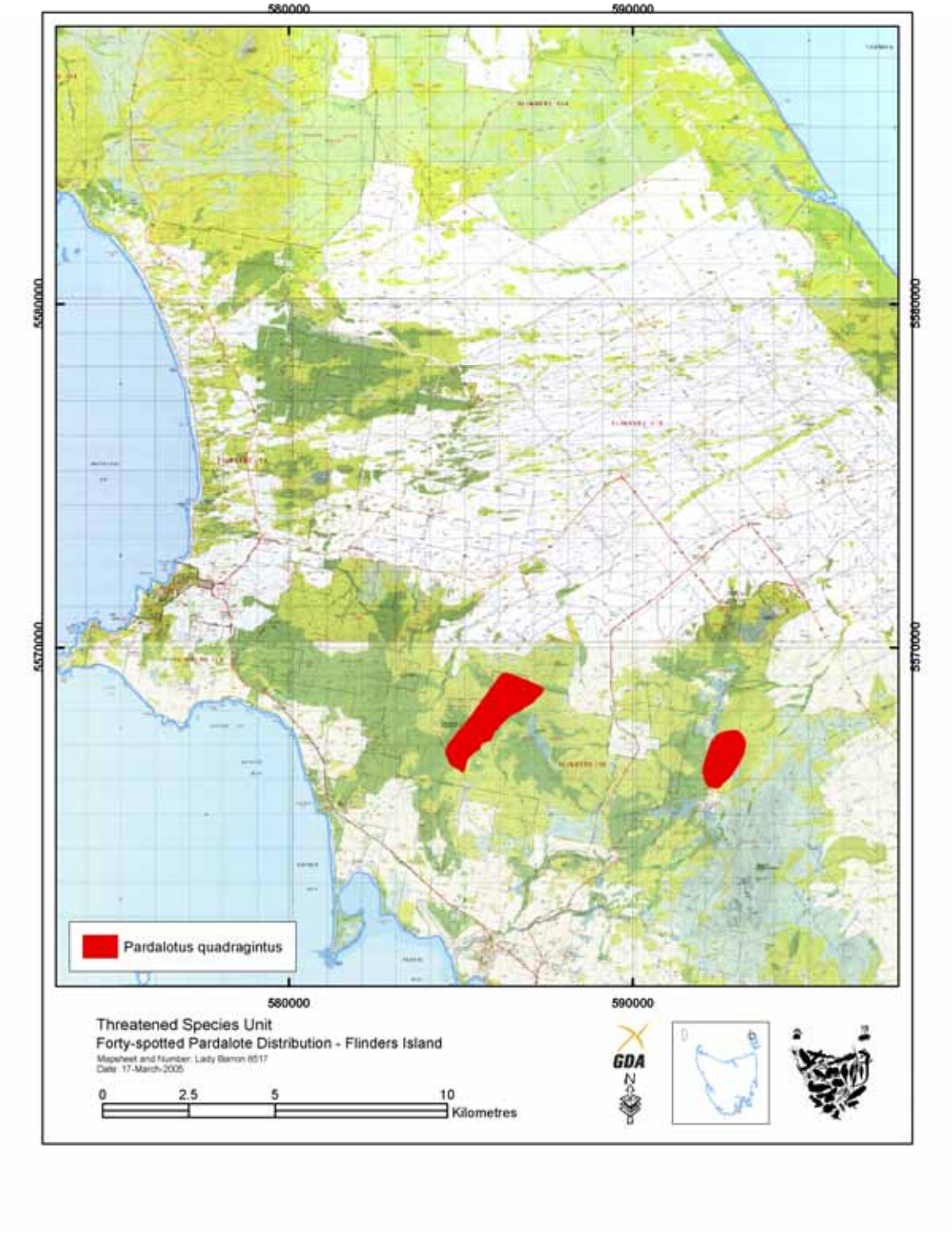

Fig. 1c. Distribution of *Pardalotus quadragintus* on Flinders Island

The forty-spotted pardalote was not reported on Maria Island until the 1960's, subsequent surveys have revealed it to be located in forest and woodland wherever white gums occur (Brown 1989). The species was reported on Bruny Island during the late 1800's but was not recorded again until the 1960's (Milledge 1980). Following a considerable survey effort in 1986 and 1992 it is now known from most localities on the island supporting white gum forest/woodland. The species was first reported from Partridge Island (located just north of Bruny Island's Labillardiere Peninsula) in 1978 where a breeding colony is known to be extant.

Tinderbox peninsula including Howden supports the only substantial colonies of the forty-spotted pardalote on the Tasmanian mainland. They were first reported in the 1960's and the population appears to have remained buoyant over the last few decades with additional colonies being found in the 1980's and 1990's (Bryant 1998). Other colonies known to be extant are near Hobart on the lower slopes of Mt Nelson and at Coffee Creek, Kingston (Bryant 1997).

The localities of most recent extinction of the forty-spotted pardalote are on the Tasmanian mainland. Whereas the species was historically recorded as abundant in suitable habitat on the Wellington Range it now appears absent from this area. It was located at Mt Faulkner in 1981 but more recent surveys failed to find any birds breeding (Brown 1986, Bryant 1997). Colonies were first reported from the Lime Bay area on the Tasman Peninsula in 1955, small colonies were recorded in 1981, a few birds in 1986 and by 1990 no birds could be located in this area (Bryant 1991). A colony on the Conningham Peninsula was first identified in 1972, reconfirmed in 1981 but searches since 1985 have failed to identify the species. A small colony south of Conningham Peninsula on Simmonds Point was identified in 1981 and although surveys have been undertaken in 1992, 1994 and 1996, it was last observed in 1986 (Bryant 1997).

Notwithstanding the record of dramatic decline on the Tasmanian mainland there may still be opportunities for colonies to be found or establish in suitable habitat particularly on Flinders Island, along the east coast of Tasmania and on the Tasman and Forestier peninsulas. If past conservation measures have been successful and/or populations are expanding naturally there may also have been opportunities for colonisation or recolonisation of potential habitat outside the range of known colonies.

Using the results of environmental domain analysis and a study of the vegetation at extant colonies Brereton *et al.* (1997) proffered the idea that the forty-spotted pardalote has always been restricted to the east coast of Tasmania. The environmental domain of the forty-spotted pardalote is characterised by low rainfall, high annual temperature and low elevation on shallow but fertile soils, a profile limited to a narrow band of land along the east coast.

Population Size

Prior to the 1960's there was no reliable assessment of the size of the population of forty-spotted pardalotes in Tasmania (Rounsevell & Woinarski 1983). As further potential habitat has been surveyed, and additional colonies have been discovered and mapped, estimates of the size of the total population have improved.

With knowledge of most of the extant colonies and their extent, Brown (1986) provided an estimate of the number of forty-spotted pardalotes in Tasmania of 3,520 breeding birds. Bryant (1997) updated this estimate from counts between 1994 and 1997 to 3,840 birds (the increased estimate is due to new colonies found on Flinders Island). Both authors consider that the actual population size is likely to fall within 20% of their estimates indicating an actual population size

of between 3,072 and 4,608 breeding birds in 1997. Allowing for variation in the counting methods and the discovery of additional habitat and colonies since 1986, Bryant (1997) considers that the population of the forty-spotted pardalote in Tasmania probably remained stable over the decade between 1986 and 1997.

Methods used to estimate population size of the forty-spotted pardalote (Rounsevell & Woinarski 1983; Brown 1986; Brown 1989; Bryant 1997) require an experienced observer with a sound knowledge of the habitat and ecology of the species. The forty-spotted pardalote is small, cryptic, often quiet and forages high in the tree canopy. Brown (1986) emphasises the need for observers to be familiar not only with the vocalisations of the forty-spotted pardalote but also co-occurring species. Visual identification of the species may be made through one or a range of cues such as colour, feeding behaviour and flight pattern. According to Rounsevell & Woinarski (1983) and Brown (1986) it is possible to count all birds in small well-defined populations but this becomes difficult with large and more extensive colonies. For larger colonies population estimates are extrapolated from sample counts (along transects or at plot points) undertaken in parts of the colony. Rounsevell and Woinarski (1983) note that the most reliable estimates are those based on a thorough census or series of census made at the same site over a number of years.

The notion of a 'colony' requires definition as it is used extensively with regard to research and conservation management of the forty-spotted pardalote. For the purposes of the Recovery Plan a 'colony boundary' defines the continuous extent of suitable habitat (which equates to the extent of white gum in the canopy occupying a projected cover of ≥10%) that is occupied by a breeding group of forty-spotted pardalotes. Brown (1986) defined colony boundaries on the basis of easily defined and recognisable management units and the ease of population assessment. Consequently, using colony boundaries defined by Brown (1986) results in some colonies being separated by only small distances at breaks in the forest habitat such as across roads or small paddocks or through forest not supporting white gum. Within major populations such as on Bruny Island, Maria Island and at Tinderbox there may be considerable movement of birds and flow of genetic material between neighbouring colonies. Bryant estimated that a colony could be less than 0.5 hectares in size with only 5% white gum to maintain a single pair of birds (Bryant, pers com.).

To determine future population trends and to measure the success of specified recovery actions for the forty-spotted pardalote it is essential that regular estimates of the population size be undertaken (either in total or in representative colonies). It is important that whether this is achieved through total census or by sub-sampling techniques that the method is repeatable and rigorous.

Habitat

White gum is the fundamental component of the habitat of the forty-spotted pardalote. All known colonies are found in dry sclerophyll forests or woodlands that comprise white gum in the tree canopy layer at a projected cover of 10% or more (Brereton *et. al.* 1997). The colonies occur on the east coast in areas of low annual rainfall, high annual mean temperature, low altitude and on shallow, fertile soils (Brereton *et. al.* 1997). This geographical and environmental domain occurs in a narrow band between Bicheno and Southport, and all colonies except those of Flinders Island, occur within this region (Brereton *et. al.* 1997). All patches of forest containing white gum that fit these geographical and environmental parameters are considered to be habitat critical to the survival of the forty-spotted pardalote.

Forty-spotted pardalotes forage predominantly in white gum, which appears to be pivotal to the survival of individuals and breeding colonies (Woinarski & Rounsevell 1983; Woinarski & Bulman 1985; Brown 1986; Dorr 1999). The reason for this is thought to be white gums' abundant production of manna and the size and shape of its foliage giving pardalotes easier access to the leaf surface when compared to the foliage of co-occurring eucalypts (Dorr 1999). Except for mountain gum *E. dalrympleana*, white gum produces the greatest abundance of manna of all Tasmanian eucalypts.

Foraging behaviour and habitat selection by the forty-spotted pardalote has been investigated by Woinarski and Bulman (1986), Woinarski and Rounsevell (1983) and Dorr (1999). It is known that food availability from white gum varies seasonally and across the range of the forty-spotted pardalote. In a brief study at known colonies over the summer and autumn Dorr (1999) detected a general decline in the production of manna and abundance of lerps. This accords with an expected decline in the activity of insects over the colder months of the year and may also be a stimulus for dispersal, if only locally, by forty-spotted pardalotes.

The Comprehensive Regional Assessment of the Tasmania Regional Forest Agreement (RFA) identified 50 communities that represent the diversity of forest ecosystems in Tasmania. The habitat at known colonies of the forty-spotted pardalote falls into six of these forest community types including: white gum grassy forest, white gum coastal shrubby forest on Holocene sand, dry stringybark (*E. obliqua*) forest, white peppermint (*E. pulchella*) - blue gum (*E. globulus*) – white gum grassy shrubby dry sclerophyll forest, black gum (*E. ovata*) – white gum forest and black peppermint (*E. amygdalina*) forest on a sandstone substrate. Four of these forest communities and a fifth community in its old growth form are recognised as insufficiently protected within the public CAR (Comprehensive, Adequate and Representative) reserve system in Tasmania. Consequently, Tasmania's RFA lists these forests as priorities for protection on private land and through the RFA's Private Forest Reserves Program (PFRP).

Threats

The most significant threat to the survival of the forty-spotted pardalote is related to the loss or decline in area and fragmentation of suitable habitat. Loss of suitable habitat (dry sclerophyll forests supporting white gum) through clearing for agriculture, forestry and residential development has been considerable in eastern Tasmania. Grassy white gum forest in the south-east bioregion has been reduced by over 50% since European settlement and major clearing of dry sclerophyll forests has taken place along the coastal plains. Clearing of forest/woodland supporting white gum on private land continues.

Fragmentation of forest habitat was an inevitable result of a European history of land clearing in eastern Tasmania. This is particularly evident on Bruny Island where some 76 extant colonies of the forty-spotted pardalote are defined, many separated from each other by small distances of cleared land (Bryant 1992). Pre-European vegetation on Bruny Island would probably have provided continuity of forest/woodland habitats with a mosaic of white gum dominated communities, hence providing channels for dispersal and/or movement of forty-spotted pardalotes to winter foraging areas. Many authors have emphasised the limited dispersal ability of the forty-spotted pardalote (eg. Woinarski & Rounsevell 1983; Woinarski & Bulman 1985; Brown 1986; Dorr 1999). If only small distances of open habitat are sufficient to isolate colonies then this trait may have implications to the design of actions aimed at restoration of habitat between existing colonies.

Structural changes to the forest habitat that reduce tree canopy cover may lead to reductions in the size of colonies or the local extinction of the forty-spotted pardalote. Fire and dieback are notable causes of this phenomenon. Wildfires have the potential to kill canopy trees and over-firing can reduce the potential for eucalypt recruitment. Timber harvesting has a direct impact on the canopy layer and firewood removal can impact on the supply of standing and fallen trees, and ultimately on the availability of nesting hollows. Stock grazing has been implicated as a causal factor in eucalypt dieback and continuous grazing regimes can prevent regeneration of forest canopy species.

Fragmentation and disturbance of the forest canopy favours invasion by woodland birds. Many authors consider invasion by the noisy miner (*Manorina melanocephala*) is a major threat to the forty-spotted pardalote where its habitat has been fragmented and/or opened up by disturbance (eg. Woinarski & Bulman 1985; Brown 1986; Bryant 1991). The noisy miner is an aggressive and opportunistic species that has the potential to displace the forty-spotted pardalote through competition for food resources. It has expanded its distribution in Tasmania on the heels of land clearance and disturbance of forest habitats. Brown (pers. comm.) notes that noisy miners are absent from all known colonies of the forty-spotted pardalote and all recent extinctions have been associated with the invasion of the species' habitat by noisy minors. Noisy miners are absent from Maria Island which supports the most robust population of the forty-spotted pardalote in Tasmania.

Other species cited as possible contributors to the decline of the forty-spotted pardalote through competition for food resources and/or breeding habitat include the black-headed honeyeater (*Melithreptus affinis*) and the striated pardalote (Woinarski & Bulman 1985). The introduced Starling (*Sturnus vulgaris*) is also notable for its abundance during breeding at some fragmented colonies. The introduced laughing kookaburra (*Dacelo novaeguineae*) a potential nest predator also occurs within the range of the forty-spotted pardalote.

Achievements of the Recovery Plan

At the outset of the 1991-1997 Recovery Plan the population estimate of the forty-spotted pardalote in Tasmania was 3,520 breeding birds spread over 110 colonies and 3,789 hectares. When the Recovery Plan expired in 1997 the population estimate was 3,840 birds over 121 colonies and 4,107 hectares (Bryant & Jackson 1999). The population has apparently not declined over this period and 11 new colonies covering 318 hectares have been discovered. Further survey work for new colonies will benefit from habitat and distribution modelling studies on the forty-spotted pardalote undertaken during the course of the Recovery Plan.

The most significant breeding colony on private land at Dennes Hill on Bruny Island (92 ha) was acquired by the Crown and proclaimed as a Nature Reserve. It is now managed for the conservation of the forty-spotted pardalote. A colony on private land at Walkers Hill on Flinders Island (20 ha) was protected through a land exchange with the Crown in 1999 and was adhered to the Darling Range Conservation Area in 2002. The importance of conserving colonies on Crown land on Flinders Island (280 ha) was recognised during Tasmania's RFA and all known colonies were subsequently incorporated into the new Brougham Sugarloaf Conservation Area. Three colonies of the forty-spotted pardalote occur in State forest on Bruny Island. These colonies have been designated for protection from logging by Forestry Tasmania. Several other colonies on private and public owned lands have now been afforded protection through reservation, formal management agreements and/or by perpetual covenant. Prior to the Recovery Plan approximately

55% of the currently known colonies of the forty-spotted pardalote were protected. During the life of the Recovery Plan protection was secured for a further 11% of the colonies by area.

White gum tree planting was a major action of the Recovery Plan and involved a large component of voluntary community support. Several thousand local provenance white gum seedling were grown and distributed to landowners across Bruny Island and areas south of Hobart for use in rehabilitation works and other strategic plantings. Seedling distribution and plantings provided an ideal conduit for flow of information and education between the recovery program team and the general community. The success of the plantings was monitored by the project officer during the life of the Recovery Plan. A program of white gum planting at Dennes Hill Nature Reserve in areas historically cleared and cultivated was undertaken until the Recovery Plan expired in 1997. Trial plots to assess eucalypt regeneration and planting techniques were established on Bruny Island in 1994 and monitored over the course of the Recovery Plan.

Prescriptions for conservation of forty-spotted pardalotes and potential habitat were developed for use in the preparation of Forest Practices Plans as outlined in the Forest Practices Code (2000) and for use in the application of local government planning schemes such as the Kingborough Council Draft Planning Scheme (Kingborough Council 2000). Colonies of the forty-spotted pardalote are identified as a priority for protection in the Kingborough Council Planning Scheme and developments in and around known colonies are scrutinised by council with regard to their potential impacts on the species.

A major publicity campaign aimed at improving public awareness was undertaken over the course of the Recovery Plan. This involved numerous articles in newspapers and popular magazines, radio and television interviews, school and public seminars and ultimately the production of a video based on the recovery of the forty-spotted pardalote. Interpretative material was produced including note sheets and educational displays for use at specific sites such as Walkers Lookout on Flinders Island, Darlington on Maria Island, McCrackens Gully on Bruny Island and at Coffee Creek, Kingston. A lease agreement and covenant over a small area of pardalote habitat on Bruny Island was signed which allows the Crown not only to manage the habitat but also develop facilities to interpret the ecology of the species and the recovery strategy.

Future Conservation Strategy

The new 2006-2010 Recovery Plan will build on the foundation established by the original Recovery Plan. Mechanisms and incentives for conservation of natural values on private land in Tasmania have improved and expanded considerably over the last 5 years with establishment of the Natural Heritage Trust and the RFA's Private Forest Reserves Program. Changes to tax legislation and rate rebating schemes established by local councils are providing additional incentives to landowners in the wake of improved land use control measures such as the Landuse Planning and Approvals Act 1993 (LUPAA), local planning schemes (eg. Kingborough Planning Scheme 2000) and Tasmanian state land-use policies (eg. Coastal Policy). Within this framework it is possible to envisage protection, by some form of management agreement or perpetual covenant, for most forty-spotted pardalote colonies on private land. All colonies are considered to be important for the conservation of the species as recognised by the Tasmanian Governments and by relevant land use planning bodies such as the Forest Practices Authority and local governments. Currently 17 colonies on Bruny Island and 1 colony on the Tasmanian mainland (covering 255 ha over 5 properties) are proposed for inclusion in Tasmania's Private CAR Reserve System through the Private Forest Reserves Program. A small area of 5.5 ha on Bruny

Island was covenanted with an associated management plan in 2000 by the Private Forest Reserves Program.

This Recovery Plan will integrate its actions where possible with the Draft Swift Parrot Recovery Plan 2001-2005 (Swift Parrot Recovery Team 2001) and the Threatened Eagles Recovery Plan (Threatened Species Section 2006). Bruny Island supports 40% (1,920 ha) of the area of occupancy of the forty-spotted pardalote and 92% (1,430 ha) of the area occupied on private land. There may be considerable gains in efficiency and other mutual benefits through an integration of actions directed at education and community involvement in the recovery process, particularly on Bruny Island and on Tasmania's south-east coast. The Swift Parrot Recovery Program and the Threatened Eagle Recovery Program have developed effective relationships with the RFA's Private Forest Reserves Program to protect important foraging and nesting habitat for these species. This Recovery Plan identifies the need for the Forty-spotted Pardalote Recovery Program to develop a similar relationship with any government and non-government programs targeting nature conservation on private land.

Down listing of the forty-spotted pardalote on State and National Acts is the principal objective of the new Recovery Plan. To achieve this it will be necessary to increase the population of the forty-spotted pardalote and expand the area of occupancy. This will involve actions not only aimed at enhancement and expansion of existing colonies but also at increasing opportunities for colonisation of potential habitat. The new Recovery Plan details research and planning tasks that are necessary to identify factors that limit expansion of colonies and/or colonisation of potential habitat and ways these factors can be attenuated or eliminated if required.

A Recovery Team for the forty-spotted pardalote will be re-activated and bolstered to include representation by local council planning staff, Parks and Wildlife Service field management staff and scientific experts. The list of Recovery Team members in 2002 is identified in Appendix 1. The Recovery Team will determine the direction and detail of actions outlined in the Recovery Plan. The success of actions will be monitored by the Recovery Team who will review progress on an annual basis. To measure the success of specific actions and track the recovery process the new Recovery Plan identifies the need to monitor the size of the population and the area of habitat occupied by the forty-spotted pardalote.

INDIGENOUS ISSUES

Indigenous communities and interests are present in the regions affected by this plan, and have the potential to play a key role in the recovery of this species. Indigenous representatives have been invited to join the Recovery Team, and implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region. Land containing key colonies on Bruny Island is owned by the indigenous community who have already expressed a willingness to be involved in the program and protection for the species.

A formal consultation process is under way for Tasmanian Recovery Plans to ensure that assistance and input from the indigenous community is sought. The Tasmanian Aboriginal Land and Sea Council (TALSC) and the Aboriginal Heritage Office (Department of Tourism, Arts and the Environment - DTAE) will assist in the identification of potential indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the species' conservation. Continued liaison between DPIW and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions. Approval to conduct activities on indigenous land will always be sought and all

recovery activities will be conducted in a manner that is consistent with the requests of TALSC and the Aboriginal Heritage Office (DTAE).

AFFECTED INTERESTS

Recovery actions under this plan will also include consideration of the role and interests of land holders, land managers and other affected interests in the region.

Recovery Objectives

The overall objective of the Recovery Plan is to down list the status of the forty-spotted pardalote from endangered to vulnerable within 10 years. The Recovery Plan has the greatest potential to address the issue of ongoing decline in the extent of habitat. The population of the forty-spotted pardalote can be increased through habitat enhancement, expansion of existing habitat and by colonisation of potential habitat.

The specific objectives of the Recovery Plan are:

- To protect and manage known colonies.
- To increase the size of the population.
- To increase the area of occupancy.
- To identify threats and quantify factors limiting expansion of colonies and colonisation of potential habitat. Develop rapid response plans to act on identified threats.
- To increase public awareness and community involvement in the recovery process.
- To integrate the recovery program with other nature conservation programs.

Performance Criteria

To protect and manage known colonies.

- The area of habitat protected on private land through perpetual covenants on title and/or management agreements, or by purchase and subsequent reservation by the Crown, is increased by a target of 150 ha.
- The number of colonies protected on private land by perpetual covenants on title and/or management agreements, or by purchase and subsequent reservation by the Crown is increased by a target of 10 colonies.
- A re-survey of the existing colonies is completed and species status assessed.

To increase the size of the population.

- The size of the population is increased measurably - by 50 individuals.
- New colonies or localities recolonised by the species are identified and expansion of existing colonies.

To increase the area of occupancy.

- The area of known habitat mapped on private land is increased.
- Additional habitat available for expansion of colonies and/or recolonisation is identified.
- Thirty hectares of white gum habitat is rehabilitated adjacent to existing colonies and/or linking colonies, which will be potential habitat in the future.
- A strategy for identification, management and monitoring of white gum habitat important for nesting and/or foraging by the species is implemented.

To identify and quantify factors limiting expansion of colonies and colonisation of potential habitat.

- Threats and factors limiting expansion of the area of occupancy of the forty-spotted pardalote are identified.
- Plans for amelioration of threats or factors limiting expansion are prepared for rapid response.

To maintain public awareness of the species and community involvement in the recovery process.

- Community based networks and arrangements are fostered.
- Feedback mechanisms are established (or re-established) and maintained to monitor community involvement, awareness and achievements.

Recovery Actions

- Protect and manage known colonies.
- Monitor the population and habitat.
- Identify threats and factors limiting expansion of colonies and colonisation of potential habitat.

- Increase the size of the population and the area of occupancy.
- Maintain community awareness of the species and involvement in recovery actions.

Action 1. Protect and manage known colonies.

Action 1a. Protect and manage known colonies on private land.

Aim: Protect known colonies on private land from disturbance and/or clearing and manage for conservation of the forty-spotted pardalote.

Rationale: Many forty-spotted pardalote colonies have been identified as strategically important for protection or have been nominated by landowners for protection by the RFA's Private Forest Reserves Program. The strategic importance of these colonies relates not only to the conservation value of colonies but also to their coincidence with forest communities identified as high priorities for inclusion in Tasmania's CAR reserve system. Opportunities exist for the bulk of the colonies on private land to be incorporated into binding arrangements for protection through government and non-government conservation programs under the *Nature Conservation Act 2002*, or under the *Landuse Planning and Approvals Act 1993*.

Method: A dedicated project officer is required to prioritise colonies for protection, identify management (including habitat rehabilitation) and monitoring requirements and develop management plans and other protective agreements with landowners. The project officer will provide expert advice to landowners, and private and government nature conservation programs on private land regarding protection and management requirements of the species. The project officer will also identify sources of funding such as the Fencing Incentive Scheme Tasmania and assist landowners to acquire funds for specific on-ground works.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
40.0	*8.0*	*8.0*	*8.0*	*8.0*	*72.0*

Action 1b. Finalise Dennes Hill Management Plan

Aim: Ensure active management for conservation of forty-spotted pardalotes within Dennes Hill Nature Reserve.

Rationale: An area of 92 ha on Dennes Hill, Bruny Island was acquired by the Crown in 1992 and proclaimed as a Nature Reserve. It supported the most significant breeding colony on private land. A draft management plan was prepared in 1996. Approval of the management plan and implementation of the specified management prescriptions are necessary to ensure long-term conservation of the forty-spotted pardalote within the Reserve.

Method: A project officer is required to review and update the draft plan and expedite the public review and government approval process.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
1.5	*0.0*	*0.0*	*0.0*	*0.0*	*1.5*

Action 2. Monitor the size of the population and the area of occupancy

Aim: Determine trends in the size of the population and the area of occupancy overall, and at specified colonies.

Rationale: Identifying trends in the parameters of population size and area of occupancy are often fundamental to determining the conservation status of a species and assessing the success of recovery actions. The forty-spotted pardalote is a case in point. The strategy for recovery is based on improving and expanding habitat and maintaining or increasing the size of the population. The most succinct measure of the success of these actions will be to detect an increase in one or both of these parameters. Also, the impact of very hot fires on the pardalote colony on Flinders Island during 2002/2003 needs to be determined as well as the success of increasing the population extent and area (Action 4).

Method: The extent of the habitat and the size of the population at all known colonies will be determined in the final year of the Plan. The extent of the habitat and the size of the population of a small but representative subset of the known colonies will be assessed in years 1 to 4. The subset will include colonies where actions aimed at enhancement and expansion of habitat are being implemented and at sites where new colonies are identified.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
7.0	*4.0*	*4.0*	*4.0*	*16.0*	*35.0*

Action 3. Identify threats and factors limiting expansion of colonies and colonisation of potential habitat.

Action 3a. Assess the role of interspecific competition, interference behaviour and predation in limiting the expansion of colonies and colonisation of potential habitat.

Aim: Assess the role of interspecific competition, interference behaviour and/or predation by other native and/or introduced avian species on the expansion of colonies and colonisation of potential habitat. Develop plans enabling rapid response to identified threats.

Rationale: A potential threat to the recovery of the forty-spotted pardalote is competition from other avian species. Of particular concern are aggressive species with similar habitat and/or food requirements to the forty-spotted pardalote such as the noisy miner and kookaburra. There is growing circumstantial evidence to implicate the noisy miner as a causal agent in the local extinction of the forty-spotted pardalote on the Tasmanian mainland. Clearance and degradation of habitat in and around forty-spotted pardalote colonies has provided the opportunity for

invasion by the noisy miner. The introduced laughing kookaburra is a potential nest predator and is becoming more abundant within the range of the forty-spotted pardalote. It is clear that unless the recovery program can determine the significance of these threats and develop the capacity to control their impacts then enhancement, restoration and/or expansion of habitat may fail to achieve its goal. Plans must be prepared enabling rapid response to threats eg noisy miners.

Method: Provide logistic, financial and intellectual support to a study aimed at assessing the importance of competition in limiting colony expansion and colonisation of potential habitat.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
12.0	*12.0*	*12.0*	*0.0*	*0.0*	*36.0*

Action 3b. Assess the role of habitat structure and condition in limiting the expansion of colonies.

Aim: Assess the role of factors such as eucalypt dieback and brush-tail possum browsing on the quality of foraging habitat and determine the structural requirements of the forest habitat necessary to support forty-spotted pardalotes.

Rationale: The impacts of factors such as eucalypt dieback, stock grazing and brush-tail possum browsing on the quality of foraging habitat for the forty-spotted pardalote have not been investigated. Over the last decade concerns have been raised, particularly from landowners on Bruny Island, that dieback in white gum habitat may be limiting the potential for expansion of colonies. A better understanding of the role of dieback and the specific habitat requirements of the species will assist in the development of effective actions aimed at enhancement and restoration of habitat.

Method: Provide logistic, financial and intellectual support to studies aimed at assessing the importance of factors such as brush-tail possum browsing and eucalypt dieback in limiting colony expansion and colonisation of potential habitat.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
12.0	*12.0*	*12.0*	*0.0*	*0.0*	*36.0*

Action 3c. Assess the use of artificial nest boxes by the forty-spotted pardalote.

Aim: Determine the benefit of nest boxes as an aide to colony expansion.

Rationale: An experiment will be conducted using nest boxes to determine the influence of additional nesting boxes on colony expansion.

Method: Construct and install tailored nest boxes in unused white gum habitat adjacent to existing colonies. Monitor use of nest boxes in the breeding season over the duration of the Recovery Plan. The major task of this action is the construction and installation of nest boxes. A

large number of nest boxes will be necessary for use in habitat where hollows are in good supply (control habitat) and where hollows are absent such as in regrowth white gum forest.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
5.0	*0.5*	*0.5*	*0.5*	*0.5*	*7.0*

Action 4. Increase the size of the population and area of occupancy.

Action 4a. Map potential habitat available for expansion and/or recolonisation.

Aim: Determine potential habitat available for expansion and/or recolonisation.

Rationale: The accuracy and detail of mapping of white gum forest communities has greatly improved since implementation of the original Recovery Plan. A major improvement came with preparation of the Tasmania RFA map of forest communities (RFA 1997). Refinements to this mapping have continued through the Vegetation Management Strategy for Tasmania (DPIWE 2001). Areas of high probability occurrence of the forty-spotted pardalote identified by environmental domain analysis are along the east coast of Tasmania, particularly on Freycinet, Tasman and Forestier peninsulas.

Method: Use recent mapping of white gum forest communities in combination with environmental domain and/or other habitat modelling techniques to refine maps of the distribution of potential habitat.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
2.0	*0.0*	*0.0*	*0.0*	*2.0*	*4.0*

Action 4b. Survey potential habitat.

Aim: Determine distribution of forty-spotted pardalotes in potential habitat.

Rationale: A significant amount of potential habitat on the east coast of Tasmania and on Flinders Island has not been surveyed, or recently surveyed, for the forty-spotted pardalote. There is a possibility that searches made in suitable habitat within the environmental domain of the forty-spotted pardalote will be successful. The discovery of new colonies will assist the program to meet the specific objectives of increased population size and area of occupancy.

Method: Field surveys in potential habitat will be conducted during the period of the Recovery Plan. Areas to be targeted by field surveys will be directed by refinements to the species' habitat modelling and vegetation mapping of the distribution white gum forest communities.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
9.5	*1.5*	*5.0*	*1.5*	*1.5*	*19.0*

Action 4c. Undertake tree planting programs with subsequent monitoring to expand and/or link habitat at specific colonies.

Aim: Increase the size of the population and create habitat corridors between known colonies.

Rationale: Tree planting programs have been shown to be a useful approach to the expansion of white gum habitat at known colonies. This is evident at localities of private land plantings and at Dennes Hill Nature Reserve. Tree planting programs also provide opportunities for the recovery program, community groups and volunteers to work together on recovery actions and see tangible results from their efforts. Tree planting for re-establishment of habitat in cleared and cultivated areas are specific management actions of the Draft Management Plan for Dennes Hill Nature Reserve and the Operations Plan for McCrackens Gully Private CAR Reserve.

Method: Local provenance white gum and other eucalypt species (where they were a component of the original forest) will be planted on cleared or degraded land at Dennes Hill Nature Reserve, Peter Murrell Conservation Area and at McCrackens Gully Private Forest Reserve. Other sites will be included in this program where they are considered to be strategic in linking habitat. Coordination of the program activities (i.e. growing seedlings, planting, follow up care and monitoring) will be undertaken by a project officer.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
2.0	*9.0*	*1.5*	*1.5*	*1.5*	*15.5*

Action 5. Maintain community awareness of the species and involvement in recovery actions.

Aim: Maintenance of involvement by the community, landowners and other volunteers in recovery actions. Maintenance of awareness within the community of the need to retain and manage white gum habitat.

Rationale: Community, volunteer and landowner support are essential to the implementation of on-ground activities such as tree planting and other habitat enhancement works. Habitat restoration at Dennes Hill Nature Reserve and McCrackens Gully Private Forest Reserve will rely heavily on the recovery programs' ability to muster a large voluntary workforce. Education and promotion of the species are important to the long-term maintenance of habitat.

Method: The recovery program will establish or re-establish links with community and volunteer groups to ensure a continued support for on-ground recovery actions. These links will also provide a channel for the flow of educational material and liaison. A network established on Bruny Island during the original Recovery Plan will be re-invigorated. Existing community groups such as local Landcare Groups will be tapped for opportunities to overlap on-ground works and educational activities.

Where possible education, awareness activities and products for the general public or community groups will be combined with other programs such as the Swift Parrot Recovery Program and

Threatened Eagles Recovery Program. Educational and promotional material/activities should place the forty-spotted pardalotes in the context of the conservation of dry sclerophyll forests, many of which support white gum. Conservation of forests supporting white gum will not only capture habitat for threatened species such as the swift parrot and the wedge-tailed eagle but also a range of poorly reserved vegetation communities.

The Threatened Species Section will identify opportunities for combining resources and expertise from other threatened species recovery programs for the production and dissemination of educational and interpretative material and field activities.

Costs ($'000):

Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Total*
5.0	*5.0*	*5.0*	*1.5*	*1.5*	*18.0*

Implementation Schedule

Task	Description	Priority	Feasibility	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
1	**Protect and manage known colonies**								
1a	Protect and manage known colonies on private land	1	100%	40.0	8.0	8.0	8.0	8.0	72.0
1b	Finalise Dennes Hill Management Plan	1	100%	1.5	0.0	0.0	0.0	0.0	1.5
2	**Monitor the size of the population and the area of occupancy**	1	100%	7.0	4.0	4.0	4.0	16.0	35.0
3	**Identify threats and factors limiting expansion of colonies and colonisation of potential habitat.**								
3a	Assess the role of interspecific competition, interference behaviour and predation in limiting the expansion of colonies and colonisation of potential habitat.	1	100%	12.0	12.0	12.0	0.0	0.0	36.0
3b	Assess the role of habitat structure and condition in limiting the expansion of colonies.	1	100%	12.0	12.0	12.0	0.0	0.0	36.0
3c	Determine whether hollow availability is limiting the expansion of colonies.	1	100%	5.0	0.5	0.5	0.5	0.5	7.0
4	**Increase the size of the population and area of occupancy.**								
4a	Map potential habitat available for expansion and/or recolonisation.	2	100%	2.0	0.0	0.0	0.0	2.0	4.0
4b	Survey potential habitat.	2	100%	9.5	1.5	5.0	1.5	1.5	19.0
4c	Undertake tree planting programs to expand and/or link habitat at specific colonies.	2	100%	2.0	9.0	1.5	1.5	1.5	15.5
5	**Maintain community awareness of the species and involvement in recovery actions.**	2	100%	5.0	5.0	5.0	1.5	1.5	18.0
	Total			96.0	52.0	48.0	17.0	31.0	244.0

References

Bell, P. J. (1997) Review of the recovery process for the forty-spotted pardalote. Prepared for Environment Australia, Endangered Species Program.

Bulman, Rounsevell & Woinarski (1986). The Forty-spotted Pardalote – an RAOU Conservation Statement. RAOU Report No. 17, Melbourne RAOU

Brereton, R., Bryant, S. L. & Rowell, M. (1997). Habitat modeling of the Forty-spotted Pardalote and recommendations for management. Report to the Tasmanian RFA Environment and Heritage Technical Committee, Hobart.

Brown, P. B. (1986). The Forty-spotted Pardalote in Tasmania. National Parks and Wildlife Technical Report 1986/4, Hobart.

Brown, P. B. (1989). The forty-spotted pardalote on Maria Island. Tasmanian Bird Report. **18**: 4-13.

Bryant, S. L. (1991). The Forty-spotted Pardalote Recovery Plan: Management Phase. Department of Parks, Wildlife and Heritage, Hobart.

Bryant, S. L. (1992). Long term survival of the Forty-spotted Pardalote on Bruny Island. WWF Final Report. Project No. 157. Parks, Wildlife and Heritage, Tasmania.

Bryant, S. L. (1997). Status of forty-spotted pardalotes. Tasmanian Bird Report. **26**: 45-50.

Bryant, S.L. (1998). Little Bird in a big package. Wingspan **8** (3) p 12-15

Bryant, S.L. & Jackson, J (1999). Tasmania's threatened fauna handbook: what, where and how to protect Tasmania's threatened animals. Threatened Species Unit, Parks and Wildlife Service, Hobart.

CARSAG (2000). Forest conservation priorities for use outside of CARSAG and the RFA Private Land Reserve Program. Unpublished report.

Dorr, T. L. (1999). Foraging behaviour and habitat selection of the forty-spotted pardalote Pardalotus quadragintus. Unpublished Honours Thesis, Department of Zoology, University of Tasmania.

Garnett, S. T. & Crowley, G. M. (2000) The Action Plan for Australian Birds 2000. Environment Australia, Canberra.

Kingborough Council (2000). Draft Planning Scheme 2000. A performance based planning scheme. Kingborough Council. 131pp.

Milledge, D.R. (1980). The distribution, status, ecology and evolutionary position of the Forty-spotted Pardalote. Proceedings of the 78th Annual Congress of the RAOU, Hobart.

Parks and Wildlife Service (1997a) Draft Dennes Hill Nature Reserve Management Plan. Department of Environment and Land Management, Hobart.

Parks and Wildlife Service (1997b) Coal Mines Historic Site Management Plan. Department of Environment and Land Management, Hobart.

Parks and Wildlife Service (1998) Maria Island National Park and Ile Des Phoques Nature Reserve Management Plan. Department of Environment and Land Management, Hobart.

Private Forest Reserves Program (2000) Operations Plan for McCrackens Gully Private CAR Reserve. Department of Primary Industries Water and Environment, Hobart.

Rounsevell, D. E. & Woinarski, J. C. Z. (1983). Status and conservation of the Forty-spotted Pardalote Pardalotus quadragintus (Aves: Pardalotidae). Australian Wildlife Research, **10**:343-349.

Swift Parrot Recovery Team (2001). Swift Parrot Recovery Plan. Department of Primary Industries, Water and Environment, Hobart.

Threatened Species Unit (1998). Listing Statement: Forty-spotted Pardalote Pardalotus quadragintus. Parks and Wildlife Service, Tasmania.

Threatened Species Section (2006). Fauna recovery Plan: Threatened Eagles 2006-2010. Department of Primary Industries and Water, Hobart

Woinarski, J. C. Z. (1983). Comparative ecology of pardalotes, including the forty-spotted pardalote, Pardalotus quadragintus (Aves: Pardalotidae) in south-eastern Tasmania.

Woinarski, J. C. Z. & Bulman, C. (1985). Ecology and breeding biology of the forty-spotted pardalote and other pardalotes on north Bruny Island. Emu, **85**: 106-119.

Appendix 1

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Appendix 2.

Research likely to provide information that will assist the conservation of the forty-spotted pardalote:

Management for maintenance of condition and biodiversity of grassy white gum forest, particularly in relation to the frequency of fire and stimulus for canopy species regeneration.

Determination of habitat patch size thresholds, in fragmented and continuous forest environments, for long-term viability of the species' colonies.

Food resources and the relationship between site productivity and site characteristics are required to identify factors limiting the distribution of the species.

Population ecology, particularly colony dynamics, juvenile dispersal and home range is needed to determine the species' potential for expansion.

Identification of noisy miner as a threat to the forty-spotted pardalote and potential control measures.

Genetic studies to identify potential movement between colonies and to improve understanding of dispersal.