INTERIM RECOVERY PLAN NO. 223

SMALL TWO-COLOURED KANGAROO PAW

(*ANIGOZANTHOS BICOLOR* SUBSP. *MINOR*)

INTERIM RECOVERY PLAN

2006-2011

May 2006

Department of Conservation and Land Management
Species and Communities Branch (SCB)
Kensington

Natural Heritage Trust
Helping Communities Helping Australia

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

CALM is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from May 2006 to April 2011 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given regional approval on 13 February, 2006 and was approved by the Director of Nature Conservation on 22 February, 2006. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at May 2006.

IRP PREPARATION

This Interim Recovery Plan was prepared by Julie Patten[1], Ryan Butler[2], Gillian Stack[3] & Andrew Brown[4].

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ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

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Bethea Loudon	Conservation Officer, CALM's Katanning District
Amanda Shade	Horticulturalist, Botanic Gardens and Parks Authority
Anne Cochrane	Research Scientist, CALM's Threatened Flora Seed Centre

Thanks also to staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and CALM's Species and Communities Branch for assistance.

Cover photograph by Andrew Brown

CITATION

This Interim Recovery Plan should be cited as:

Department of Conservation and Land Management (2006) Small Two-coloured Kangaroo Paw (*Anigozanthos bicolor* subsp. *minor*) Interim Recovery Plan 2006-2011. Interim Recovery Plan No. 223. Department of Conservation and Land Management, Perth, Western Australia.

SUMMARY

Scientific Name:	***Anigozanthos bicolor* subsp. *minor***	**Common Name:**	Small Two-coloured Kangaroo Paw
Family:	Haemodoraceae	**Flowering Period:**	August to November
CALM Regions:	South Coast and Wheatbelt	**CALM Districts:**	Esperance, Albany and Katanning
Shires:	Esperance, Ravensthorpe, Lake Grace and Jerramungup	**Recovery Teams:**	Esperance, Albany and Katanning

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Dixon B (1991) Kangaroo Paw the Wild Species, Description, Propagation and Cultivation. *Australian Plants* 16 (126) pp 77-81, Society for Growing Australian Plants; Hopper, S.D. (1993) *Kangaroo Paws and Catspaws*: *A natural history and field guide* Department of Conservation and Land Management, Perth; Hopper, S.D. (1987) Anigozanthos. *Flora of Australia* 45: 112-126. Australian Government Publishing Service, Canberra.

Current status: *Anigozanthos bicolor* subsp. *minor* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act* 1950 in September 1987 and ranked as Endangered in 1999. It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criteria B2b(iv,v)c(iv) (IUCN 2000) due to a continuing decline in number of populations and extreme fluctuations in the number of mature plants. The subspecies is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The main threats are continued clearing, lack of disturbance, inappropriate fire regimes, grazing (by stock, macropods and rabbits), weed invasion and rising salinity.

Description: *Anigozanthos bicolor* subsp. *minor* is a dwarf rhizomatous herb with flattened leaves 5-10 cm long and hairy flowers held on scapes 5-20 cm high. Each flower has a green perianth 30-45 mm long and a red ovary. The perianth is strongly constricted above the middle and is just 3-5 mm wide at the narrowest point. When flowering, *A. bicolor* subsp. *minor* usually has several flowering stems 5–20 cm tall with solitary flowers.

Habitat requirements: *Anigozanthos bicolor* subsp. *minor* is known historically from thirteen localities over a range of 290 km between the Fitzgerald River National Park and Condingup Peak. Many of these localities are unconfirmed as herbarium collections have not been made. The subspecies grows in moist sandy soil in heath communities and in shallow soils over granite.

Habitat critical to the survival of the species, and important populations: Habitat critical to the survival of the species includes the area of occupancy of important populations; areas of similar habitat surrounding important populations ie. moist sandy soil in heath communities and shallow soils near granite outcrops – these provide potential habitat for natural range extension and are necessary to allow pollinators to move between populations; the local catchment area where the species occurs; and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

Given that this subspecies is listed as Critically Endangered, it is considered that all known habitat for wild and future translocated populations is habitat critical.

Benefits to other species/ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Anigozanthos bicolor* subsp. *minor* will also improve the status of remnant vegetation in which it is located.

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The taxon is specifically listed under the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES).

Role and interests of indigenous people: Indigenous communities interested or involved in the region affected by this plan have not yet been identified. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs lists two art sites in the vicinity of Population 1 of *Anigozanthos bicolor* subsp. *minor*. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

Social and economic impact: Some populations of *Anigozanthos bicolor* subsp. *minor* occur on private land and the implementation of this recovery plan may therefore have some potential to have limited social and economic impact at these sites. Recovery actions will involve liaison and cooperation with all stakeholders with regard to these areas.

Affected interests: Stakeholders potentially affected by the implementation of this plan include the Shires of Esperance and Ravensthorpe as managers of road reserve habitat (Populations 5, 8 and 9) and a Recreation Reserve (Population 1), and the owners of private land where Populations 4, 11, 12a and 12b occur.

Evaluation of the Plans Performance: CALM will evaluate the performance of this IRP in conjunction with the Esperance, Albany and Katanning Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:

1. CALM staff conducted a field survey in October 1999 that encompassed the sites of all known populations of the subspecies. No populations were located in the Albany or Katanning districts. However, a large population was observed at Condingup Peak (700-800 plants) and a small population east of Gibson (2 plants). Both of these are in the Esperance District.
2. CALM staff conducted a three day field trip in November 2003 that encompassed a large area between Ravensthorpe and the Lake King-Hyden Road which had been burnt the previous summer. No populations of *Anigozanthos bicolor* subsp. *minor* were located. The area that contains Population 2 had not been burnt.
3. Staff from CALM's Esperance District regularly monitors populations of the taxon.
4. Staff from Albany and Katanning districts monitor known sites and conduct surveys for populations of the taxon.
5. The Esperance, Albany and Katanning District Threatened Flora Recovery Teams are overseeing the implementation of this IRP.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: No significant deterioration in habitat condition of known populations over the period of the plan's adoption under the EPBC Act.

Criteria for failure: Significant deterioration in habitat condition over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions
2. Map total habitat
3. Monitor populations
4. Formally notify land managers
5. Liaise with land managers
6. Develop and implement a fire management strategy
7. Seek long-term protection of habitat
8. Promote awareness
9. Stimulate germination
10. Conduct further surveys
11. Collect seed
12. Obtain biological and ecological information
13. Review the need for a full Recovery Plan

1. BACKGROUND

History

C.A. Gardner made the first known collection of *Anigozanthos bicolor* subsp. *minor* in 1935 and considered it to be a colour form of *A. bicolor*. S.D. Hopper described it as a distinct subspecies in 1987. It was then not seen for some 5 years and was presumed extinct until extensive searches conducted by CALM staff in 1999 located 700-800 plants in two localities. These plants rapidly declined over a period of two years and no extant plants are currently known. However, as *Anigozanthos bicolor* subsp. *minor* is known to re-establish from soil stored seed following summer fire or soil disturbance, there is potential for populations to re-establish in all known localities.

Description

Anigozanthos bicolor has red and green flowers that are similar to *A. manglesii* and *A. gabrielae*. However, they are smaller and more slender than those of *A. manglesii*, with smaller anthers (2-6 mm long) on longer filaments (1.5-7.5 mm) (Hopper 1993). *A. bicolor* has larger flowers than *A. gabrielae* and the perianth is curved rather than straight. There are four recognised subspecies; *bicolor*, *exstans*, *decrescens* and *minor*. *A. bicolor* subsp. *minor* and *A. bicolor* subsp. *decrescens* can be distinguished from other subspecies by the strong constriction of their perianth. *A. bicolor* subsp. *minor* differs from *A. bicolor* subsp. *decrescens* in its shorter leaves (5-10 cm long compared to 10-25 cm long), shorter stems (5-20 cm compared to 10-45 cm), smaller perianth (30-45 mm long compared to 45-65 mm long) and ovary hair colour (red compared to purple-red). In addition, the distribution of *A. bicolor* subsp. *minor* is disjunct from all other subspecies, as it occurs much further south-east (Hopper 1987, 1993, Craig and Coates 1994, Brown *et al* 1998).

Anigozanthos bicolor subsp. *minor* is a dwarf rhizomatous herb with flattened leaves 5-10 cm long and hairy flowers held on scapes 5-20 cm high. Each flower has a green perianth 30-45 mm long and a red ovary. The perianth is strongly constricted above the middle and is just 3-5 mm wide at the narrowest point. When flowering, *A. bicolor* subsp. *minor* usually has several flowering stems 5–20 cm tall with solitary flowers.

When flowering *Anigozanthos bicolor* subsp. *minor* usually has several flowering stalks, 5–20 cm tall, that bare solitary flowers.

Distribution and habitat

Anigozanthos bicolor subsp. minor is known historically from twelve well separated localities over a range of 290 km between the Fitzgerald River National Park, Lake King and Condingup. It favours moist sandy soil in heath communities and has also been found in shallow soil near granite outcrops. It flowers best after disturbance or summer fire (Hopper 1990). Most localities have not been confirmed through the collection of herbarium specimens and have not been resighted since their initial discovery. Only three of the twelve populations are confirmed.

Associated native plants include *Adenanthos* sp., *Allocasuarina* sp., *Banksia speciosa, Borya sphaerocephala, Calothamnus* sp., *Calytrix* spp., *Chamelaucium* sp., *Conostylis petrophiloides, Diuris laxiflora, Eucalyptus x tetragona, Eucalyptus incrassata, E. perangusta, Leptospermum* sp., *Lysinema* sp., *Patersonia* sp., *Verticordia* sp. and *Thryptomene* sp.

Populations 1, 2, 3, 4, 7, 8, 13 and 14 occur in CALM's Esperance District; Populations 5, 6, 9, 11, and 12 occur in CALM's Albany District; and Population 10 occurs in CALM's Katanning District.

Summary of population land vesting, purpose and tenure

Pop. No. & Location	District	Shire	Vesting	Purpose	Tenure
1. Condingup	Esperance	Esperance	Shire of Esperance	Recreation	Non CALM Act
2. North of Cascades	Esperance	Ravensthorpe	-	Vacant Crown Land	Non-CALM Act-General
3. Dalyup*	Esperance	Esperance	Conservation	Conservation of Flora	Nature Reserve

			Commission	and Fauna	
4. North east of Gibson	Esperance	Esperance	-	Private Property	Freehold
5. Fitzgerald*	Albany	Ravensthorpe	Shire of Ravensthorpe	Road reserve	Non-CALM Act
6. Twertup*	Albany	Jerramungup	Conservation Commission	National Park and Recreation	National Park
7. Jerdacuttup -Stokes Inlet*	Esperance	Esperance	Conservation Commission	National Park and Recreation	National Park
8. North east of Gibson	Esperance	Esperance	Shire of Esperance	Road reserve	Non-CALM Act
9. North west of Ravensthorpe **	Albany	Ravensthorpe	Shire of Ravensthorpe	Road reserve	Non-CALM Act
10. Pallarup	Katanning	Lake Grace	-	-	-
11. West of Hopetoun***	Albany	Ravensthorpe	-	Private Property	Freehold
12a. North west of Ravensthorpe****	Albany	Ravensthorpe	-	Private Property	Freehold
12b. North west of Ravensthorpe****	Albany	Ravensthorpe	-	Private Property	Freehold
13. West of Hopetoun	Esperance	Ravensthorpe	Conservation Commission	Conservation of Flora and Fauna	Nature Reserve
14. West of Hopetoun	Esperance	Ravensthorpe	Conservation Commission	Conservation of Flora and Fauna	Nature Reserve

Asterisks denote unconfirmed populations.* N. Foote[1] 1987, ** M. Graham[2] 1990's, *** S. Challenger[3] 1985 and A. Carmicheal[4] 1984 (in S. Hopper field notes), **** S. Hopper 1987.

Biology and ecology

The genus *Anigozanthos* is endemic to the south of Western Australia and contains eleven species and 22 subspecies. Two subspecies are Declared as Rare Flora (DRF) and three are listed as Priority flora.

All species of *Anigozanthos* have hermaphroditic flowers. These are mostly bird pollinated but some may also be pollinated by small mammals and honey bees. Yellow throated miners and honeyeaters have been seen feeding on the nectar of *A. bicolor* subsp. *minor* at Condingup Peak (field notes Steve Hopper[5]).

Several *Anigozanthos* species have horizontal rhizomes that provide the ability to re-shoot after fire (Dixon 1991). Very little is known about their root system and whether they are dependent on micorrhizal associations, although they grow well in cultivation in sterile potting mixes. During dry summer conditions members of the genus *Anigozanthos* rely on moisture stored in their rhizomes (Dixon 1991). It is not known if *A. bicolor* subsp. *minor* has this ability. However, as it only appears for a single year following disturbance this seems unlikely.

Most species of *Anigozanthos* can be easily raised from seed. However, some species produce few viable seeds and others germinate erratically. Treating seeds with hot (55-60 degree) water has been shown to improve germination (Dixon 1991).

Little is known about the biology and ecology of *Anigozanthos bicolor* subsp. *minor*. The species responds well to summer fire and has been seen after a dry season fire. Monitoring carried out by CALM's Science Division in the 1980s suggests that it appears shortly after a disturbance event, flowers in the first year then disappears again (A. Brown pers. obs.). It is therefore difficult to survey. Although fire appears to be the normal stimulus for germination, plants were noted growing abundantly at Population 1 in 1999 despite the fact that there had been no fires in many years. Germination may have been stimulated by the heavy summer rainfall and extreme runoff from a nearby granite rock that caused washouts (A. Brown pers. obs.).

[1] Nick Foote – Plant collector
[2] Mal Graham – Former District Operations Officer CALM's Katanning District
[3] Stephen Challenger - Member of the Esperance Wildflower Society
[4] Alan Carmicheal – Wildflower enthusiast
[5] Professor Steve Hopper – School of Plant Biology, Faculty of Natural and Agricultural Sciences, University of Western Australia

It is presumed that *Anigozanthos bicolor* subsp. *minor* is not susceptible to dieback disease caused by the plant pathogen *Phytophthora cinnamomi*; however it is susceptible to other fungal diseases such as ink-spot (*Alternaria alternata*) and rust.

Threats

Anigozanthos bicolor subsp. *minor* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act* 1950 in September 1987 and ranked as Endangered in 1999. It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criteria B2b(iv,v)c(iv) (IUCN 2000) due to a continuing decline in number of populations and extreme fluctuations in the number of mature plants. The subspecies is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The main threats are continued clearing, lack of disturbance, inappropriate fire regimes, grazing (by stock, macropods and rabbits), weed invasion and rising salinity.

- **Lack of disturbance** is the most likely explanation for there being no extant plants. Occasional fire or some other form of disturbance appears to be required for seed germination. Many of the areas that previously contained populations of *Anigozanthos bicolor* subsp. *minor* have not had any form of disturbance for a long period of time.
- **Continuing clearing** is a threat to the habitat of *Anigozanthos bicolor* subsp. *minor*. Historically, several populations were located following rolling and burning prior to cropping and these areas are now cleared farmland.
- **Inappropriate fire regimes** would adversely affect the viability of populations. The subspecies appears following summer fire, and fires at other times of the year may not stimulate germination of soil-stored seed.
- **Grazing** by rabbits, kangaroos and/or stock (at Populations 4, 8, 11, 12, and 13) may be a threat. However, no damage has been noted to plants in the past.
- **Introduced animals** such as rabbits may damage the habitat of *Anigozanthos bicolor* subsp. *minor* through warren construction, increased nutrient levels from droppings and the introduction of weeds.
- **Salinisation** of groundwater as a result of altered hydrology is a severe and increasing problem in the wheatbelt. *Anigozanthos bicolor* subsp. *minor* (Population 8) grows adjacent to saline flats and the affected area has the potential to expand due to a rising watertable.
- **Weeds** are a potential threat to Populations 4 and 8, particularly following fire. Population 8 is close to farmland and Population 4 is completely surrounded by farmland.

Summary of population information and threats

Pop. No & Location	Land Status	Year/No. plants	Threats
1. Condingup	Shire Recreation Reserve	1982 1 1999 700-800 2003 0	Lack of disturbance, inappropriate fire regimes, grazing by kangaroos and rabbits
2. North of Cascades	VCL	1983 5000+ 2003 0	Lack of disturbance, inappropriate fire regimes
3. Dalyup*	Conservation of Flora and Fauna	1988 0 1999 0	Lack of disturbance, Inappropriate fire regimes
4. North east of Gibson	Private Property	1987 40 1999 0	Now cleared farmland
5. Fitzgerald*	Shire road reserve	1967 Report 1999 0	Lack of disturbance, Inappropriate fire regimes
6. Twertup*	National Park	1967 Report 1999 0	Lack of disturbance, inappropriate fire regimes
7. Jerdacuttup -Stokes Inlet*	National Park	1999 0	Lack of disturbance, inappropriate fire regimes
8. North east of Gibson	Private Property	1963 Herbarium record 1999 2 2004 0	Lack of disturbance, inappropriate fire regimes, road maintenance, salinity, weeds
9. North west of Ravensthorpe **	Shire road reserve	1999 0	Lack of disturbance, inappropriate fire regimes, road maintenance
10. Pallarup	unknown	1935 Herbarium record 1999 0	Lack of disturbance, inappropriate fire regimes
11. West of Hopetoun***	Private Property		Lack of disturbance, inappropriate fire regimes
12. North west of Ravensthorpe****	Private Property	1987 0	Lack of disturbance, inappropriate fire regimes

12b. North west of Ravensthorpe****	Private Property	1987 4	Lack of disturbance, inappropriate fire regimes
13. West of Hopetoun	Nature Reserve	2004 160	Lack of disturbance, inappropriate fire regimes
14. West of Hopetoun	Nature Reserve	2004 67	Lack of disturbance, inappropriate fire regimes

Asterisks denote unconfirmed populations.* N. Foote 1987, ** M. Graham 1990's, *** S. Challenger 1985 and A. Carmicheal 1984 (in S. Hopper field notes), **** S. Hopper 1987.
Populations in **bold text** are considered to be Important Populations

Guide for decision-makers

Section 1 provides details of current and possible future threats. Proposed developments and on-ground works (clearing, firebreaks etc) in the immediate vicinity of habitat critical to the survival of *Anigozanthos bicolor* subsp. *minor* will require assessment. Works should not be approved unless the proponents can demonstrate that activities will not be detrimental to the species, its habitat or potential habitat, or the local hydrology (surface and ground water).

Habitat critical to the survival of the species, and important populations

Habitat critical to the survival of the species includes the area of occupancy of important populations; areas of similar habitat surrounding important populations ie. moist sandy soil in heath communities and shallow soils near granite outcrops – these provide potential habitat for natural range extension and are necessary to allow pollinators to move between populations; the local catchment area where the species occurs; and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

Given that this subspecies is listed as Critically Endangered, it is considered that all known habitat for wild and future translocated populations is habitat critical.

Benefits to other species/ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Anigozanthos bicolor* subsp. *minor* will also improve the status of remnant vegetation in which it is located.

International Obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The taxon is specifically listed under the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES).

Role and interests of indigenous people

Indigenous communities interested or involved in the region affected by this plan have not yet been identified. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs lists two art sites in the vicinity of Population 1 of *Anigozanthos bicolor* subsp. *minor*. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social or economic impacts. However, as some populations are located on private property their protection may potentially affect farming activities. Recovery actions will involve liaison and cooperation with all stakeholders with regard to these areas.

Affected interests

Stakeholders potentially affected by the implementation of this plan include the Shires of Esperance and Ravensthorpe as managers of road reserve habitat (Populations 5, 8 and 9) and a Recreation Reserve (Population 1), and the owners of private land where Populations 4, 11, 12a and 12b occur.

Evaluation of the Plans Performance

CALM will evaluate the performance of this IRP in conjunction with the Esperance, Albany and Katanning Districts Threatened Flora Recovery Teams. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.
Recovery criteria
Criteria for success: No significant deterioration in habitat condition of known populations over the period of the plan's adoption under the EPBC Act
Criteria for failure: Significant deterioration in habitat condition over the period of the plan's adoption under the EPBC Act.

Existing recovery actions

The owners of land on which populations 1 and 8 occur have been notified of the presence of *Anigozanthos bicolor* subsp. *minor* on their land. These notifications detailed the Declared Rare status of the species and associated legal obligations.

CALM staff conducted a field survey in October 1999, which encompassed the habitat of all populations of the subspecies that had been historically recorded. No populations were located in the Albany and Katanning districts. However, a large population was observed at Condingup Peak (700-800 plants) and a small population east of Gibson (2 plants) in the Esperance district.

In November 2003 CALM staff conducted a field survey between Ravensthorpe and the Lake King-Hyden Road, encompassing a large area that was burnt during a wildfire in the previous summer. No populations of *Anigozanthos bicolor* subsp. *minor* were located. Surveys included the habitat of Population 2. However, this area had not been burnt in the fire.

Staff from CALM's Esperance, Albany and Katanning Districts monitor all locations of this taxon.

The Esperance, Albany and Katanning District Threatened Flora Recovery Teams are overseeing the implementation of this IRP.

Future recovery actions

As some populations occur on private property, permission has been or will be sought from the land owners prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority, however this should not constrain addressing any of the priorities if funding is available for 'lower' priorities, and other opportunities arise.

1. Coordinate recovery actions

The Esperance District Threatened Flora Recovery Team (EDTFRT), Albany District Threatened Flora Recovery Team (ADTFRT) and Katanning District Threatened Flora Recovery Team (KDTFRT) will continue to oversee the implementation of recovery actions for *Anigozanthos bicolor* subsp. *minor* and will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions

Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $2,200 per year

2. Map total habitat

It is a requirement of the EPBC Act that spatial data relating to total habitat of the species be determined. Although habitat critical to the species' survival is described in Section 1, the areas as described have not yet been mapped and that will be redressed under this action. If any additional populations are located, then total habitat will also be determined and mapped for these locations.

Action: Map total habitat
Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $4,000 in the first year

3. Monitor populations

Locations of *Anigozanthos bicolor* subsp. *minor* will be monitored for germination of soil-stored seed. Annual monitoring of factors such as habitat degradation, pollinator activity, seed production, recruitment, longevity, grazing, weed invasion and predation is also essential. If monitoring shows that there is a high level of threat from weeds or grazing, appropriate control measures will be undertaken.

Action: Monitor populations
Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $2,000 per year

4. Formally notify land managers

The owners of land on which populations 1 and 8 occur have been notified of the presence of *Anigozanthos bicolor* subsp. *minor* on their land. In order promote the rediscovery and protection of all populations, information about the species and the need to protect it will be provided to all other landowners and land managers where populations have been found historically but are not known now.

Action: Formally notify land owners and land managers
Responsibility: CALM (Species and Communities Branch)
Cost: $500 in the first year

5. Liaise with land managers

Staff from CALM's Esperance, Albany and Katanning Districts will continue to liaise with relevant land managers and landowners to ensure that the locations of both known and historic populations are not accidentally damaged or destroyed. Two significant sites that occur in the vicinity of *Anigozanthos bicolor* subsp. *minor* are listed on the Aboriginal Sites Register maintained by the Department of Indigenous Affairs and Aboriginal input and involvement will be sought in the management of populations in these areas.

Action: Liaise with land managers
Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $1500 per year

6. Develop a fire management strategy

Fire is believed to stimulate the germination of soil-stored seed. However, it is thought that the fire needs to occur over the late Spring, Summer, early Autumn period and that fires at other times of the year would not be effective. This needs to be clarified and, once trials have been carried out, a fire management strategy for areas

that contain populations of the subspecies developed to provide details of the recommended fire frequency, timing, and intensity of burns.

Action: Develop a fire management strategy
Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $2,400 for preparation in year three, $1,000 for implementation in fourth and fifth years (if required)

7. Seek long-term protection of habitat

Ways and means of improving the security of populations and their habitat will be investigated. This may include conservation covenants, the Land for Wildlife scheme or possibly land acquisition.

Action: Seek long-term protection of habitat
Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $1,000 per year, plus cost of any land purchases

8. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of the wild populations of this species will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged.

A reply paid postal drop of a pamphlet that illustrates *Anigozanthos bicolor* subsp. *minor* and describes its distinctive features and habitat will be developed and distributed to residents in Shires throughout its range. Postal drops aim to stimulate interest, provide information about threatened species and provide a name and number to contact if new populations are located by members of the community. An information sheet that includes a description of the plant, its habitat type, threats, management actions and photos will also be produced.

Action: Promote awareness
Responsibility: CALM (Esperance, Albany and Katanning Districts, Corporate Relations) through the EDTFRT, ADTFRT and KDTFRT
Cost: $1,300 in first year and $500 in subsequent years

9. Stimulate germination

Small scale experimental burns and smoke water will be trialled over a portion of one or more known populations to determine their effectiveness in encouraging recruitment. The application of smoke water will leave surrounding vegetation intact and may also stimulate germination of associated species. Burning trials will be conducted on Population 1, 2 or 8.

Action: Stimulate germination
Responsibility: CALM (Esperance District) through the EDTFRT
Cost: $2000 per year for first 4 years

10. Conduct further surveys

Further survey for the species will be undertaken on a systematic basis in areas of suitable habitat during its flowering period (August-November). Helms Arboretum near Esperance, where unconfirmed populations have been recorded and other areas of suitable habitat near existing populations will be the main focus for survey, especially the first year after a fire or soil disturbance.

Action: Conduct further surveys

Responsibility: CALM (Esperance, Albany and Katanning Districts) through the EDTFRT, ADTFRT and KDTFRT
Cost: $3,000 per year

11. Collect seed

As there are no currently known extant populations, seed collections have not yet been made. Seed will therefore be collected from all populations when they re-establish from germination of soil-stored seed. Such collections are needed to guard against extinction if wild populations are lost and also to propagate plants for possible future translocations. Cryostorage of seed will also be beneficial for the long term survival of the species.

Action: Collect seed
Responsibility: CALM (TFSC, Esperance, Albany and Katanning Districts) and BGPA through the EDTFRT, ADTFRT and KDTFRT
Cost: $3,100 in third and fifth year (if plants are found)

12. Obtain biological and ecological information

Research designed to increase an understanding of the biology and ecology of the species will provide a scientific basis for management of *Anigozanthos bicolor* subsp. *minor* in the wild. Research will ideally include:

1) Pollination biology and seed set
2) Factors determining level of flower and fruit abortion
3) Size and viability of soil seed bank
4) Level of invertebrate grazing or removal of seed
5) Seed germination requirements
6) Role of disturbance in regeneration
7) Effects of fungal diseases such as ink spot and rust
8) Effects of weeds on recruitment and establishment
9) Response of *A. bicolor* subsp. *minor* and habitat to herbicide treatments
10) Response of *A. bicolor* subsp. *minor* and habitat to fire
11) Effects of salinity on population dynamics
12) Extent of genetic variation within and between populations. This is essential information if new populations are to be established.
13)

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Esperance, Albany and Katanning Districts) and BGPA through the EDTFRT, ADTFRT and KDTFRT
Cost: $20,000 per year for third, fourth and fifth years

13. Review the need for a full Recovery Plan

If the species is still ranked as Critically Endangered at the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for further recovery actions and an update to this IRP will be assessed.

Action: Review the need for a full Recovery Plan
Responsibility: CALM (Species and Communities Branch, Esperance, Albany and Katanning District) through the EDTFRT, ADTFRT and KDTFRT
Cost: $20,300 in the fifth year (if required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from May 2006 to April 2011 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered after five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. REFERENCES

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6. KEY AND TAXONOMIC DESCRIPTION

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Four subspecies of *Anigozanthos bicolor* are recognised in the following key.

1. Perianth parallel sided or slightly constricted above the middle, outer filaments 2-5.5 mm long .....2.

    2. Stems 20-60 cm high. Perianth 45-65 mm long and 5.5-12 mm wide at the narrowest point above the middle ..... **Anigozanthos bicolor subsp. bicolor**

    2. Stems 10-25 cm high. Perianth 55-75 mm long and 4-10 mm wide at the narrowest point above the middle ..... **Anigozanthos bicolor subsp. exstans**

1. Perianth strongly constricted above the middle. Outer filaments 4-7.5 mm long 3

    3. Leaves 10-25 cm long. Stems 10-45 cm tall. Perianth 45-65 mm long. Hairs on ovary red-purple ..... **Anigozanthos bicolor subsp. decrescens**

    3. Leaves 5-10 cm long. Stems 5-20 cm tall. Perianth 30-45 mm long. Hairs on ovary red ..... **Anigozanthos bicolor subsp. minor**

Anigozanthos bicolor subsp. minor

Leaves 5-10 cm long. Scapes several, 5-20 cm tall. Perianth strongly constricted, 3-5 mm wide at narrowest point above the middles, 30-45 mm long. Outer filaments 4-6 mm long. Hairs on ovary red.

Rare, in disjunct populations near Lake King, Stokes Inlet and Esperance, W.A. Grows in well-watered sand, sometimes by granite outcrops, in heath.

This taxon was included under *A. gabrielae* by D. Geerinck, but the types are clearly referable to *A. bicolor* on the basis of dried perianth 31-35 mm long, lobes 7 mm long, anthers 1.7 mm long, filaments 4.5 mm long.