Spiral Fruited Wattle

(*Acacia cochlocarpa* subsp. *cochlocarpa*)

RECOVERY PLAN

Department of Environment and Conservation
Kensington

Australian Government

Government of Western Australia

Department of Environment and Conservation
Our environment, our future

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. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

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.

DEC 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 IRP, which results from a review of, and replaces, IRP No. 24 *Acacia cochlocarpa* subsp. *cochlocarpa* (Stack and English 1999), will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced.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 approved by the Director of Nature Conservation on the 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate as at April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

IRP PREPARATION

This IRP was prepared by Kathy Himbeck[1]

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ACKNOWLEDGEMENTS

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

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Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information. Thanks also to DEC's Species and Communities Branch and the private land holders who provided information and assistance in locating populations in the field.

Cover photograph by Kathy Himbeck.

CITATION

Department of Environment and Conservation (2009) Spiral Fruited Wattle (*Acacia cochlocarpa* subsp. *cochlocarpa*).. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra.

SUMMARY

Scientific Name:	*Acacia cochlocarpa* subsp. *cochlocarpa*	**Common Name:**	Spiral fruited wattle
Family:	MIMOSACEAE	**Flowering Period:**	June - July
DEC Region:	Midwest	**DEC District:**	Moora
Shire:	Moora	**Recovery Team:**	Moora District Threatened Flora Recovery Team
NRM Region:	Northern Agricultural		

Illustrations and/or further information: Brown, A., Thompson-Dans, C. and Marchant, N. (eds) (1998) *Western Australia's Threatened Flora.* Department of Conservation and Land Management, Western Australia; Department of Environment and Conservation (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora* (Accessed 2007). Department of Environment and Conservation, Western Australia. http://www.calm.wa.gov.au/science/; Maslin, B. R (Coordinator) (2001) *Wattle: Acacias of Australia*. Australian Biological Resources Study, Australia.

Analysis of outputs and effectiveness of *Acacia cochlocarpa* subsp. *cochlocarpa* IRP 24 (1999-2002) prepared by Gillian Stack and Val English:

The criteria for success in the previous plan ('the number of individuals within populations and/or the number of populations have increased') has been met, as the number of known populations has increased from two to four, with the discovery of one new population and the establishment of two translocated populations. The number of known plants has increased from 132 to approximately 670, an increase of over 400 percent in the number of mature plants. This has occurred mainly due to the initial success of the two translocated populations.

Actions recommended in the previous plan that have been implemented, include:
Action 1. Implement translocation plan
Action 3. Develop a fire management strategy
Action 4. Preserve genetic diversity
Action 5. Obtain biological and ecological information
Action 7. Disseminate information
Action 8. Write updated Interim Recovery Plan

Actions 4, 5 and 7 and other recovery actions included in the plan are ongoing and are included in this revised plan. New recovery actions included in this plan are 'coordinate recovery actions', 'map habitat critical to survival' and 'liaise with landholders'.

Current Status: *Acacia cochlocarpa* subsp. *cochlocarpa* was declared as Rare Flora in November 1997 under the Western Australian *Wildlife Conservation Act 1950* and was ranked as Critically Endangered (CR) in November 1998 under World Conservation Union (IUCN 1994) Red List criterion B1+2c. There are only 135 mature plants known in three wild populations (one extinct, one in decline and one moderately healthy) on highly disturbed road reserves and private property. All populations are affected by fragmentation and continuing degradation of habitat. A further 535 plants are known from two translocated populations in a Nature Reserve. The main continuing threats to natural populations are road and track maintenance activities, inappropriate fire regimes and insect galling. *A. cochlocarpa* subsp. *cochlocarpa* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Description: *Acacia cochlocarpa* subsp. *cochlocarpa* is a sprawling, low growing, glabrous shrub to 70 cm tall and up to 3 m wide, with slightly flexuose branchlets. The phyllodes are incurved and erect, up to 7.5 cm long and 6 mm wide, with 5 - 7 nerves per face. They are linear to narrowly elliptic. The flower heads are golden, sessile and cylindrical, 7 - 10 mm long. The tightly coiled seedpods are up to 4 mm wide (Patrick and Brown 2001).

A second subspecies, *Acacia cochlocarpa* subsp. *velutinosa,* occurs near Manmanning and differs in its shorter phyllodes, velvety branchlets, phyllodes and legumes, and in its smaller, oblong flower heads. *A. cochlocarpa* subsp. *cochlocarpa* is also similar to *A. alocophylla* ms which has 8–nerved phyllodes, and to *A. tetraneura,* which has 4-nerved phyllodes and bracteoles exserted on the buds (Patrick and Brown 2001).

Habitat requirements: *Acacia cochlocarpa* subsp. *cochlocarpa* is known from a narrow 700 m length of road reserve and private property near Watheroo in the Moora Shire. Populations are associated with brown sand, or clayey sand with laterite. Plants occur as two close populations in disturbed open low scrub on road reserve and on private property. The subspecies grows in association with *Hakea scoparia, Allocasuarina campestris*, and a number of other *Acacia* species.

Habitat critical to the survival of the subspecies, and important populations: Given that *Acacia cochlocarpa* subsp. *cochlocarpa* is ranked as Critically Endangered (CR) in Western Australia under the World Conservation Union (IUCN 1994) Red List criterion B1+2c and Endangered under the Commonwealth EPBC Act, it is considered that all known habitat for wild populations is critical to the survival of the subspecies and that all wild populations are important populations. Habitat critical to the survival of *A. cochlocarpa* subsp. *cochlocarpa* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the subspecies or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Acacia cochlocarpa* subsp. *cochlocarpa* will also improve the status of associated native vegetation. Additionally, two Declared Rare Flora species occur in association with *A. cochlocarpa* subsp. *cochlocarpa*. These include *Calothamnus accedens* (Critically Endangered under the Western Australian *Wildlife Conservation Act 1950*; Extinct under the Commonwealth EPBC Act) and *Gastrolobium hamulosum* (Critically Endangered under the Western Australian *Wildlife Conservation Act 1950*; Endangered under the Commonwealth EPBC Act).

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993 and will assist in implementing Australia's responsibilities under that Convention. *Acacia cochlocarpa* subsp. *cochlocarpa* is not listed under any specific international treaty and this recovery plan does not affect Australia's obligations under any other international agreements.

Indigenous consultation: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, one significant site occurs within a kilometre of Population 1 of *Acacia cochlocarpa* subsp. *cochlocarpa*. The involvement of the Indigenous community is currently being sought to determine if there are any Indigenous issues identified in the Plan. If no role is identified for Indigenous communities in the recovery of this subspecies, opportunities may exist through cultural interpretation and awareness of the subspecies.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to 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 subspecies' conservation. Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impact: There is potential for some social and economic impact during the implementation of this recovery plan as most populations of *Acacia cochlocarpa* subsp. *cochlocarpa* occur on private property and road reserves that are not specifically managed for conservation.

Affected interests: The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of *Acacia cochlocarpa* subsp. *cochlocarpa* populations on private property will have implications for the property owners. Where it occurs on road reserves under the care, control and management of Main Roads Western Australia (MRWA), the authority will be required to ensure protection of those populations. Where populations occur in Conservation Estate, DEC, as the managing authority will be required to protect populations from threatening processes and potential damage from management practices such as prescribed burning and track maintenance. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance: This recovery plan will be reviewed within five years and an assessment of the status of the populations and future directions will be made at that time. The performance of the recovery plan and the progress of Recovery Actions will be evaluated by DEC in conjunction with the Moora District Threatened Flora Recovery Team.

Completed Recovery Actions

1. In 1999 and 2000, *Acacia cochlocarpa* subsp. *cochlocarpa* seedlings were planted at two sites in Gunyidi Nature Reserve, north of Watheroo, consistent with an approved Translocation Proposal.
2. All known populations were surveyed in 2006.
3. A fire management strategy has been developed.
4. Seed has been collected from all populations and placed in long term storage at DEC's Threatened Flora Seed Centre (TFSC).
5. Research on flowering phenology, soil seedbanks, and the impact of fire, weeds and grazing on the subspecies was conducted by Yates and Broadhurst in 2002.
6. An information sheet for *Acacia cochlocarpa* subsp. *cochlocarpa* has been produced.
7. An updated recovery plan has been prepared.

8. DRF markers have been erected at Populations 2 and 3.

Ongoing and future recovery actions

1. Staff from DEC's Moora District will continue to monitor all known populations.
2. The Moora District Threatened Flora Recovery Team (MDTFRT) will oversee the implementation of this recovery plan in their respective regions and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Recovery plan objective: The objective of this recovery plan is to identify and abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: The number of populations has increased or the number of individuals within populations has increased by ten percent or more over the term of the plan.

Criteria for failure: The number of populations has decreased or the number of individuals within populations has decreased by ten percent or more over the term of the plan.

Recovery Actions: Below are listed those Recovery Actions considered most important to fulfil the criteria for success of this plan. Whilst some actions will be undertaken simultaneously, they are ordered depending on priority with the more urgent recovery actions at the top of the list. Each is explained in more detail in the following section.

1. Coordinate recovery actions	7. Liaise with relevant land managers and Indigenous groups
2. Monitor translocated populations	8. Investigate the impact of insect galling
3. Monitor natural populations	9. Disseminate information
4. Implement further translocations	10. Collect seed for long term storage and future translocations
5. Map habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa*	11. Amend the fire management strategy
6. Conduct further field surveys	12. Review this plan and assess the need for further recovery actions

1. BACKGROUND

An analysis of outputs and effectiveness of IRP 24 (1999-2002) by G. Stack and V. English follows. This IRP replaces IRP No. 24.

The criteria for success in the previous plan ('the number of individuals within populations and/or the number of populations have increased') has been met, as the number of known populations has increased from two to five, with the discovery of one new wild population and the establishment of two translocated populations. The number of known plants in populations (wild and translocated combined) has increased from 132 to 670, an increase of 80% in the number of mature plants. This has occurred mainly due to the initial success of the two translocated populations.

Actions carried out through the previous plan include:

Action 1. Consistent with an approved Translocation Proposal, *Acacia cochlocarpa* subsp. *cochlocarpa* seedlings were planted at two sites in Gunyidi nature reserve, north of Watheroo in 1999 and 2000.
Action 3. A fire management strategy has been developed.
Action 4. Seed has been collected from all populations and placed in long term storage at DEC's Threatened Flora Seed Centre (TFSC).
Action 5. Research on flowering phenology, soil seedbank and the impact of fire, weeds and grazing on *Acacia cochlocarpa* subsp. *cochlocarpa* were investigated by Yates and Broadhurst in 2002.
Action 7. An information sheet has been produced for *Acacia cochlocarpa* subsp. *cochlocarpa*.
Action 8. An updated Interim Recovery Plan has been prepared.

Actions 4, 5 and 7 and other recovery actions included in the plan are ongoing and are included in this revised plan.

History

Acacia cochlocarpa was described by Carl Meisner in 1855 from collections made by James Drummond from locations given as 'Swan River' and 'between Moore and Murchison Rivers'. A population located in 1973 was destroyed when a road was realigned prior to 1991 (Population 1). Populations 2 and 3 were discovered in 1991 but extensive surveys conducted between Carnamah and Watheroo since then have failed to locate any new populations. The two extant wild populations are in close proximity to one another and could be considered a single population but have separate managers. There has been a decrease in total plant numbers and it has been suggested that the populations are senescing. A translocation was carried out in August 1998 to address the significant immediate threats posed to this taxon from the low number of plants in wild populations and fragmentation of habitat. The numbers of plants in wild populations is still stagnant and the populations may require disturbance or additional plantings to boost their size. A larger translocation is recommended to further secure the future of this taxon.

Description

Acacia cochlocarpa subsp. *cochlocarpa* is a sprawling, glabrous shrub, 70 cm tall by 3 metres wide, and has slightly flexuose branchlets. The phyllodes, which are incurved and erect, are 3 to 7.5 cm long and 3 to 6 mm wide, 5 to 7 nerves per face, and are linear to narrowly elliptic. The flower heads are golden, sessile and cylindrical, and up to 10 mm long. The seedpods are tightly coiled and up to 4 mm wide (Brown *et al*. 1998).

A second subspecies, *Acacia cochlocarpa* subsp. *velutinosa,* occurs near Manmanning and differs in its shorter phyllodes, velvety branchlets, phyllodes and legumes, and in its smaller, oblong flower heads. *Acacia cochlocarpa* subsp. *cochlocarpa* is also similar to *Acacia alocophylla* ms, which has 8–nerved phyllodes, and to *Acacia tetraneura*, which has four-nerved phyllodes and bracteoles exserted on the buds (Brown *et al*. 1998).

Distribution and habitat

Early sightings of *Acacia cochlocarpa* subsp. *cochlocarpa* between the Swan River and 'westward from Moora' by Diels in 1901 suggested that this taxon once occurred over a range of almost 250 km. The majority of these collections were however north of Watheroo over a range of 20 km. Most of the roadside populations appear to have been lost since then. Two extant wild populations are currently known from a disturbed road reserve and private property, growing in sand, or clayey-sand with laterite in an open shrubland of *Allocasuarina campestris*, other *Acacia* species and *Hakea scoparia*. The two translocated populations are in similar habitat.

Table 1. Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. N of Watheroo	Moora	Moora	Main Roads WA	Road Reserve	Main Roads WA
2. N of Watheroo	Moora	Moora	Main Roads WA	Road Reserve	Main Roads WA
3. N of Watheroo	Moora	Moora	Freehold	Private Property	Landowners
4T. N of Watheroo	Moora	Moora	Conservation Commission of Western Australia	Conservation of Flora and Fauna (Nature Reserve)	DEC
5T. N of Watheroo	Moora	Moora	Conservation Commission of Western Australia	Conservation of Flora and Fauna (Nature Reserve)	DEC

Populations in **bold text** are considered to be Important Populations. Populations with a 'T' are Translocated Populations.

Biology and ecology

In 2002 Yates and Broadhurst conducted research on the biology and ecology of *Acacia cochlocarpa* subsp. *cochlocarpa* providing information on flowering phenology, soil seedbanks and the impact of fire, weeds and grazing. They found that 'the size class structure of the population was skewed towards larger (older) individuals with many plants senescing and beginning to reach the end of their life-span' and there was also an 'absence of seedlings and juveniles'. An explanation for the lack of recruitment is related to the inactivation of the seed bank by a lack of disturbance such as fire. The habitat has not been burnt for a considerable time. The seeds have a hard seed coat and remain dormant until the seed coat is ruptured by heating or scarifying. This is a method exploited by many Australian species of *Acacia* to survive the fires that were a regular natural occurrence in many Australian habitats.

In 1996, staff from the Department's Threatened Flora Seed Centre (TFSC) observed predation of fruits and low fruit production due to galling of the flowers caused by an unidentified wasp. In 1997 fruit production was greater than the previous year. These variations in fruit production can be caused by a variety of factors (e.g. rainfall, population size, pollinator abundance, resource availability and pollen quality) and may not be solely influenced by the wasp. Yates and Broadhurst (2002) suggest that the years of high seed production and the presence of a persistent soil seed bank from previous years may buffer the taxon against the impacts of reduced seed production in some years. This is known as the storage effect. Yates and Broadhurst (2002) also found that plants were producing substantial quantities of seed and the seed was being incorporated into soil seed reserves beneath adult plants. Also the number of seeds per square metre of soil was within or greater than the range reported for a common *Acacia*. These results would suggest that seed production is not limiting the potential for population growth, and is not responsible for the absence of seedlings and juveniles in the population.

From the same study Yates and Broadhurst (2002) found that rainfall has an impact on inflorescence, legume and seed production with the highest numbers for each factor being recorded after an above average rainfall year, as well as varying between the three consecutive years of the study. Also seedling establishment and growth was found to be higher in the areas that were fenced from grazing, although this exclusion did not affect survivorship.

Threatening processes

Acacia cochlocarpa subsp. *cochlocarpa* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in November 1997 and was ranked as Critically Endangered (CR) in November 1998 under World Conservation Union (IUCN 1994) Red List criterion B1+2c. There are only 135 mature plants known in three wild populations (one extinct, one in decline and one moderately healthy) on highly disturbed

road reserves and private property. All populations are affected by fragmentation and continuing degradation of habitat. A further 535 plants are known from two translocated populations in a Nature Reserve. The main continuing threats to natural populations are road and track maintenance activities, inappropriate fire regimes and insect galling. *A. cochlocarpa* subsp. *cochlocarpa* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **Road maintenance activities** including grading of the road reserve, construction of drainage channels and mowing the roadside vegetation to improve visibility are a threat to Population 2 of *Acacia cochlocarpa* subsp. *cochlocarpa* as plants occur close to the edge of the paved road surface. These disturbance events also encourage weed invasion into the habitat. Indiscriminate herbicide application to control roadside weeds as part of road maintenance may damage or kill plants of this taxon.
- **Track maintenance activities** such as grading could impact on the taxon, as some plants occur downslope of an existing track and could be partially buried by road material following grading.
- **Inappropriate fire regimes** will adversely affect the viability of populations. *Acacia cochlocarpa* subsp. *cochlocarpa* is thought to have a long-lived soil seed bank with seed germinating following fire, however, a regime of frequent fires would rapidly deplete these reserves if plants were not able to reach reproductive maturity and produce enough seed in the fire-free period to replace themselves (Yates *et al*. 2003). In the absence of fire, plants may senesce and die before being able to regenerate. It is therefore thought that occasional localised fires are needed for the maintenance of populations of this taxon.
- **Insect galling** is a potential threat to the reproductive capacity of the taxon as the galls occur on flowers and prevent them from being pollinated and producing seed.

The intent of this plan is to provide actions that will deal with immediate threats to *Acacia cochlocarpa* subsp. *cochlocarpa*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. - Summary of population information and threats

Pop. No. & Location	Land Status	Year/No plants	Population Condition	Threats
1. N of Watheroo	Road Reserve	1991 0 1996 0	Extinct	Destroyed during road realignment before being Declared as Rare Flora.
2. N of Watheroo	Road Reserve	1996 44 1998 83 2006 75	Moderate	Road maintenance activities, inappropriate fire regimes, insect galling
3. N of Watheroo	Private property	1996 36 1998 47 2006 60	Moderate	Track maintenance activities, inappropriate fire regimes, insect galling
4T. N of Watheroo	Nature Reserve	2002 320 2003 306 2004 296 2005 357 2006 321	Healthy	Inappropriate fire regimes, insect galling
5T. N of Watheroo	Nature Reserve	2000 424 2001 221 2002 187 2003 188 2004 188 2005 196 2006 214	Healthy	Inappropriate fire regimes, insect galling

Note: All populations are considered to be important populations

Guide for decision-makers

Table 2 provides details of current and possible future threats. Developments in the immediate vicinity of the populations or within the defined habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa* require assessment for the potential for a significant level of impact.

Habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa* and important populations

Given that *Acacia cochlocarpa* subsp. *cochlocarpa* is ranked as Critically Endangered (CR) in Western Australia under the World Conservation Union (IUCN 1994) Red List criterion B1+2c and Endangered under the Commonwealth EPBC Act, it is considered that all known habitat for wild populations is critical to the survival of the subspecies, and that all wild populations are important populations. Habitat critical to the survival of *A. cochlocarpa* subsp. *cochlocarpa* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the subspecies or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Acacia cochlocarpa* subsp. *cochlocarpa* will also improve the status of associated native vegetation. Two Critically Endangered taxa occur in association with *Acacia cochlocarpa* subsp. *cochlocarpa*. These taxa are listed in the table below:

Conservation-listed flora species occurring in habitat of *Acacia cochlocarpa* subsp. *cochlocarpa*

Species name	Conservation Status (Western Australia)	Conservation Status (EPBC Act)
Calothamnus accedens	DRF, Critically Endangered	Extinct
Gastrolobium hamulosum	DRF, Critically Endangered	Endangered

For a description of the priority categories see Atkins (2006)

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention. *Acacia cochlocarpa* subsp. *cochlocarpa* is not listed under any specific international treaty however, and this recovery plan does not affect Australia's obligations under any other international agreements.

Indigenous consultation

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, one significant site occurs within a kilometre of Population 1 of *Acacia cochlocarpa* subsp. *cochlocarpa*. The involvement of the Indigenous community is currently being sought to determine if there are any Indigenous issues identified in the Plan. If no role is identified for Indigenous communities in the recovery of this subspecies, opportunities may exist through cultural interpretation and awareness of the subspecies.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to 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 subspecies' conservation.

Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. However, as *Acacia cochlocarpa* subsp. *cochlocarpa* Population 3 occurs on private property the protection of the subspecies at that site may potentially affect development and asset protection measures. Recovery actions refer to continued liaison between stakeholders with regard to populations located on private property.

Affected interests

The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of *Acacia cochlocarpa* subsp. *cochlocarpa* populations on private property will have implications for the property owners. Where it occurs on road reserves under the care, control and management of Main Roads Western Australia (MRWA), the authority will be required to ensure protection of those populations. Where populations occur in Conservation Estate, DEC, as the managing authority will be required to protect populations from threatening processes and potential damage from management practices such as prescribed burning and track maintenance. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance

DEC, in conjunction with the Moora District Threatened Flora Recovery Team, will evaluate the performance of this recovery plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following four years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this recovery plan is to continue to abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Criteria for success: The number of populations has increased or the number of individuals within populations has increased by ten percent or more over the term of the plan.

Criteria for failure: The number of populations has decreased or the number of individuals within populations has decreased by ten percent or more over the term of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

In 1999 and 2000, *Acacia cochlocarpa* subsp. *cochlocarpa* seedlings were planted at two sites on Gunyidi Nature Reserve north of Watheroo, consistent with an approved Translocation Proposal (Coates and Monks 1998). Data collected during monitoring included the number of surviving plants, height, width of the crown in two directions, reproductive state, number of inflorescences and pods, number of viable seeds, whether second-generation plants were present and general health of the plants. The seedlings also were subject to several experimental treatments including watered, mulched, seedlings planted at age nine months, seedlings planted at age 18 months, and protection from grazing. Seedlings raised as a result of seed viability tests were planted back into one of the translocation sites in 2005. Results indicate that fencing seedlings immediately after planting enhances success but the mulch and watering treatments had little to no effect on survival or growth (Monks and Coates 2002). The younger seedlings (nine months) were more vigorous and healthier, producing a denser canopy and a greener overall appearance compared to the 18 month old seedlings. Translocated populations will be monitored on an annual basis.

The extant wild population was fully surveyed in 1998 and then from 1999 to 2001 when Dr Colin Yates was conducting his fire research trials. The populations were monitored in 2004 when seed was collected and a full survey conducted in 2006 in preparation for this plan.

Plants are killed by fire and, depending on the frequency of fires, subsequent seedlings may not reach reproductive maturity, leading to a depletion of the seed bank. With this in mind, a fire management strategy was developed for *Acacia cochlocarpa* subsp. *cochlocarpa* which recommended that fire be excluded. However, Yates and Broadhurst (2002) subsequently recommended that the wild populations would benefit from careful use of fire to stimulate germination, in association with weed control. The work done by Yates and

Broadhurst uses rigorous research techniques, and the resulting recommendations and comments for management purposes have been considered and will be prudently implemented. The frequency of fire for management purposes should not exceed the life expectancy of this taxon to ensure that the wild populations do not decline as a result of this practice. Therefore, a fire regime of controlled burning a portion of aging plants in a population every 15-20 years is recommended in this plan, in conjunction with careful weed control. The fire

characteristics, seasonality, effectiveness of weed control, and regeneration, will be accurately recorded and reported. Information recorded will include plant population structure, and individual plant characteristics. Reporting will be followed by careful examination of the results of burning, and adaptation of the fire regime in response to results.

Seed was collected from 25 plants in wild populations in November 2004, resulting in over 10,000 seeds being stored at -18° C in DEC's Threatened Flora Seed Centre (TFSC). The TFSC tests the viability of the seed initially, after one year in storage, and again after five years. The techniques involved with seed germination are continually improving so it is difficult to ascertain if it is the quality of the seed or the techniques that are affecting the differing rates of germination when the trials are conducted. Given the rate of germination and seedling mortality, only about 8,000 mature plants will be able to be produced from stored seed even though there are 10,000 seeds in storage.

Flowering phenology, soil seedbank and the impact of fire, weeds and grazing on *Acacia cochlocarpa* subsp. *cochlocarpa* were investigated by Yates and Broadhurst (2002). The results of this research indicated that the decline in populations of this taxon was related to poor seed germination and seedling establishment. The reason for this is possibly the reduced frequency of disturbances such as fires, following clearing of much of the bushland surrounding populations that would historically have allowed fires to be carried to the species' habitat. Good follow-up rainfall is required and competition from weeds and pressures from grazing need to be managed to ensure good survivorship of the seedlings following a disturbance event. The study showed that there was a good seed reserve, but the trigger to break the dormancy was lacking.

Extensive surveys were conducted in 1996 by a consultant working for CALM. No other surveys for additional populations of *Acacia cochlocarpa* subsp. *cochlocarpa* have since been carried out.

An information sheet for *Acacia cochlocarpa* subsp. *cochlocarpa* was jointly produced by the Natural Heritage Trust and CALM. The sheet contains photographs, a description of the plant, its habitat type, threats and management actions. This poster is available to anyone interested in Declared Rare Flora (DRF) and is distributed to owners of land that contains this species, and to landowners who live in close proximity to known populations.

DRF markers have been erected to mark Populations 2 and 3.

Ongoing and future recovery actions

Staff from DEC's Moora District will continue monitoring populations.

The Moora District Threatened Flora Recovery Team (MDTFRT) will oversee the implementation of this recovery plan in their respective regions and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate owners/land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The MDTFRT will coordinate recovery actions for *Acacia cochlocarpa* subsp. *cochlocarpa* and other DRF in the Moora District. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $900 per year.

2. Monitor translocated populations

In 1999 an experimental translocation of *Acacia cochlocarpa* subsp. *cochlocarpa* into Gunyidi Nature Reserve was carried out. Continued monitoring is essential to determine the long-term success of the translocation (personal communication L. Monks[1]).

Action: Monitor translocated populations
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $850 per year.

3. Monitor natural populations

There are only two extant wild populations of *Acacia cochlocarpa* subsp. *cochlocarpa* and it is crucial that they are maintained. The status of the populations will be checked through regular monitoring of threats and counting the number of mature individuals. Factors such as gall activity during the seed production period, weed densities, habitat degradation, fence integrity, population stability (expansion or decline), pollination activity, seed production, recruitment and longevity will need to be monitored. The visibility of the DRF markers will also be monitored and maintenance will be conducted when required.

Action: Monitor natural populations
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $1,150 per year.

4. Implement further translocations

Acacia cochlocarpa subsp. *cochlocarpa* is known from two small wild populations and two translocated populations that together contain a relatively low number of extant plants. The experimental translocation into Gunyidi Nature Reserve has been very successful and, using knowledge gained from this study, a larger site will be selected and a translocation proposal developed that will adhere to guidelines set out in CALM Policy Statement No. 29 *Translocation of Threatened Flora and Fauna.*

Action: Implement further translocations
Responsibility: DEC (Science Division, Moora District) through the MDTFRT
Cost: $13,500 in year 4 and $3,600 in year 5.

5. Map habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa*

Although habitat critical to the survival of the subspecies is referred to in Section 1, all the areas described have not yet been accurately mapped, and this will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa*
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $500 in year 1.

6. Conduct further field surveys

Further surveys for *Acacia cochlocarpa* subsp. *cochlocarpa* will be undertaken on a systematic basis in areas of suitable habitat during the taxon's flowering period (June-July). Appropriate habitat on private lands will be surveyed where possible. Volunteers from the local community, Wildflower Societies, Naturalist Clubs and other community-based groups will be encouraged to participate in surveys supervised by DEC staff. Summaries of areas surveyed will be sent to Species and Communities Branch (SCB) and also retained at relevant District Office. Areas previously surveyed include parts of Watheroo National Park and Pinjarrega Nature Reserve. Suggested survey locations include areas of likely habitat near previous collection sites south of Marchagee and west of Moora.

[1] Leonie Monks: Research Scientist, Science Division, DEC

Action: Conduct further field surveys
Responsibility: DEC (Science Division, Moora District) through MDTFRT
Cost: $3,500 in years 1, 3 and 5.

7. Liaise with relevant land managers and Indigenous groups

As all natural populations of *Acacia cochlocarpa* subsp. *cochlocarpa* occur on lands that are not managed by DEC, close liaison with land managers is essential. Input and involvement will also be sought from any Noongar groups that have an active interest in areas that are habitat for the subspecies.

Action: Liaise with relevant land managers and Indigenous groups
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $1,200 per year.

8. Investigate the impact of insect galling

Some biological and ecological information has been obtained through the work of Yates and Broadhurst (2002). However, an understanding of the impact of insect galling would also assist in the future management of *Acacia cochlocarpa* subsp. *cochlocarpa*. The wasp responsible for galling and the impact of its activities are having on seed production and recruitment will be investigated.

Action: Investigate the impact of insect galling
Responsibility: DEC (Science Division, Moora District) through the MDTFRT
Cost: $6,750 in year 1, then $2,300 in years 2, 3, 4 and 5.

9. Disseminate information

While some public awareness material has been produced for *Acacia cochlocarpa* subsp. *cochlocarpa*, other avenues such as the development of a bush book on DRF that occur along road reserves in the DEC Moora District have yet to be canvassed. Such a book would promote an awareness of all DRF species occurring on road reserves in the area and aid in the identification of threatened flora species. The book may also lead to the discovery of new populations of the taxa. A large colour poster containing a selection of Critically Endangered species found in the Moora District will also be produced for display in libraries, community centres and other public venues in the area.

Action: Disseminate information
Responsibility: DEC (Moora District, SCB) through the MDTFRT
Cost: $2,800 in year 1.

10. Collect seed for long term storage and future translocations

Preservation of genetic material is essential to guard against extinction of the subspecies if wild populations are lost and to store germplasm as a genetic resource for translocation purposes. The subspecies germinates easily from seed and is therefore the preferred method of germplasm storage. It is therefore recommended that seed be collected and stored. Collections should aim to sample and preserve the maximum range of genetic diversity possible from all populations (determined by an appropriate molecular technique such as genetic fingerprinting if possible). The *Germplasm Conservation Guidelines for Australia* produced by the Australian Network for Plant Conservation (ANPC) should be used to guide this process (ANPC 1997).

Action: Collect seed for long term storage and future translocations
Responsibility: DEC (Moora District, TFSC) through the MDTFRT
Cost: $1,350 in years 1 and 5 and $750 in year 2.

11. Amend and implement the fire management strategy

The fire management strategy produced with recommendations for fire exclusion will be amended to include information gathered from research conducted by Yates and Broadhurst (2002).

A fire regime of controlled burning a portion of dead or aging plants in a population every 15 to 20 years will be implemented in conjunction with careful weed control. The fire characteristics, seasonality, effectiveness of weed control, and regeneration will be accurately recorded and reported. Information recorded will include plant

population structure and individual plant characteristics. Reporting will be followed by careful examination of the results of burning, and adaptation of the fire regime in response to the results.

Action: Amend and implement the fire management strategy
Responsibility: DEC (Moora District) through the MDTFRT
Cost: $2,500 in year 1, $1,500 in years 2 and 3.

12. Review this plan and assess the need for further recovery actions

If *Acacia cochlocarpa* subsp. *cochlocarpa* is still ranked Critically Endangered (WA) near the end of the five-year term of this recovery plan, a review will be undertaken and a revised plan prepared if necessary.

Action: Review this plan and assess the need for further recovery actions
Responsibility: DEC (Moora District, SCB) through the MDTFRT
Cost: $9,500 in year 5.

Table 3. Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DEC (Moora District) through the MDTFRT	Ongoing
Monitor translocated populations	High	DEC (Moora District) through the MDTFRT	Ongoing
Monitor natural populations	High	DEC (Moora District) through the MDTFRT	Ongoing
Implement further translocations	High	DEC (Science Division, Moora District) through the MDTFRT	2013
Amend and implement the fire management strategy	High	DEC (Moora District) through the MDTFRT	2011
Map habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa*	High	DEC (Moora District) through the MDTFRT	2009
Conduct further field surveys	High	DEC (Science Division, Moora District) through MDTFRT	2009
Liaise with relevant land managers and Indigenous groups	High	DEC (Moora District) through the MDTFRT	Ongoing
Investigate the impact of insect galling	Medium	DEC (Science Division, Moora District) through the MDTFRT	2013
Disseminate information	Medium	DEC (Moora District, SCB) through the MDTFRT	2009
Collect seed for long term storage and future translocations	Medium	DEC (Moora District, TFSC) through the MDTFRT	2013
Review this plan and assess the need for further recovery actions	Low	DEC (Moora District, SCB) through the MDTFRT	2013

4. TERM OF PLAN

Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If the taxon is still ranked EN after five years, the need for further recovery actions and an update of this IRP will be assessed.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

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6. TAXONOMIC DESCRIPTION

The following taxonomic description of *Acacia cochlocarpa* subsp. *cochlocarpa* by B. R. Maslin and A. R. Chapman was extracted from *Nuytsia* (1999).

Sprawling low shrub 0.3-0.7 m high, 1.5-3 m across. Branchlets glabrous. Stipules early caducous. Phyllodes narrowly oblong-elliptic (3) 4-7.5 cm long, 4-6 mm wide, glabrous, 5-7 nerved with the central nerve equidistant from margins; apex acute. Heads obloid to shortly cylindrical, 7-10 mm long (dry); bracteoles obovate, 0.7-0.8 mm long, obtuse. Pods are glabrous and tightly spirally coiled.

Distribution: occurs in the south-west of Western Australia, restricted to near Watheroo and an early collection west of Moora.

Habitat: grows on clayey sand in open shrubland or scrub with *Allocasuarina campestris*.

Phenology: Flowering recorded from June to August; mature pods collected in November and December.

SUMMARY OF RECOVERY ACTIONS AND COSTS

	Year 1			Year 2			Year 3			Year 4			Year 5		
Recovery Action	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**	**DEC**	**Other**	**Ext.**
Coordinate recovery actions	650		250	650		250	650		250	650		250	650		250
Monitor translocated populations	550		300	550		300	550		300	550		300	550		300
Monitor natural populations	650		500	650		500	650		500	650		500	650		500
Implement further translocations										5000		8500	1750		1850
Map habitat critical to the survival of *Acacia cochlocarpa* subsp. *cochlocarpa*	250		250												
Conduct further field surveys	1100	600	1800				1100	600	1800				1100	600	1800
Liaise with relevant land managers and Indigenous groups	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Investigate the impact of insect galling	2150		4600	750		1550	750		1550	750		1550	750		1550
Disseminate information	500	600	1700												
Collect seed for long term storage and future translocations	600		750	500		250							600		750
Amend the fire management strategy	550		1950	550		950	550		950						
Review this plan and assess the need for further recovery actions													2000		7500
Total	7400	1600	12500	4050	400	4200	4650	1000	5750	8000	400	11500	8450	1000	14900
Yearly Total	**21,500**			**8,650**			**11,400**			**19,900**			**24,350**		

Ext. = External funding (funding to be sought), Other = in kind contribution by landholders, local government etc, DEC = in kind contribution by various DEC divisions.

Total DEC:	$32,550
Total Other:	$4,400
Total External Funding:	$48,850
Total costs:	**$85,800**