Department of Parks and Wildlife

Interim Recovery Plan No. **343**

Butterfly-leaved Gastrolobium (*Gastrolobium papilio*)

Interim Recovery Plan

2014–2019

Department of Parks and Wildlife, Western Australia

June 2014

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CCWA	Conservation Commission of Western Australia
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DGPS	Differential Global Positioning System
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife (also shown as Parks and Wildlife)
DRF	Declared Rare Flora
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
RP	Recovery Plans
SCD	Science and Conservation Division
SCB	Species and Communities Branch (Parks and Wildlife)
SWALSC	South West Aboriginal Land and Sea Council
SWRTFCRT	South West Region Threatened Flora and Communities Recovery Team
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
VU	Vulnerable
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Policy Statements Nos. 44 and 50 (CALM 1992; CALM 1994). Note: The Department of Conservation and Land Management (CALM) formally became the Department of Environment and Conservation (DEC) in July 2006 and the Department of Parks and Wildlife in July 2013. Plans 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.

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

This plan, which results from a review of, and replaces plan No. 85 Butterfly-leaved Brachysema (*Brachysema papilio*) (Phillimore, Soutar and English 2001), will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked as CR in WA, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 10th June 2014 and was approved by the Director of Science and Conservation on 27th June 2014. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at June 2014.

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Cover photograph by Ben Lullfitz.

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Summary

Scientific name:	***Gastrolobium papilio***	**Common name:**	Butterfly-leaved Gastrolobium
Family:	Fabaceae	**Flowering period:**	October–December
DPaW region:	South West	**DPaW district:**	Blackwood
Shire:	City of Busselton	**NRM region:**	South West Catchment Council
IBRA region:	Swan Coastal Plain	**Recovery team:**	SWRTFCRT
IBRA subregion:	Perth		

Distribution and habitat: *Gastrolobium papilio* is endemic to Western Australia where it is confined to a single location on the edge of the Whicher Range south-west of Busselton. It inhabits very shallow red sandy-clay soil over ironstone in winter wet flats (Brown *et al*. 1998).

Habitat critical to the survival of the species, and important populations: *Gastrolobium papilio* is ranked as Critically Endangered (CR) in Western Australia and, as such, it is considered that the habitat of the wild population is critical to the survival of the species and that the wild population is an important population. Habitat critical to the survival of *G. papilio* includes the area of occupancy of the population, areas of similar habitat surrounding the population (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Conservation status: *Gastrolobium papilio* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as CR in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iii)+2ab(iii); C1+2a(ii) due to its extent of occurrence being less than 100km^2; populations being severely fragmented, a continuing decline in the quality of habitat, area of occupancy less than 10km^2, less than 250 mature individuals known from the wild, an estimated continuing decline of at least 25% within three years, a continuing decline in the number of mature individuals and at least 90% of mature individuals in one subpopulation. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Threats: The main threats to the species are hydrological changes, mining, disease, weeds, fire, grazing, and factors influencing growth, reproduction and survival.

Existing recovery actions: The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. The Department of Mines and Petroleum (DMP) - formerly Minerals and Energy - was formally notified of this species and its location in October 1994. Adjacent private property owners were notified in February 1999. These notifications detail the current status of the species as Declared Rare Flora (DRF) and the associated legal obligations in regards to its protection.
2. Parks and Wildlife's Blackwood District has informed wildflower pickers that the area in which *Gastrolobium papilio* occurs is an exclusion zone not available for commercial wildflower picking.
3. *Gastrolobium papilio* was surveyed and boundaries mapped with a Differential Global Positioning System (DGPS) in 1999 and 2000.
4. Laboratory testing shows that *Gastrolobium papilio* has some resistance to dieback caused by *Phytophthora cinnamomi*.
5. Experimental application of phosphite to the habitat commenced in 1996 and follow-up spraying occurred in April and December 1998, and May 2000. From 2001 to 2012, phosphite was applied annually.

6. Parks and Wildlife district staff are assessing the effectiveness of phosphite treatment by monitoring dieback indicator species *Lambertia echinata* subsp. *occidentalis* and *Banksia nivea* subsp. *uliginosa*.
7. Bollards were installed across an access track in 1999 to prevent vehicles entering the habitat of *Gastrolobium papilio*.
8. Standard disease hygiene measures are being implemented at the site by Parks and Wildlife District staff and include cleaning footwear and vehicles on entry. Access is under dry conditions only where possible. All vehicle access tracks into the area are closed or have gates installed to prevent the spread of dieback.
9. Approximately 4,600 seeds are currently stored in Parks and Wildlifes Threatened Flora Seed Centre (TFSC) at –18°C. and 393 seeds were sent to Kew for the Millennium Seed Bank.
10. The Botanic Gardens and Parks Authority (BGPA) currently have 38 *Gastrolobium papilio* plants, representing ten clones, in their nursery.
11. Translocations of three ironstone species, including 375 *Gastrolobium papilio* plants (328 in Oates Nature Reserve and 52 in Negus Nature Reserve) were undertaken in June 2001.
12. In June 2012 an additional 29 seedlings were planted at Oates Nature Reserve and 265 at Negus Nature Reserve. In September 2012, 99% of seedlings were surviving. Monitoring will be undertaken quarterly until 2015 and annually post 2015.
13. Trials on the impact of grazing by kangaroos were conducted on the population.
14. Fencing of the western half of the Threatened Ecological Community (TEC) that contains *Gastrolobium papilio* was completed in July 2010.
15. An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Gastrolobium papilio*.
16. A brochure was produced by Geocatch with Parks and Wildlife's assistance to highlight the value of Abba Plains vegetation and support landholder protection of remnant areas.
17. A coordinated fire response plan for the region, detailing appropriate strategies in case of wildfire, was updated and incorporated into the Fire Control Working Plan.
18. Weed control has been undertaken at translocation sites in Negus and Oates Nature Reserves.

Plan objective: The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success:
- The number of *populations has increased from one to two or more over the term of the plan and/or
- The number of mature plants has increased by 33% or more over the term of the plan from 63 to 84 or more.

Criteria for recovery failure:
- The number of mature plants has decreased by 33% or more over the term of the plan from 63 to 42 or less.

* Currently only the natural population is included. Translocated populations will be included in the criteria for success and failure if they are increasing in size due to natural recruitment.

Recovery actions

1. Coordinate recovery actions
2. Monitor natural and translocated populations
3. Apply phosphite
4. Determine susceptibility to diseases such as aerial canker
5. Maintain disease hygiene
6. Extend translocation program
7. Undertake weed control
8. Update and implement the fire management strategy
9. Maintain fencing
10. Protect plants from herbivory
11. Collect and store seed
12. Obtain biological and ecological information
13. Ensure long-term protection of habitat
14. Liaise with land managers and Aboriginal communities
15. Promote awareness
16. Map habitat critical to the survival of *Gastrolobium papilio*
17. Review this plan and assess the need for further recovery actions

1. Background

An analysis of outputs and effectiveness of Interim Recovery Plan (IRP) No 85 (2001-2004) by Phillimore, Soutar and English 2001 follows. This revised plan replaces IRP No. 85.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) have not been met. When the plan was written in 2001, the species was known from one population and approximately 100 mature plants. The number of mature plants has since decreased to 63 (37% decrease) with the majority of the deaths appearing to be from drought. Attempts have been made to establish new populations through translocations but many translocated plants died and translocated populations are not self-sustaining.

Most recovery actions in the previous plan have now been fully or partially implemented while a few are yet to be started or are no longer required. The species' restricted extent of occurrence and a continuing decline in the quality of habitat and plant numbers requires further recovery actions being implemented.

Action 15 is redundant as Parks and Wildlife no longer produces full flora recovery plans. Interim Recovery Plans (IRP's) have been extended to a five year term after which they are reviewed and updated if required. The current status of recovery actions is listed in table 1.

Table 1: Status of recovery actions included in previous plan

Recovery action	Status	Result
Coordinate recovery actions	Ongoing	Recovery actions are coordinated and conducted by the Blackwood District Flora Conservation Officer. Although the SWRTFCRT was set up to assist in the coordination of recovery actions it has not met for many years.
Apply phosphite	Ongoing	A 4.2 hectare area was sprayed in May, June and spring 1996 with follow-up spraying in April and December 1998. Phosphite was applied annually between 2000 and 2012.
Monitor the impact of phosphite application	Ongoing	Parks and Wildlife's District staff are assessing the effectiveness of phosphite application through the monitoring of key dieback indicator species. Plants are tagged and assigned with a health score out of five.
Implement disease hygiene measures	Measures implemented	Standard disease hygiene measures are being implemented by district staff i.e. clean footwear/vehicles on entry. Access is under dry conditions only where possible. All vehicle access tracks into the habitat of the species are closed or have locked gates to prevent the spread of dieback.
Propagate plants for translocation	Plants propagated	Plants were propagated for translocation in 2001, 2012 and 2013.
Undertake and monitor translocation	Translocation undertaken, monitoring ongoing	Translocation of *Gastrolobium papilio* was undertaken in 2001 and 2002 with 375 plants planted in two sites and 52 in a third site. Survival rates were very poor with only six plants remaining in 2010. In June 2012, an additional 29 seedlings were planted at one site and 265 at another. As at September 2012 99% of these were surviving.
Undertake weed control	Weed control conducted	Weed control has been undertaken at translocation sites both of which have high weed loads.
Develop and implement a fire management strategy	Strategy complete, implementation ongoing	A coordinated fire response plan detailing appropriate strategies in case of wildfire was updated and incorporated into the Fire Control Working Plan. The information was communicated to other fire response organisations.
Monitor population	Ongoing	The population has been regularly monitored with data collected on population demography, habitat and population health and threats.

		Boundaries were mapped with a DGPS. All monitoring data is stored at Parks and Wildlife's Blackwood District and SCB.
Collect seed	Collections made, ongoing	A total of 1,328 seeds were collected by TFSC and district staff in 2011 with 935 stored at the TFSC and 393 at the Millenium Seed Bank. Further seed collection is planned.
Liaise with relevant land managers	Ongoing	Land managers have been informed of the threatened status of the species and its location. A meeting of department staff involved in fire control was undertaken to familiarise them with sensitive environment sites in the District.
Alter care control and management of habitat	Not completed	
Obtain biological and ecological information	Started, ongoing	Research began in 2001 to ascertain the most appropriate age of seedlings for translocation success. Testing for susceptibility to *Phytophthora* dieback found 18% of inoculated plants died. Grazing pressure by kangaroos was found to be significantly impacting on the species and its habitat.
Promote awareness	Ongoing	An A4 sized poster has been developed for *Gastrolobium papilio*. A brochure has also been produced by Geocatch with Parks and Wildlife's assistance to highlight the value of Abba Plains vegetation and support landholder protection of remnant areas. Scanned photographs of DRF within the Blackwood District were provided to Parks and Wildlife's field staff so that they can recognise possible new populations.
Write a full Recovery Plan	No longer a requirement	As Parks and Wildlife no longer produces full recovery plans for flora, this plan will be reviewed and a new plan written if required.

Ongoing recovery actions included in the previous plan are included in this revised plan. New recovery actions are determine susceptibility to diseases such as aerial canker; maintain fencing; protect plants from herbivory; map critical habitat; and review this plan and assess the need for further recovery actions.

History

Gastrolobium papilio was discovered during a floristic survey of the southern Swan Coastal Plain by Greg Keighery in 1991 (Gibson *et al*. 1994). The species was named *Brachysema papilio* by Crisp *et al*. in 1995. A taxonomic revision was undertaken by Chandler *et al*. in 2002 and the species was placed with *Gastrolobium*.

No new populations have been located since its discovery. The extant population comprises approximately 63 mature plants.

Gastrolobium papilio is a component of the 'Southern Swan Coastal Plain Ironstone (Busselton Area) (Busselton or Southern Ironstone Association)' Threatened Ecological Community (TEC). The ironstone habitat is highly susceptible to infestation by *Phytophthora* dieback, however, laboratory testing shows *G. papilio* has some resistance to the disease.

To enable the mining of mineral sands on private property adjacent to the population of *Gastrolobium papilio*, lowering of the water table began in early March 2004. As a condition of mining an artificial recharge system was installed to maintain groundwater levels within the ironstone community. Backfill of the southern end of the pit was completed in January 2005 with a rapid response in the water levels (still with the artificial recharge system being maintained). However, when Parks and Wildlife's staff visited the site in February 2005 an area of 100 x 60m of the ironstone community was found to be highly stressed. Approximately 70% of the population was dead or dying, possibly as a consequence of hydrological change or drought. In response, about 9000 litres of water was sprayed over a 30 x

30m section, equating to 10mm of rain. Monitoring in 2006 and 2010 reported the population was slowly recovering and seedling recruitment was observed. Mining has now finished and the private land has been returned back to pasture.

In 2001, two translocations were carried out in an attempt to bolster the number of extant plants. Unfortunately, very few translocated plants have survived.

Description

Gastrolobium papilio is a dense low shrub to 1.5m across with distinctive leaves shaped like a butterfly's wings, hence the common name 'butterfly-leaved Gastrolobium' (Crisp 1995; Keighery 1995). Its leaves are up to 2cm long with a rigid, sharp point. Flowers are pale red to cream and are held in loose inflorescences (Brown *et al*. 1998).

Gastrolobium papilio is easily distinguished from most other *Gastrolobium* species by its leaf shape and nodding, paired flowers. *Gastrolobium praemorsum* is similar but differs in having softer leaves that are not pungent and erect, and larger flowers (Chandler *et al*. 2002).

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; Chandler, G.T., Crisp, M.D., Cayzer, L.W. and Bayer, R.J. (2002) Monograph of *Gastrolobium* (Fabaceae: Mirbelieae). *Australian Systematic Botany* 15: 619−739; Western Australian Herbarium (1998−) *FloraBase-The Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dec.wa.gov.au/;Williams, K., Horan, A., Wood, S. and Webb, A. (2001) *Declared rare and poorly known flora in the Central Forest Region*. Western Australian Wildlife Management Program No. 33. Department of Conservation and Land Management, Western Australia.

Distribution and habitat

Gastrolobium papilio is endemic to Western Australia where it is confined to a single location south-west of Busselton. The extent of occurrence is estimated to be the same as the area of occupancy which is approximately 0.015km^2. The species grows in very shallow red sandy-clay soil over ironstone in winter wet flats (Brown *et al*. 1998). Associated species include *Hakea varia*, *Loxocarya magna* and *Chamelaucium* sp. C Coastal Plain (R.D. Royce 4872).

Table 2. Summary of population land vesting, purpose and manager

Population number & location	Parks and Wildlife district	Shire	Vesting	Purpose	Manager
1a. ESE Busselton	Blackwood	City of Busselton	CCWA	SF	Parks and Wildlife
1b. ESE Busselton	Blackwood	City of Busselton	CCWA	SF	Parks and Wildlife
2T. ESE Busselton	Blackwood	City of Busselton	CCWA	NR	Parks and Wildlife
3T. ESE Busselton	Blackwood	City of Busselton	CCWA	NR	Parks and Wildlife

Note: Populations 2 and 3 are translocated populations.

Biology and ecology

Gastrolobium papilio can grow in the open but appears to prefer an over-storey suggesting it requires some shade or protection.

Flowering time varies between September and December. Fruiting has been observed between late November and early January.

Monitoring of *Gastrolobium papilio* after a hot fire in 1992 found that recruitment can occur from both seed and rootstocks (Keighery 1995).

Phytophthora dieback is present in the habitat of *Gastrolobium papilio*. However, testing under laboratory conditions indicates the species has some resistance with 18% of 11 plants inoculated dying.

Grazing by kangaroos appears to significantly impact on *Gastrolobium papilio*. In areas where kangaroos were excluded, severely grazed plants recovered well.

Conservation status

Gastrolobium papilio is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iii)+2ab(iii); C1+2a(ii) due to its extent of occurrence being less than 100km^2; populations being severely fragmented, a continuing decline in the quality of habitat, area of occupancy less than 10km^2, less than 250 mature individuals known from the wild, an estimated continuing decline of at least 25% within three years, a continuing decline in the number of mature individuals and at least 90% of mature individuals in one subpopulation. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Hydrological changes** may be a future threat to the species (Tille and Lantzke 1990). Clearing for agriculture is likely to have caused an increase in surface runoff and recharge of the groundwater. This is supported by Short and McConnell (2000), who show that the area is at medium to high risk in terms of dryland salinity within the next 50 years. Waterlogging and salinity will require monitoring.
- **Mining:** the population is located adjacent to the southern part of an inactive mineral sands mine and there is a potential for further mining in the area. Active leases M70/1070 (Cable Sand), M70/609 (Ilmenite) and E70/2977 (Doral Mineral Sands) currently cover the site of the population and its surrounding habitat.
- **Disease:** Although testing has revealed *Gastrolobium papilio* has some resistance to *Phytophthora*, it may have a greater indirect impact by altering the composition and structure of the associated plant community, resulting in altered levels of shade, soil moisture retention and competition. It is also thought that aerial canker (*Botryosphaeria ribis* and *Diplodina* sp) is present at the site.

- **Weeds** including blackberry nightshade (*Solanum nigrum*), flat weed (*Hypochaeris radicata*) and Cape weed (*Arctotheca calendula*) are encroaching from the northern and western boundaries of the reserve.
- **Altered fire regimes** may impact the viability of the population. *Gastrolobium papilio* is known to regenerate from seed and rootstock following fire. Frequent fire could, however, deplete soil stored seed reserves and facilitate weed invasion.
- **Grazing** and trampling by rabbits (*Oryctolagus cuniculus*), kangaroos (*Macropus fuliginosus*) and pigs (*Sus domesticus*) are impacting on the population, including through soil disturbance, plant damage, increased nutrient levels from droppings and the introduction of weeds. Grazing is also affecting the establishment of seedlings. In May 2012 a large area of pig damage within the Threatened Ecological Community (TEC) was found. A pig trap was set up on adjacent private land and the area has been regularly monitored.
- **Factors influencing growth, reproduction and survival** such as disturbance regimes, drought, plant pathogens, small population size and fragmentation are a threat to the species.

The intent of this plan is to provide actions that will mitigate immediate threats to *Gastrolobium papilio*. Although climate change and drought may have a long-term effect on the species, actions taken directly to prevent their impact are beyond the scope of this plan.

Table 3. Summary of population information and threats

Population number & location	Land status	Year / no. of plants	Condition of:		Threats
			plants	habitat	
1a. ESE Busselton	SF	1992 100+ 1994 50 (100) 2000 100+ 2002 150+ 2005 *40 [70% dead] 2006 *40 (20) [15 dead] 2010 *63	Healthy	Excellent	Disease, hydrological changes, altered fire regimes, weed invasion, mining, grazing
1b. ESE Busselton	SF	2002 20+ 2006 *40 (20)[15 dead] 2010 *63	Healthy	Excellent	Disease, hydrological changes, altered fire regimes, weed invasion, mining, grazing
2T. ESE Busselton	NR	2001 328 2002 59 2005 26 2010 5 2012 (29)			Poor survival
3T. ESE Busselton	NR	2001 52 2002 29 2005 25 2010 1 2012 (265)			Poor survival

Note: Populations in **bold text** are considered to be important populations; () = number of seedlings/juveniles; Populations 2 and 3 are translocated populations; and * = total for subpopulations combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Gastrolobium papilio* may require assessment.

Actions that result in any of the following may impact on the species:

- Damage or destruction of occupied or surrounding potential habitat;

- Alteration of the local surface or subsurface hydrology;
- Changed fire regimes;
- Reduction in population size; and
- Spread of *Phytophthora* dieback.

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

Gastrolobium papilio is ranked as CR in Western Australia and it is considered that all known habitat for the wild population is critical to the survival of the species and that the wild population is an important population. Habitat critical to the survival of *G. papilio* includes the area of occupancy of the population, areas of similar habitat surrounding the population (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Gastrolobium papilio* will also improve the status of associated native vegetation. Six Declared Rare Flora (DRF) and 11 priority flora taxa occur within 500m of the species (see table 4).

Table 4. Conservation-listed flora species occurring within 500m of *Gastrolobium papilio*

Species name	Conservation status (WA)	Conservation status (EPBC Act)
Chamelaucium sp. C Coastal Plain (R.D. Royce 4872)	DRF (VU)	VU
Darwinia whicherensis	DRF (CR)	EN
Lambertia echinata subsp. *occidentalis*	DRF (CR)	EN
Petrophile latericola	DRF (CR)	EN
Banksia nivea subsp. *uliginosa*	DRF (EN)	EN
Banksia squarrosa subsp. *argillacea*	DRF (VU)	VU
Andersonia ferricola	Priority 1	-
Loxocarya striata subsp. *implexa*	Priority 1	-
Schoenus pennisetis	Priority 1	-
Calytrix sp. Tutunup (G.J. Keighery& N. Gibson 2953)	Priority 2	-
Hakea oldfieldii	Priority 3	-
Isopogon formosus subsp. *dasylepis*	Priority 3	-
Loxocarya magna	Priority 3	-
Acacia flagelliformis	Priority 4	-
Banksia meisneri subsp. *ascendens*	Priority 4	-
Calothamnus quadrifidus subsp. *teretifolius*	Priority 4	-
Franklandia triaristata	Priority 4	-

For a description of conservation codes for Western Australian flora see http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf

The Threatened Ecological Community (TEC) 'Southern Swan Coastal Plain Ironstone (Busselton Area) (Busselton or Southern Ironstone Association)' in which the species grows was ranked as CR in 1995. This plant assemblage occurs on ironstone soils that are highly restricted in distribution and this site is

one of only 15 occurrences of this species-rich plant community. For a description of TEC categories see DEC (2010).

This plan will be implemented in conjunction with the TEC recovery plan (Meissner and English 2005) and the flora recovery plans for *Darwinia whicherensis* (previously *Darwinia* sp. Williamson), *Banksia nivea* subsp. *uliginosa*, *Banksia squarrosa* subsp. *argillacea*, *Lambertia echinata* subsp. *occidentalis* and *Petrophile latericola*.

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. The species is not listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre Convention on International Trade in Endangered Species and this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed no sites of Aboriginal significance adjacent to the population of *Gastrolobium papilio*. Nevertheless input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and the DAA to determine if there are any issues or interests with respect to management for this species. Opportunity for future involvement in the implementation of the plan is included as an action in the plan. Aboriginal involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this species occurs.

Social and economic impacts

The population is on land managed by Parks and Wildlife and the implementation of this recovery plan will cause some economic impact through the cost of implementing recovery actions. The area is also subject to several mineral extraction leases and impact may be through the loss of land available for development. For private property locations adjacent to the population, impacts to landholders may occur through restrictions imposed on the management of these lands.

Affected interests

These include Parks and Wildlife which has primary management responsibility and mining tenement holders that may be affected by actions referred to in this plan.

Evaluation of the plan's performance

Parks and Wildlife, in conjunction with the South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT), will evaluate the performance of this plan. In addition to annual

reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. Recovery objective and criteria

Plan objective

The objective of this plan is to abate identified threats and maintain or enhance the *in situ* population to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success:

- The number of extant *natural populations has increased from one to two or more over the term of the plan and/or
- The number of mature individuals has increased by 33% or more over the term of the plan from 63 to 84 or more.

* Currently only the natural population is included. Translocated populations will be included in the criteria for success and failure if they are increasing in size due to natural recruitment.

Criteria for recovery failure:

- The number of mature individuals has decreased by 33% or more over the term of the plan from 63 to 42 or less.

3. Recovery actions

Existing recovery actions

The Department of Mines and Petroleum (DMP) was formally notified of the existence of this species and its location in October 1994. The adjacent private property owners were notified in February 1999. These notifications detail the current status of the species as DRF and the associated legal obligations in regards to their protection. The mining company with a tenement over an area containing the population was notified of the presence of the species in June 1999. A Notice of Intent to mine the private property adjacent to the population was issued in November 2000. Mining operations began in 2004 and an artificial watering system was established to maintain groundwater levels. A sprinkler system was set up in 2005 following plant deaths. Aerial photographs and on-ground mapping using a Differential Global Positioning System (DGPS) were utilised to determine the extent of the stress event within the occurrence. The taxon was remapped and plant health scored to determine priority for watering with drip irrigation. Monitoring of vegetation health and plant water potential (i.e. if plants are under stress due to the dewatering) was conducted quarterly. Groundwater monitoring by the mining company ceased in 2006.

Parks and Wildlife's Blackwood District has informed licenced wildflower pickers that the area in which *Gastrolobium papilio* occurs is an exclusion zone that is not available for commercial wildflower picking.

Gastrolobium papilio was surveyed and boundaries mapped with a DGPS in 1999 and 2000. This information is stored in Parks and Wildlife's Blackwood District Geographic Information System database.

Laboratory testing has shown that *Gastrolobium papilio* has some resistance to *Phytophthora* dieback caused by *Phytophthora cinnamomi* with two (18%) of the 11 plants that were inoculated with the pathogen dying.

Experimental application of phosphite to the habitat of *Gastrolobium papilio* commenced in 1996 with 4.2 hectares sprayed in May, June and spring that year. Follow-up spraying occurred in April and December 1998 and May 2000. Between 2001 and 2012, phosphite was applied annually following the break of season and then again one month later. Parks and Wildlife's district staff are assessing the effectiveness of the treatment by monitoring the local key dieback indicator species *Lambertia echinata* subsp. *occidentalis* and *Banksia nivea* subsp. *uliginosa*. Individual plants are tagged and assigned with a health score out of five.

Standard disease hygiene measures implemented at the site by district staff include having clean footwear and vehicles on entry. Access is under dry conditions only where possible. All vehicle access tracks into the TEC have been closed or have had gates installed to prevent the spread of dieback and unauthorised entry.

Some 4,680 seeds collected from *Gastrolobium papilio* are currently stored in Parks and Wildlife's Threatened Flora Seed Centre (TFSC) at –18°C (see table 5). The seed has been processed and the germination rate ranged from 81 to 100%.

Table 5. TFSC collection details for *Gastrolobium papilio*

Accession number	Date collected	Population number	Collection type	Seeds/follicles in storage	Germination rate (%)
00195	15/12/1994	1	B/5, B/5	460	98
00282	12/12/1995	1	B/10	205	100
00522	2/12/1997	1	B/20	170	100
00768	14/12/2000	1	B/60	1076	100
03217	22/12/2009	1	I/20	1430	81
03325	4/01/2002	1	B/40	404	94
03635	7/12/2011	1	I/26, I/5	935	not yet conducted

Note: 'I' = a collection of individuals and the number of plants collected; 'B' = a bulked collection and the number of plants sampled

The Botanic Garden and Parks Authority (BGPA) currently have 38 *Gastrolobium papilio* plants in the nursery and botanic gardens. The plants originated from cutting material and seed. The species strike rate from cuttings ranged from 0 to 58%.

Two occurrences of the TEC 'Shrubland Association on Southern Swan Coastal Plain Ironstone' encompassing an area of approximately 28.2 hectares in total have been purchased. Negus Nature Reserve was purchased in 1999 and land adjacent to Oates Road (Oates Nature Reserve) was purchased by Parks and Wildlife in 1997 and 2003. Translocations of three ironstone species, including 375 *Gastrolobium papilio* plants (328 Oates Nature Reserve and 52 Negus Nature Reserve), into these two sites was undertaken in June 2001. Experimental treatments included 'ripped and mounded' and 'not ripped and mounded'. Ripped and mounded included shattering the surface layers of ironstone

to allow root penetration, followed by the creation of a raised planting site using local soil to minimise inundation of roots. Rabbits, weeds, strong winds and inundation, followed by a longer than average summer drought, contributed to plant deaths with initial survival being poor. Only five live plants remained at Oates Nature Reserve in 2010 and one plant at Negus Nature Reserve. Watering systems were set up at both sites, weed control continued and windbreaks were planted in 2002 to reduce transplant deaths.

In 2011 funding for re-stocking of translocation sites was obtained. In June 2012, 29 seedlings were planted at Oates Nature Reserve and 265 seedlings at Negus Nature Reserve. As at September 2012, 99% of these seedlings were surviving.

Grazing pressure by kangaroos was found to be significantly impacting on *Gastrolobium papilio* and the TEC, and exclusion of kangaroos resulted in the recovery of severely grazed plants. As a result of the grazing exclusion trials, funding was obtained to fence the western half of the TEC (containing *G. papilio*) to exclude kangaroos. This fence was completed in July 2010.

An A4 sized poster that provides a description of the species and information about threats and recovery actions, was developed for *Gastrolobium papilio* (under its previous name of *Brachysema papilio*). It is hoped that the poster will result in the discovery of new populations.

A brochure was produced by Geocatch with Parks and Wildlife's assistance to highlight the value of Abba Plains vegetation and support landholder protection of remnant areas. The brochure included a section on local threatened flora and photographs of *Gastrolobium papilio*.

A coordinated fire response plan for the region, detailing appropriate strategies in case of wildfire, was updated and incorporated into the fire control working plan. The information was communicated to other fire response organisations. A meeting of departmental staff involved with fire control was undertaken in 2001. This was designed to familiarise and inform staff of sensitive environmental sites within the District. The fire management strategy in place for the natural population is due for review and will need to include the two translocated populations.

Weed control has been undertaken at the two translocation sites, Negus Nature Reserve and Oates Nature Reserve, which are highly modified sites with high weed loads. There has been control of major weeds, such as kikuyu (*Cenchrus clandestinus*) and pennyroyal (*Mentha pulegium*) at Negus Nature Reserve. Guildford grass (*Romulea rosea*) control has also been trialled at both Negus Nature Reserve and Oates Nature Reserve.

Future recovery actions

Parks and Wildlife with the assistance of the South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this plan and will include information on progress in annual reports to Parks and Wildlife's Corporate Executive and funding bodies. Where recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to actions being undertaken. The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any recovery action if funding is available and other opportunities arise.

1. Coordinate recovery actions

Parks and Wildlife with assistance from the SWRTFCRT will coordinate recovery actions for *Gastrolobium papilio* and will include information on progress in annual reports to Parks and Wildlife's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Blackwood District), with assistance from the SWRTFCRT
Cost:	$8,000 per year

2. Monitor natural and translocated populations

Monitoring of grazing, weed invasion, habitat degradation, disease presence (*Phytophthora* sp. and aerial canker (*Botryosphaeria ribis* and *Diplodina* sp), population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity will be undertaken. Regular monitoring to evaluate the effectiveness of phosphite application will also continue.

Salinity and groundwater levels, and depth and timing of inundation in the community will be monitored as part of the implementation of the recovery actions outlined in the plan for the TEC 'Southern Swan Coastal Plain Ironstone (Busselton Area) (Busselton or Southern Ironstone Association)' (Meissner and English 2005).

Action:	Monitor natural and translocated populations
Responsibility:	Parks and Wildlife (Blackwood District), with assistance from the SWRTFCRT
Cost:	$8,000 per year

3. Apply phosphite

Although *Gastrolobium papilio* is somewhat resistant to *Phytophthora* dieback, the habitat in which it occurs is highly susceptible. Parks and Wildlife will continue to apply phosphite as required. Application of phosphite to the habitat of *G. papilio* will protect a number of other threatened plant species and a TEC.

Action:	Apply phosphite
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$3,000 per year

4. Determine susceptibility to diseases such as aerial canker

Testing is required (if feasible given small size of plants) to determine the susceptibility of the species to aerial canker.

Action:	Determine susceptibility to diseases such as aerial canker
Responsibility:	Parks and Wildlife (Blackwood District, Science and conservation Division (SCD))
Cost:	$3,000 in year 1

5. Maintain disease hygiene

Phytophthora cinnamomi, *Botryosphaeria ribis* and *Diplodina* sp are all potential threats to the species and its habitat. Dieback hygiene (outlined in CALM 2003) will be followed during installation and maintenance of firebreaks and when walking into populations in wet soil conditions. Purpose built signs advising of the dieback risk and high conservation values of the sites will be installed if required.

Action:	Maintain disease hygiene
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$4,000 per year

6. Extend translocation program

Further translocation may be deemed desirable for the conservation of this species, particularly as it is only known from a single location that is threatened by *Phytophthora* dieback. If required, a new translocation proposal will be developed and suitable disease free translocation sites selected. Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al*. 2004). All translocation proposals require endorsement by Parks and Wildlife's Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Extend translocation program
Responsibility:	Parks and Wildlife (SCD, Blackwood District)
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

7. Undertake weed control

Weeds are a threat to natural and translocated populations and control is required. The following actions will be implemented:

1. Determine which weeds are present and map them.
2. Select appropriate control technique; herbicide, mowing or hand weeding.
3. Control invasive weeds by hand removal and/or spot spraying around *Gastrolobium papilio* plants when weeds first emerge.
4. Revegetation with site-specific species is required (in Autumn) to maintain low weed levels.
5. Monitor the success of the treatment on weed death and the tolerance of *Gastrolobium papilio* and associated native plant species to the weed control treatment.
6. Report on the method and success of the treatment and its effect on *Gastrolobium papilio* plants and associated species.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$10,000 per year, as required

8. Update and implement the fire management strategy

Fire appears to kill most adult plants, with recruitment occurring mainly from seed following fire. However, frequent fire may result in a depleted soil seed bank. Fire will therefore be prevented from occurring in the habitat of the population, except where it is being used experimentally as a recovery tool. A fire management strategy is in place for the natural population but will need to be updated to include the two translocated populations.

Action:	Update and implement the fire management strategy
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$10,000 in year 1, and $6,000 in years 2–5

9. Maintain fencing

To protect plants from grazing and damage from kangaroos and rabbits, fencing (including translocated populations) will be maintained.

Action:	Maintain fencing
Responsibility:	Parks and Wildlife (Blackwood District), private landowners
Cost:	$2,000 per year

10. Protect plants from herbivory

The level of threat posed by rabbits and pigs may vary from year to year with conditions and numbers. When monitoring ascertains the threat is high, baiting for rabbits using 1080 oats should be undertaken in summer months when less green feed is available as an alternative food source. Protective cages should be considered if rabbit baiting is not sufficient protection for individual plants. A pig trapping and monitoring program will continue at the site and control will be conducted as required.

Action:	Protect plants from herbivory
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$15,000 in years 1, 3 and 5

11. Collect and store seed

Preservation of genetic material is essential to guard against extinction of the species if the wild population is lost. It is recommended that additional seed be collected and stored in Parks and Wildlife's TFSC and the BGPA.

Action:	Collect and store seed
Responsibility:	Parks and Wildlife (Blackwood District, TFSC), BGPA
Cost:	$10,000 per year

12. Obtain biological and ecological information

Knowledge of the biology and ecology of the species will provide a scientific basis for management of *Gastrolobium papilio* in the wild and will ideally include:

1. Soil seed bank dynamics and the role of various factors including disturbance, competition, drought, inundation and grazing in recruitment and seedling survival and survival of mature plants;
2. Reproductive strategies, phenology and seasonal growth;
3. Reproductive success and pollination biology;
4. Minimum viable population size; and
5. The impact of *Phytophthora* dieback and the effectiveness of control techniques on *Gastrolobium papilio* and its habitat.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (SCD, Blackwood District)
Cost:	$50,000 in years 1–3

13. Ensure long-term protection of habitat

While the population is located on a reserve vested in the Conservation Commission of Western Australia (CCWA), its purpose is State Forest, and is thus not explicitly reserved for conservation, even though its management is primarily for conservation. Parks and Wildlife will investigate having the State Forest converted to a Nature Reserve to reflect this management purpose.

Action:	Ensure long-term protection of habitat
Responsibility:	Parks and Wildlife (Blackwood District, SCB), DMP
Cost:	$4,000 in years 1 and 2

14. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife's Blackwood District will liaise with land managers to ensure that the population of *Gastrolobium papilio* is not accidentaly damaged or destroyed and the habitat is maintained in a suitable condition for the conservation of the species. Due to the susceptibility of the habitat to *Phytophthora* dieback, the need for hygiene procedures will be included in information provided to land managers. Aboriginal consultation will take place to determine if there are any issues or interests in areas that are habitat for the species.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	Parks and Wildlife (Blackwood District)
Cost:	$4,000 per year

15. Promote awareness

The importance of biodiversity conservation and the protection of *Gastrolobium papilio* will be promoted through the print and electronic media and by creating formal links with local naturalist groups and interested individuals. An updated information sheet that includes a description of the plant, its habitat, threats, management actions and photos will be produced.

Due to the potential susceptibility of the habitat of this species to *Phytophthora* dieback, the need for the application of dieback hygiene procedures will be included in information provided to people entering the habitat of *Gastrolobium papilio*.

Action:	Promote awareness
Responsibility:	Parks and Wildlife (Blackwood District, SCB, Public Information and Corporate Affairs (PICA)), with assistance from the SWRTFCRT
Cost:	$7,000 in years 1–2; $5,000 in years 3–5

16. Map habitat critical to the survival of *Gastrolobium papilio*

Although habitat critical to the survival of the species is alluded to in Section 1, it has not yet been mapped and 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 *Gastrolobium papilio*
Responsibility:	Parks and Wildlife (SCB, Blackwood District)
Cost:	$6,000 in year 2

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

If *Gastrolobium papilio* is still ranked as CR at the end of the five-year term of this plan, the need for further recovery actions or a review of this plan will be assessed and a revised plan prepared if necessary.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Blackwood District)
Cost:	$6,000 in year 5

Table 6. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Blackwood District), with assistance from the SWRTFCRT	Ongoing
Monitor natural and translocated populations	High	Parks and Wildlife (Blackwood District), with assistance from the SWRTFCRT	Ongoing
Apply phosphite	High	Parks and Wildlife (Blackwood District)	Ongoing
Determine susceptibility to diseases such as aerial canker	High	Parks and Wildlife (Blackwood District, SCD)	2014
Maintain disease hygiene	High	Parks and Wildlife (Blackwood District)	Ongoing
Extend translocation program	High	Parks and Wildlife (SCD, Blackwood District)	2018
Undertake weed control	High	Parks and Wildlife (Blackwood District)	Ongoing
Update and implement the fire management strategy	High	Parks and Wildlife (Blackwood District)	Updated by 2014, implementation ongoing
Maintain fencing	High	Parks and Wildlife (Blackwood District), private landowners	Ongoing
Protect plants from herbivory	High	Parks and Wildlife (Blackwood District)	2018
Collect and store seed	High	Parks and Wildlife (Blackwood District, TFSC), BGPA	2018
Obtain biological and ecological information	High	Parks and Wildlife (SCD, Blackwood District)	2016
Ensure long-term protection of habitat	High	Parks and Wildlife (Blackwood District, SCB), DMP	2015
Liaise with land managers and Aboriginal communities	Medium	Parks and Wildlife (Blackwood District)	Ongoing
Promote awareness	Medium	Parks and Wildlife (Blackwood District, SCB, PICA), with assistance from the SWRTFCRT	2018
Map habitat critical to the survival of *Gastrolobium papilio*	Medium	Parks and Wildlife (SCB, Blackwood District)	2015
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Blackwood District)	2018

4. Term of plan

This plan will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions will be determined.

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6. Taxonomic description

Gastrolobium papilio from Chandler *et al*. (2002).

Tangled, clumped *shrubs*, up to 1.5m high, often climbing through other shrubs. *Branchlets* ascending, wiry, terete, densely pubescent. *Petioles* terete, continuous but not decurrent with the branchlet, 1–3mm long. *Leaves* spreading to ascending, opposite (seedling leaves with some subalternate), mostly obcrescentic, tending to transversely narrowly rhombic or obtriangular, 5–18 x 10–28mm, glabrescent, venation reticulate; apex stiffly mucronate, almost pungent-pointed, often with a small triangular lobe; margins undulate, crenulated, recurved; base rounded or cordate. *Stipules* recurved to curled up, setaceous, 3–5mm long. *Inflorescences* racemes, axillary or terminal on short, axillary shoots, 2(–4)-flowered; *peduncle* 15–25mm long; *rachis* 0–15mm long; *subtending bracts* leaf-like or reduced to trilobed scales *c*. 3mm long. *Flowers*: pendulous, not resupinate; *pedicels* wiry, 6–10mm long. Calyx campanulate, 12–13mm long including the 2–3-mm receptacle, densely villous, lobes not recurved; upper 2 lobes united higher than the lower 3, acute, 7–9mm long; lower 3 lobes triangular, acute, incurved, 8–10mm long. *Corolla*: cream to red, darkening with age; *standard* reflexed, narrowly oblong, constricted above the auricles, *c*. 15 x 6mm including the 6-mm claw, apex emarginate, base strongly auriculate; *wings* narrowly elliptic, *c*. 18 x 4mm including the 5-mm claws, apex rounded-obtuse, not incurved, not enclosing the keel, base auriculate on the upper margin only, slightly saccate; *keel* half elliptic, *c*. 20 x 6mm including the 5-mm claws, apex rounded, base auriculate, saccate. *Style* long, slightly incurved, base pubescent; *ovary* stipitate, with a disc present at the base, densely pubescent; *ovulesc*. 12. *Pod* ± enclosed by the calyx, slightly stipitate, obliquely narrowly ellipsoid, 13–15 x *c*. 5mm, moderately villous. *Seed* not seen.