



## **Consultation Document on Eligibility for Delisting**

### ***Carex tasmanica* (curly sedge)**

You are invited to provide your views and supporting information related to:

- 1) the eligibility of *Carex tasmanica* (curly sedge) for delisting from the EPBC Act threatened species list in the vulnerable category; and
- 2) discussion of the management and possible effects of delisting of the above species.

Evidence provided by experts, stakeholders and the general public is welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing or delisting under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Draft information for your consideration of the eligibility of this species for delisting from the vulnerable category starts at page 3 and information associated with consideration for delisting of this species starts at page 12. To assist with the Committee's assessment, the Committee has identified a series of specific questions on which it seeks your guidance at page 18.

Responses are to be provided in writing either by email to:  
[species.consultation@environment.gov.au](mailto:species.consultation@environment.gov.au)

or by mail to:

The Director  
Terrestrial Species Conservation Section  
Wildlife, Heritage and Marine Division  
Department of the Environment  
PO Box 787  
Canberra ACT 2601

**Responses are required to be submitted by 15 January 2016.**

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## **General background information about listing threatened species**

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at: <http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at: <http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at: <http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at: <http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

## **Information about this consultation process**

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

# *Carex tasmanica*

## Curly sedge

### **Taxonomy**

Conventionally accepted as *Carex tasmanica* Kukenthal, 1904.

### **Sub-species Information**

#### **Description**

The curly sedge (family Cyperaceae) is a densely tufted perennial with stout, felted roots and a long rhizome (Wilson, 1994, cited in VicFlora, 2014). Leaves are borne at and just above the base of the flowering stems. The blades are up to 40 cm long and 2 mm wide, leathery, generally flat, tapering to a blunt or rounded point, the tips coiling as they dry (Curtis and Morris 1994, cited in DPIPWE, 2013a). The flower-head consists of 3-6 spikes; the uppermost spikes are stalked and male, the others mostly female (Wilson 1994, cited in VicFlora, 2014). Male spikes are approximately 3.5 cm long; female spikes 2.5-3 cm long (Curtis and Morris 1994, cited in DPIPWE, 2013a). The fruit (nut) is approximately 2 mm long, brown-ish black and enclosed within a leathery sac (Curtis and Morris 1994, cited in DPIPWE, 2013a).

#### **Distribution**

The curly sedge is endemic to Victoria and Tasmania, where it is known from an estimated total of between 500 000 and one million individual plants (Carter, 2010). However, the number of plants and extent of each population are difficult to estimate at some sites, due to the difficulty distinguishing between the curly sedge and other sedges outside the flowering period (Carter, 2010). Plants can spread by rhizomes, so some 'clumps' of plants may in fact just be a single clone (Carter, 2010). There is also some potential confusion regarding terminology and the interpretation of the number of populations of this species, with varying reports referring to the number of populations, subpopulations, and sites. Carter (2010) reported that the species was known from a total of about 60 sites (40 in Tasmania, 20 in Victoria), with most of those in Victoria occurring as just two populations, and the remaining sites being generally small and isolated. DPIPWE (2013a) reported that more than 100 subpopulations of the curly sedge are known in Tasmania, with at least 50 of these discovered since 2005 (DPIPWE, 2013a). Wapstra (2014) reported that defining populations for a species such as *Carex tasmanica* is somewhat problematic because it can occur as virtually continuous swathes through wet paddocks or as discontinuous patches separated by only short distances. Wapstra (2014) further reported that if records greater than 1 km apart are taken as separate subpopulations, there are at least 90 populations in Tasmania.

The total extent of occurrence of the curly sedge based on a minimum convex polygon around all records from Victoria and Tasmania is calculated to be 142 551 km<sup>2</sup> (ERIN, 2015a). The calculated total area of occupancy is 416 km<sup>2</sup>, based on the 2x2 km grid method (ERIN, 2015b).

### **Tasmania**

The calculated extent of occurrence of the curly sedge in Tasmania is 11 160 km<sup>2</sup> (ERIN, 2015a), and the estimated total area of occupancy is 368 km<sup>2</sup> (ERIN, 2015b).

In Tasmania the species occurs in the Northern and Southern Midlands and the Derwent Valley, with isolated occurrences on the east coast and far south (DPIPWE, 2013a). It grows in soaks and seepage lines in a range of grassland and grassy woodland communities, but may also be found in disturbed areas in wet eucalypt forest and also in roadside drains (DPIPWE, 2013a). In Tasmania the curly sedge occurs from sea level to approximately 600 m above sea level on a wide range of soil types derived from dolerite, basalt, sandstone and windblown sands (Gilfedder and Kirkpatrick, 1996).

Kirkpatrick (2004) reported that the curly sedge was not known from any secure conservation reserve in Tasmania; however, the species is now found in ten public reserves in Tasmania: Mount Direction Conservation Area, Derwent Marine Conservation Area, Mount Field National Park, Kate Reed Nature Recreation Area, Coningham Nature Recreation Area, Heathy Hills Nature Reserve, Blackman River, Derwent Foreshore Walk, Macquarie River at Ross Bridge, and Wellington Park (Murdoch, 2014). Several subpopulations are protected by conservation covenants under the *Tasmanian Nature Conservation Act 2002* (DPIPWE, 2013a; Murdoch, 2014), and in numerous less formal reserves including river reserves, public reserves, road reserves and informally protected sites on public and private land (Murdoch, 2014). In Tasmania, a total of 107 km<sup>2</sup> of 'known to occur' area—approximately 11.6% of the total area—is contained within protected areas (ERIN, 2015c).

The curly sedge was previously known from 40 sites within south-eastern Tasmania and the Midlands, but a further 351 records have been added to DPIPWE's *Natural Values Atlas* (NVA) since 2000 (Murdoch, 2014). The population of mature individuals across these new sites is listed as 73,500 plants, although the true total is likely to be higher, because at least a third of the new listings on the NVA are presence/absence records, rather than records of the number of plants present (Murdoch, 2014). The largest of the newly identified sites is at Brighton in south eastern Tasmania, comprising an estimated 18,000 plants (Murdoch, 2014).

The species has been successfully propagated by the Royal Tasmanian Botanic Gardens, and in Tasmania more than 200 plants were reintroduced to their original habitats in the Greater Hobart area (Ball, 1995). It was originally intended that 1000 plants would be reintroduced as a recovery action, but this was curtailed as the number of known naturally occurring populations increased (Ball, 1995).

## Victoria

The calculated total extent of occurrence of the curly sedge in Victoria is 10 570 km<sup>2</sup> (ERIN, 2015a), and the estimated total area of occupancy is 48 km<sup>2</sup> (ERIN, 2015b).

In Victoria, the curly sedge occurs just north of Melbourne (at Craigieburn) and in the far south-west (to Heywood near Portland); however, the precise distribution of Curly sedge in Victoria is unclear due to the close similarity, and likely confusion, with other species (Carter, 2010). The curly sedge is most similar to *Carex brownii* and *C. iynx*, and scattered records of these species, from the Western Plains of Victoria, may also include *C. tasmanica* (Cheal, 1992). Nineteenth century records from Whitestone Swamp (near Ballarat), Lake Jollicum Wildlife Reserve (near Streatham) and from Lake Omeo (near Benambra in far eastern Victoria) have been attributed to an undescribed species *Carex* sp. aff. *bichenoviana* (Morcom 1999, cited in Carter, 2010). In Victoria, the curly sedge occurs in seasonally wet, fertile, heavy basalt clay soils, usually around the margins of slightly saline drainage lines or freshwater swamps (Carter, 2010). The dominant vegetation type varies, but is often grassy/sedgy and generally lacks trees, although woolly tea-tree, *Leptospermum lanigerum* occurs close to a number of sites in the south-west (Carter, 2010).

In Victoria, the curly sedge is still numerically abundant, with most sites located on private land, with a few on roadsides and only one in a conservation reserve: Craigieburn Nature Conservation Reserve (Carter, 2010). In Victoria, a total of 5.6 km<sup>2</sup> of 'known to occur' area—approximately 4.8% of the total area—is contained within protected areas (ERIN, 2015c). Important sites necessary for the long term survival and recovery of the curly sedge have been identified for Victoria, but not for Tasmania; however, little is known about the condition of most populations in Victoria (Carter, 2010).

## **Relevant Biology/Ecology**

Very little is known of the ecology of the curly sedge (Murdoch, 2014). The species is found in seasonally moist to waterlogged sites with heavy, fertile, loamy soils, which are often slightly saline (e.g. at the upper margin of the band of salt-tolerant vegetation around saline lakes or coastal salt marshes) (Cheal, 1992). Curly Sedge can tolerate short periods of complete

submersion (Carter, 2010). Mean annual rainfall across the known geographic range is 300–600 mm, with a moderate to pronounced winter maximum (Cheal, 1992). Permanent flooding or drying of creeks and swamps inhabited by *C. tasmanica* is likely to destroy populations, due to the species' apparent habitat specificity to certain soil moisture and/or drainage conditions (DSE, 2009).

The species responds well to some forms of mechanical disturbance (such as roadside slashing and/or shallow scraping), which can promote seed germination and/or seedling establishment (Gilfedder and Kirkpatrick 1996). Many of the *C. tasmanica* populations grow in drainage ditches, and young plants are usually associated with bare ground (Gilfedder and Kirkpatrick 1996). Persistence of populations at some sites may be mainly via division of adult plants or spread via rhizomes (Murdoch, 2014). The curly sedge is resistant to herbicides used for controlling roadside vegetation (Gilfedder and Kirkpatrick 1996), although the degree of resistance and to which herbicides have apparently not been determined.

The curly sedge flowers in spring (Wilson 1994, cited in VicFlora, 2014), and wind is the most likely pollination vector for this species (A. Hingston pers. comm., cited in DPIPWE, 2013a). The curly sedge is capable of resprouting after fire (Gilfedder 1991).

## Threats

Although numerous populations of curly sedge have been discovered since the early 1990s (Carter, 2010), Briggs and Leigh (1995) and Gilfedder and Kirkpatrick (1996) argued that the species was still vulnerable to extinction, pointing to the loss of subpopulations and the lack of formal reservation. However, Gilfedder (2013, pers. comm., cited in DPIPWE, 2013a), now considers such a status to be unwarranted, and the curly sedge is not considered threatened in Tasmania (DPIPWE, 2013a, b).

The former abundance of curly sedge is not known, although it is likely that it was once common to abundant across its range, especially in south-western Victoria (Carter, 2010). The species occurs within areas heavily modified by agriculture, and much of its preferred habitat of seasonally damp sites in native grassland and grassy woodland has been lost or severely degraded since European settlement because of agricultural practices and, to a lesser extent, urban and industrial development (Carter, 2010). Remaining sites where the species occurs invariably contain a high percentage cover of introduced plants, and have been severely altered through vegetation clearing and altered drainage (Carter, 2010). Although the species remains numerically abundant, in Victoria most plants occur in just two large populations, both on private land (Carter, 2010). Most of the Victorian populations are small (>100 plants) and occur on private land and roadsides, with few populations and small numbers of plants occurring in any form of reserve (Carter, 2010). Plants on private land are threatened by a lack of, or inappropriate, management or by potential future alterations to current management practices (DSE, 2009).

In Tasmania, prior to 1992, only 10 sites were known; however, over 40 new sites have been discovered since then (Carter, 2010).

The main current threats to curly sedge are summarised as follows:

Weed invasion. Most curly sedge sites contain a high percentage cover of introduced plants, both pasture grasses and weeds, and weed invasion is the greatest threat (Carter, 2010). The most problematic weeds include: sharp rush *Juncus acutus* subsp. *acutus*, Cape weed *Arctotheca calendula*, artichoke thistle *Cynara cardunculus*, needle-grasses *Nasella* species, gorse *Ulex europaeus*, boxthorn *Lycium ferocissimum*, hawthorn *Crataegus monogyna*, briar *Rosa rubiginosa*, blackberry *Rubus fruticosus*, silverweed *Potentilla anserina* and broadleaved flat weeds (e.g. *Hypochoeris radicata*) (Carter, 2010). Pasture grasses such as tall wheatgrass *Lophopyrum ponticum* and Toowoomba canary-grass *Phalaris aquatica* are also serious problems (Carter, 2010). Light grazing may control competition from introduced grasses, and cessation of grazing at presently grazed sites may be deleterious where introduced species are

expected to subsequently increase and form closed swards upon release from grazing (Carter, 2010).

Altered hydrological regimes. Further modifications to drainage patterns or flooding regimes at sites supporting curly sedge are likely to be detrimental, as the species is usually confined to a narrow ecological range on the damp margins of drainage depressions or swamps (Morcom 1999, cited in Carter 2010). The curly sedge has also been observed completely submerged, although it is not known how long plants can tolerate such inundation (Carter, 2010). Permanent drying or flooding of creeks and swamps inhabited by Curly Sedge is likely to destroy populations, given their apparent habitat specificity to certain soil moisture and/or drainage conditions (Carter, 2010). Murdoch (2014) reported that it is highly unlikely that all of the current known sites—351—would undergo a level of hydrological change that would create a decline in the extent of the species that would warrant listing on the EPBC Act. The Midlands Water Scheme has just completed construction, with the curly sedge being identified on 7 of the 75 properties to receive water from the scheme (Murdoch, 2014). At all of these sites the habitat for the species was maintained under a Farm Water Access Plan, and hence there will be no significant impact on any known populations for the species due to a change in land use across the Midlands Water Scheme area (Murdoch, 2014).

Grazing. The issue of grazing and the conservation of curly sedge is complex. In Tasmania, the curly sedge persists, and can thrive, on degraded sites under certain livestock grazing regimes (W. Potts DPIW Tas Pers. comm., cited in Carter, 2010). Curly sedge appears to tolerate some level of grazing by sheep but does not respond well to cattle grazing (Gilfedder and Kirkpatrick, 1996). In Victoria, at one of the two largest known populations—on private land at Branxholme—plant numbers have steadily increased for at least the last 23 years under controlled light grazing by sheep (David Fenton Branxholme; pers comm., cited in Carter, 2010), although the mechanism is unclear. This site, which has not been ploughed for at least 60 years, is seasonally grazed lightly by sheep (average of c. 9 sheep/hectare) (Carter, 2010). However, the explanation for this increase in abundance is unclear. The curly sedge may have flourished at that site because (1) sheep preferentially graze introduced pasture grasses and clovers over curly sedge, reducing competition, and/or (2) grazing is mostly excluded over summer, allowing new seedlings of curly sedge to establish (Carter, 2010). Craigieburn Nature Conservation Reserve is also lightly grazed at low stocking rates by sheep (c. 2.5 sheep/hectare) and kangaroos (c. 0.25 kangaroos/hectare), to reduce competition from pasture grasses and other weedy species, and promote maintenance of a diverse open native grassland community (Carter, 2010). Seedling establishment has been observed at both the Branxholme and Craigieburn sites under prevailing grazing regimes (Carter, 2010). Light seasonal grazing apparently creates an appropriate kind and level of disturbance that is necessary for regeneration of curly sedge (L. Gilfedder DPIW pers. comm., cited in Carter, 2010).

Heavy grazing, and trampling especially by cattle but also by sheep, are detrimental (Gilfedder and Kirkpatrick, 1996). During winter, severe compaction caused by heavy grazing severely degrades habitat and tramples first-year plants, and summer grazing is likely to reduce seedling recruitment (Carter, 2010). At the Macarthur site in Victoria, a section of land where curly sedge occurred was acquired to permit a gas pipeline development. Plants were removed from the site prior to the pipeline being built, and were re-introduced to the site after the pipe was completed; however, cattle grazing subsequently destroyed most of the re-introduced plants (Carter, 2010).

Changing land use. While some grazing regimes may be compatible with, and indeed desirable for, conservation of curly sedge, changing agricultural activities from, for example, grazing to cropping may pose a serious threat (Carter, 2010). Cropping—especially raised bed agriculture—is likely to disturb the soil, destroy plants and habitat, and alter drainage regimes (Carter, 2010). Although the curly sedge survives fire and stock grazing well, its vulnerability is a product of the suitability of its habitat for clearance (Gilfedder and Kirkpatrick, 1996; Kirkpatrick, 2004).

**Roadworks.** Many populations are found on or close to roadsides, and are at risk from works such as road maintenance or widening, vehicle movement, fence construction and maintenance, and cable installation and servicing (Carter, 2010). Gravel dumping on roadsides, or firebreak construction, can also damage populations (Carter, 2010). Although many new populations of the curly sedge were found from the early 1990s onwards, its future was not considered secure by Gilfedder and Kirkpatrick (1996). At that time, virtually all populations reportedly occurred on private land or roadside verges, and generally consisted of less than 100 individuals, making them vulnerable to extinction through the use of a plough or grader (Gilfedder and Kirkpatrick, 1996). Such an extinction occurred in the municipality of Kingborough in southern Tasmania during road preparation for a subdivision (Gilfedder and Kirkpatrick, 1996). Murdoch (2014) reported that whilst routine road works occur in Tasmania, it is unlikely that there will be large-scale road building projects that will impact on the vast area covered by this species.

*Potential threats*

**Climate change.** The recovery plan reports that the curly sedge is likely to be affected by climate change throughout its range, by the actions of increased temperatures, increased evaporation rates and decreased rainfall causing further loss of habitat and reduced opportunities for growth, flowering, seed set and especially recruitment (Carter, 2010). However, no supporting evidence is provided.

**Assessment of available information in relation to the EPBC Act Criteria and Regulations**

<b>Criterion 1. Population size reduction (reduction in total numbers)</b>			
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	<b>Critically Endangered Very severe reduction</b>	<b>Endangered Severe reduction</b>	<b>Vulnerable Substantial reduction</b>
<b>A1</b>	<b>≥ 90%</b>	<b>≥ 70%</b>	<b>≥ 50%</b>
<b>A2, A3, A4</b>	<b>≥ 80%</b>	<b>≥ 50%</b>	<b>≥ 30%</b>
A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.	<i>based on any of the following</i>	(a) direct observation [except A3]	
A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.		(b) an index of abundance appropriate to the taxon	
A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]		(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat	
A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.		(d) actual or potential levels of exploitation	
		(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites	

**Evidence:**

*Note: the listing guidelines for this criterion consider decline over the longer of 10 years or three generation lengths. The average generation length of Carex tasmanica is unknown but likely to be more than 10 years, pending feedback during public consultation. Therefore, consideration of decline over 30 years is more appropriate for this species at this stage.*

The former abundance of curly sedge is not known, although it is likely to have been common to abundant across its range, especially in south-western Victoria (Carter, 2010).

Until the mid 1990s, the species was considered to be threatened throughout its range, with only a few small populations being known at that time (Ball, 1995). However, the number of known populations has increased since the early 1990s, and the species is now known from over 100 populations in Tasmania (see table, below):

**Number of known populations of *Carex tasmanica* in Tasmania since the early 1990s**

No. of populations	Reference
10	Gilfedder (1991)
35	Wells (1994)
52	Ball (1995)
33+	DSE (2009)
40	Carter (2010)
100+	DPIPWE (2013a)
90+	Wapstra (2014)

Trends in the data presented above [for Tasmania] are also indicative of historical survey effort. The species was first collected in 1900, with no further collections until December 1930 (Wapstra, 2014). Collections then occurred in 1948 and 1949, followed by 1975 and 1977. The species was well-collected in the mid 1980s, followed by a more continuous and complete collection series through the 1990s and into the 2000s to the current time (Wapstra, 2014). From 2004 to 2014 the number of records and populations increased markedly due to intensive surveys of development proposals within the species' range and habitat (e.g. major road projects in the Midlands, major irrigation projects throughout the State, etc.) (Wapstra, 2014).

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy</b>			
	<b>Critically Endangered Very restricted</b>	<b>Endangered Restricted</b>	<b>Vulnerable Limited</b>
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

**Evidence:**

The following table shows extent of occurrence (EOO) and area of occupancy (AOO) values for the curly sedge for the distributions in Victoria, Tasmania, and nationally:

	<b>Extent of occurrence (km<sup>2</sup>)</b>	<b>Area of occupancy (km<sup>2</sup>)</b>
<b>Victoria</b>	10 570	48
<b>Tasmania</b>	11 160	368

<b>Total (National)</b>	142 551	416
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All values provided by ERIN (2015a,b)

Area of occupancy was calculated using a 2x2 km grid cell method based on the IUCN Red List Guidelines 2014, and extent of occurrence was calculated using a minimum convex polygon method based on the *IUCN Red List Guidelines 2014* (ERIN, 2015a,b). The value for national EOO includes the Bass Strait in that calculation.

Observation data were based on post-1990 records (15 records in Victoria and 277 records in Tasmania) from the Species Profile and Threats Database (ERIN, 2015b). The *National Recovery Plan for the Curly Sedge Carex tasmanica* (Carter, 2010) was also referenced to validate the general location of observation records (ERIN, 2015b). Observation data were originally sourced from the Australian Natural Heritage Assessment Tool; Australian National Herbarium, Victorian Flora Site Database, and the Tasmanian DPIWE Natural Values Atlas (ERIN, 2015b).

Wapstra (2014) calculated an extent of occurrence in Tasmania of 14 138.41 km<sup>2</sup>, based on a minimum convex polygon around all known Tasmanian records.

The former distribution of the curly sedge is not known, but it is likely that it was much more widespread across its known range, especially in Victoria. Carter (2010) reported that the species was known from a total of about 60 sites in 2010—40 in Tasmania, 20 in Victoria—with most of the Victorian sites occurring as just two populations, and the remaining sites being generally small and isolated. DPIPWE (2013a) reported that more than 100 populations of the curly sedge are now known in Tasmania, with at least 50 of these discovered since 2005 (DPIPWE, 2013a). The Tasmanian populations/sites are not widely distributed across the state, and so the curly sedge could therefore be considered as severely fragmented in Victoria, but not in Tasmania, and therefore not across the national extent of the species.

Some populations of curly sedge are located in conservation reserves, especially in Tasmania. However, the nature of the threats (e.g. weed invasion, heavy grazing, roadworks) mean that they would continue to impact on the species in many locations, including conservation reserves. This is likely to lead to continuing decline in the quality of the habitat.

The species is unlikely to be subject to extreme fluctuation in any aspect of its distribution.

In summary, the extent of occurrence greatly exceeds 20 000 km<sup>2</sup>, and the area of occupancy is less than 500 km<sup>2</sup>. The Victorian populations are severely fragmented, and decline in the quality of habitat mainly due to weed invasion and heavy grazing and trampling is inferred and likely to be continuing across its national extent.

The data presented above appear to demonstrate the species is close to but not quite eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 3. Population size and decline</b>			
	<b>Critically Endangered Very low</b>	<b>Endangered Low</b>	<b>Vulnerable Limited</b>
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	<b>Very high rate 25% in 3 years or 1 generation (whichever is longer)</b>	<b>High rate 20% in 5 years or 2 generation (whichever is longer)</b>	<b>Substantial rate 10% in 10 years or 3 generations (whichever is longer)</b>

C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:		longer)	
	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a)	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

Whether there are published estimates of the number of individuals from the 1990s is not known, although none were found during this assessment. However, recent estimates of total abundance reported the total number of individuals to be greater than 50 000 (see table, below):

#### Estimates of the total number of plants of *Carex tasmanica*

Estimates of the total no. of plants (nationally)	Source
50 000 – 500 000	DSE (2009)
500 000 – 1 million	Carter (2010)
'millions'	Wapstra (2014)

Although there is little or no published information on the historical abundance of individuals from the early to mid 1990s, there is such information on the number of known populations, which has increased markedly since that time. Current estimates of abundance report an extremely large number of individuals.

Carter (2010) estimated the total of individual plants to be between 500 000 and one million. Carter (2010) also identified important sites necessary for the long term survival and recovery of the curly sedge in Victoria, and estimated the size of several populations (Table 1). Such information has apparently not been compiled for Tasmania.

**Table 1.** Important sites for conservation of the curly sedge in Victoria. Source: Carter (2010)

Location	Land status	Comments
Macarthur	private land	est. 300,000+ plants (A. McMahon Ecology Australia, 2001)
Branxholme	private land	est. 22,000–330,000+ plants across 11 ha (pers. obs. 2003); estimate based on range of densities of adult plants (0.2–3 plants per m <sup>2</sup> ); estimated in 1 ha and extrapolated across site
Inverary Lane (east of Branxholme)	road reserve (DSE)	est. 1,000–5,000 plants across c. 1 ha (pers. obs. 2003)
Heywood	crown reserve (DSE)	est. 200–400 plants across c. 0.5 ha (pers. obs. 2003)
Hotspur-Condah Rd	95% private land 5% roadside (Portland Shire Council)	est. 50,000 plants (A. Pritchard DSE, 2003)
Lake Condah	private land (aboriginal community)	Pop. size unknown; cover-abundance of 1 is given in Appendix 1 of Aboriginal Affairs Victoria (1993)
Craigieburn Nature Conservation Reserve (NCR)	reserve (Parks Victoria)	est. 2,000–10,000+ plants along Curly Sedge Creek (pers. obs. 2003)
Craigieburn	private land	est. <100 plants; along Curly SedgeCreek south of Craigieburn NCR

Wapstra (2014) estimated that there are ‘probably hundreds of thousands’ of mature individuals in Tasmania alone, and estimated that the largest population he has seen may have numbered approximately 18 000 individuals.

The number of plants and extent of each population can be difficult to estimate at some sites, due to the difficulty distinguishing between curly sedge and other sedges outside the flowering period (Carter, 2010). Plants can also spread by rhizomes, so some 'clumps' of plants may in fact just be a single clone (Carter, 2010). Nevertheless, taking into account likely misidentifications, spreading by rhizomes and clumping of plants, the estimated number of mature individuals is much greater than 10 000.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species’ status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 4. Number of mature individuals</b>			
	<b>Critically Endangered Extremely low</b>	<b>Endangered Very Low</b>	<b>Vulnerable Low</b>
Number of mature individuals	<b>&lt; 50</b>	<b>&lt; 250</b>	<b>&lt; 1,000</b>

**Evidence:**

The estimated total of individual plants is between 500 000 and one million (Carter, 2010) (see criterion 3). Taking into account likely misidentifications, spreading by rhizomes and clumping of plants, the estimated number of mature individuals is still much greater than 1000.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species’ status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 5. Quantitative Analysis</b>			
	<b>Critically Endangered Immediate future</b>	<b>Endangered Near future</b>	<b>Vulnerable Medium-term future</b>
Indicating the probability of extinction in the wild to be:	<b>≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)</b>	<b>≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)</b>	<b>≥ 10% in 100 years</b>

**Evidence:**

Population viability analysis appears not to have been undertaken, there are insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species’ status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

## **Consideration for delisting**

### **Recovery Plan**

The *National Recovery Plan for the curly sedge, Carex tasmanica* (Carter, 2010), was prepared by the then Victorian Government Department of Sustainability and Environment, and adopted by the then Australian Government Department of the Environment, Water, Heritage and the Arts in 2010. As the curly sedge is not considered threatened in Tasmania (DPIPWE, 2013a, b), DPIPWE did not endorse this recovery plan (DPIPWE, 2013b), and the recovery actions it contains were developed for Victoria only (Carter, 2010).

### **Existing Conservation Measures (all from Carter, 2010)**

Several initiatives to conserve the curly sedge are already occurring, including:

- Fencing, sympathetic grazing and weed control at the Branxholme (Vic) private land site and Craigieburn Nature Conservation Reserve.
- Several private land sites in Tasmania where curly sedge occurs are under conservation covenant or being managed under conservation management agreements with landowners.
- Invasive willow *Salix* species removal at the Heywood township site.
- Revegetation of several roadsides in the Portland area using curly sedge.
- An ecological study of the species was conducted in the mid-1990s (Gilfedder & Kirkpatrick 1996).

### **Recovery Objectives (all from Carter, 2010)**

The overall objective of recovery is to minimise the probability of extinction of the curly sedge in the wild and to increase the probability of the smaller important populations becoming self-sustaining in the long term. Within the life span of this recovery plan, the specific objectives of recovery for curly sedge are to:

1. Determine distribution, abundance and population structure
2. Identify habitat requirements
3. Ensure that important populations and their habitat are protected and managed appropriately
4. Manage threats to populations
5. Identify key biological functions
6. Determine the growth rates and viability of populations
7. Build community support for conservation

### **Program Implementation (all from Carter, 2010)**

This Recovery Plan guides recovery actions and will be managed by the Department of Sustainability and Environment in Victoria and Department of Primary Industries and Water Resources in Tasmania. A Threatened Flora Recovery Team, consisting of scientists, land managers and field naturalists will be established to oversee threatened flora recovery in south-eastern Australia. Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist sub-committees on research, *in situ* management, community education and cultivation. Regional Recovery Teams will be responsible for preparing work plans and monitoring progress toward recovery. The Recovery Team will be responsible for annual assessments of progress towards recovery. This Recovery Plan will be reviewed within five years of the date of its adoption under the EPBC Act. [NB: the review of this recovery plan was due on 15 February 2015].

### **Management Practices (all from Carter, 2010)**

On-ground site management will aim to mitigate threatening processes and thereby ensure against extinction. Major threats requiring management include accidental destruction and competition from pest plants. Further modifications to drainage patterns or flooding regimes at sites supporting curly sedge are likely to be especially detrimental, given the apparently narrow ecological band on the margins of drainage depressions or swamps in which the species occurs. A range of strategies will be necessary to alleviate these threats including protective fencing, signage, weed control, and fire management. Broad-scale protection measures applicable to all populations include legal protection of sites, habitat retention and liaison with land managers including private landholders. In addition, searches of known and potential habitat should continue to better define the distributions and size of populations.

The Recovery Plan also advocates strategies to fill some of the major gaps in our knowledge to date. These include an understanding of the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the relationships between curly sedge and associated flora, and its response to environmental processes. Demographic censusing will be necessary to gather life history information and to monitor the success of particular management actions. In addition, *ex situ* conservation measures will be a useful adjunct and will include seed storage. Community participation in recovery actions will be sought, particularly in regard to recovery team membership and implementation of on-ground works.

### **Management practices required for conservation of the curly sedge include (Carter, 2010):**

- Identification and protection of remnant populations in highly vulnerable locations.
- Management of grazing to enable populations to persist and flourish.
- Control of pest plants.
- Identification and protection of populations in instruments such as public land management plans and planning overlays under local government procedures.
- Investigation of the biology and ecology of the species to enable better targeted conservation management actions.

## Recovery Objectives, Actions and Performance Criteria (all from Carter, 2010)

No.	Action	Performance Criteria
<b>Specific Objective 1: Determine distribution, abundance and population structure</b>		
1.1	Determine the identity of doubtful records of <i>Carex</i> species to enable an accurate assessment of distribution. <b>Responsibility: DSE/RBG</b>	<ul style="list-style-type: none"> <li>The taxonomic identity of <i>Carex</i> species at Whitestone Swamp, Lake Jollicum and Lake Omeo (Vic) confirmed to determine possible new populations of <i>C. tasmanica</i>.</li> </ul>
1.2	Acquire baseline population data by conducting detailed field surveys including (a) identification of the area and extent of populations; (b) estimates of the number, size and structure of populations and (c) inference or estimation of population change. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Surveys of populations determine area occupied/number of plants.</li> </ul>
1.3	Map existing and new populations. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Population maps prepared and used in conservation management.</li> </ul>
<b>Specific Objective 2: Identify habitat requirements</b>		
2.1	Survey known habitat and collect floristic and environmental information describing community ecology and condition. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Habitat critical for survival identified and defined.</li> </ul>
2.2	Identify and survey potential habitat, using ecological and bioclimatic information indicating habitat preference. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Predictive model for potential habitat developed and tested.</li> </ul>
2.3	Map areas of important and potentially suitable habitat. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Habitat critical for survival and potential habitat mapped.</li> </ul>
<b>Specific Objective 3: Ensure that important populations and their habitat are protected and managed appropriately</b>		
3.1	Incorporate protective actions in relevant park or reserve management plans. <b>Responsibility: DSE/PV</b>	<ul style="list-style-type: none"> <li>Actions to protect species incorporated in relevant management plans.</li> </ul>
3.2	Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures. <b>Responsibility: DSE/LGA</b>	<ul style="list-style-type: none"> <li>Voluntary conservation agreements negotiated conservation covenants on the most important populations.</li> <li>Important populations on private land have effective statutory protection.</li> </ul>
3.3	Negotiate Public Authority Management Agreements for important populations on public land. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Important populations on public land have effective statutory protection.</li> </ul>
<b>Specific Objective 4: Manage threats to populations</b>		
4.1	Identify current and potential threats to the species and its habitat. <b>Responsibility: DSE</b>	<ul style="list-style-type: none"> <li>Prescriptions prepared for threat abatement.</li> </ul>

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|-----|---|---|
| 4.2 | Control threats from pest plants including woody weeds and introduced grasses at key sites.<br><b>Responsibility: DSE/PV/LGA/landowners</b>   | <ul style="list-style-type: none"> <li>• A measurable reduction in the area impacted by weeds and curly sedge population sizes maintained (or increased) at treated sites.</li> </ul> |
| 4.4 | Identify appropriate disturbance regimes (especially grazing and fire) to maintain habitat and promote curly sedge population maintenance or increase.<br><b>Responsibility: DSE/PV</b> | <ul style="list-style-type: none"> <li>• Preparation and implementation of grazing and fire management prescriptions for persistence of key populations and habitat.</li> </ul>       |

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**Specific Objective 5: Identify key biological functions**

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|-----|--|--|
| 5.1 | Evaluate current reproductive and regenerative status, including seed bank status, of each population and determining longevity, fecundity and recruitment levels.<br><b>Responsibility: DSE</b> | <ul style="list-style-type: none"> <li>• Seed bank/regenerative potential quantified for each population.</li> </ul>   |
| 5.3 | Investigate impacts of soil disturbance, fire, salinity and soil moisture on flowering, seed set and recruitment.<br><b>Responsibility: DSE</b>  | <ul style="list-style-type: none"> <li>• Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.</li> </ul> |

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**Specific Objective 6: Determine the growth rates and viability of populations**

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|-----|--|---|
| 6.1 | Develop population monitoring protocols.<br><b>Responsibility: DSE</b>   | <ul style="list-style-type: none"> <li>• Techniques for monitoring developed and implemented.</li> </ul>  |
| 6.2 | Monitor population trends and responses against recovery actions at key sites including Craigieburn, Macarthur and Branxholme.<br><b>Responsibility: DSE</b> | <ul style="list-style-type: none"> <li>• Annual census data collected, population growth rates determined and Population Viability Analysis completed.</li> </ul> |

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**Specific Objective 7: Build community support for conservation**

- |     |  |   |
|-----|--|---|
| 7.1 | Identify opportunities for community involvement in the recovery plan.<br><b>Responsibility: DSE</b> | <ul style="list-style-type: none"> <li>• Presentation(s) to community nature conservation groups.</li> <li>• Inform private landholders of fencing incentives provided by DSE and the threatened species network.</li> <li>• Educate local shires, including contractors of roadside work.</li> </ul> |
|-----|--|---|

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**Abbreviations:** DSE –Department of Sustainability and Environment (Vic); LGA – local government authorities; PV – Parks Victoria; RBG – Royal Botanic Gardens, Melbourne

## Summary of threats, mitigating activities and referrals under the EPBC Act 1999

Identified threat (from Carter, 2010)	Threat type and status	Threat abatement activities in Victoria (from Carter, 2010) relating to identified threats	Threat has led to referrals triggered under EPBC Act?	Does listing under the EPBC Act confer protection against this threat?
Weed invasion	Known, current	<ul style="list-style-type: none"> <li>• Incorporate protective actions in relevant park or reserve management plans</li> <li>• Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures</li> <li>• Negotiate Public Authority Management Agreements for important populations on public land</li> <li>• Control threats from pest plants including woody weeds and introduced grasses at key sites.</li> <li>• Identify appropriate disturbance regimes (especially grazing and fire) to maintain habitat and promote curly sedge population maintenance or increase</li> </ul>	No	No
Altered hydrological regimes	Potential, current	<ul style="list-style-type: none"> <li>• Incorporate protective actions in relevant park or reserve management plans</li> <li>• Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures</li> <li>• Negotiate Public Authority Management Agreements for important populations on public land</li> <li>• Identify appropriate disturbance regimes (especially grazing and fire) to maintain habitat and promote curly sedge population maintenance or increase</li> </ul>	Yes (Tas)	Yes
Grazing	Known, current	<ul style="list-style-type: none"> <li>• Incorporate protective actions in relevant park or reserve management plans</li> <li>• Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures</li> <li>• Negotiate Public Authority Management Agreements for important populations on public land</li> <li>• Identify appropriate disturbance regimes (especially grazing and fire) to maintain habitat and promote curly sedge population maintenance or increase</li> </ul>	No	No

Changing land use	Known, current	<ul style="list-style-type: none"> <li>• Incorporate protective actions in relevant park or reserve management plans</li> <li>• Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures</li> <li>• Negotiate Public Authority Management Agreements for important populations on public land</li> <li>• Identify appropriate disturbance regimes (especially grazing and fire) to maintain habitat and promote curly sedge population maintenance or increase</li> </ul>	Yes (Vic, Tas)	Yes
Roadworks	Known, current	<ul style="list-style-type: none"> <li>• Incorporate protective actions in relevant park or reserve management plans</li> <li>• Negotiate land management agreements, including Conservation Covenants, with private landowners for the protection of important populations on private land, and incorporate actions to protect important populations on private land into local government documents and procedures</li> <li>• Negotiate Public Authority Management Agreements for important populations on public land</li> </ul>	Yes (Vic, Tas)	Yes
Climate change	Potential, future	None identified		

Several threats (land clearing, roadworks, and altered hydrological use) are triggering referrals under the EPBC Act, indicating that listing under the Act is conferring protection to this species. For these threats, delisting would lead to removal of the protection and further loss of plants. The impacts of current threats indicate that decline in abundance is occurring, and is likely to continue to occur. However, the number of known populations has greatly increased over the last 10-20 years, and the estimated total abundance is extremely high.

For these reasons it is unlikely that delisting would lead to eligibility for re-listing in the immediate future; however, continuing impact of threats and decline in abundance may lead to eligibility in the longer term.

## **Collective list of questions – your views**

*Note: the listing guidelines for criterion 1 consider decline over the longer of 10 years or three generation lengths. The average generation length of Carex tasmanica is unknown but likely to be more than 10 years, pending feedback during public consultation. Therefore, consideration of decline over 30 years is more appropriate for this species at this stage.*

### **Biological information**

1. Can you provide any additional or alternative references, information or estimates regarding the biology of the curly sedge, especially life history (including generation length, longevity, or average life span)?
2. Can you provide any information on the mechanisms underlying recruitment and regeneration?
3. Can you provide any information on the relationships between the curly sedge and associated flora, and its response to environmental processes such as climate?

### **Population size**

4. Has the survey effort for this species been adequate to determine its national population size? If not, please provide justification for your response.
5. Do you accept the estimate of the total population size of the species (500 000 to 1 million)? If not, please provide justification for your response.
6. If you don't agree with the estimate, can you provide your own estimate of the current abundance of this species across its national extent? Can you also provide an estimate of the population size in either Victoria or Tasmania? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of: <input type="checkbox"/> 251–1000 <input type="checkbox"/> >1000 <input type="checkbox"/> >10 000 <input type="checkbox"/> >100 000 <input type="checkbox"/> >500 000
Level of your confidence in this estimate: <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much information to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, information suggests this range <input type="checkbox"/> 95–100% - high level of certainty, information indicates quantity within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range

## Evidence of total population size change

7. Are you able to provide an estimate of the total population size (i.e. of the whole species) during the mid 2000s? Please provide justification for your response.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of: <input type="checkbox"/> 251–1000 <input type="checkbox"/> >1000 <input type="checkbox"/> >10 000 <input type="checkbox"/> >100 000 <input type="checkbox"/> >500 000
Level of your confidence in this estimate: <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much information to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, information suggests this range <input type="checkbox"/> 95–100% -high level of certainty, information indicates quantity within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range

8. Are you able to comment on the extent of any change (decline or increase) in the species' total population size over the last approximately 10 years? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of change, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline <input type="checkbox"/> or increase <input type="checkbox"/> estimated to be in the range of: <input type="checkbox"/> 1–30% <input type="checkbox"/> 31–50% <input type="checkbox"/> 51–80% <input type="checkbox"/> 81–100% <input type="checkbox"/> 90–100%
Level of your confidence in this estimated decline: <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much information to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, suggests this range of decline <input type="checkbox"/> 95–100% -high level of certainty, information indicates a decline within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range

9. Please provide (if known) any additional evidence which shows the species is stable, increasing, or declining.

**Current Distribution/range/extent of occurrence, area of occupancy**

10. Is the distribution as described valid? If not, please provide justification for your response and provide alternative information.
11. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.

If you disagree with the estimates provided, can you provide alternative estimates of extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Extent of occurrence is estimated to be in the range of:

- <100 km<sup>2</sup>    100 – 5 000 km<sup>2</sup>    5 001 – 20 000 km<sup>2</sup>    >20 000 km<sup>2</sup>

Level of your confidence in this estimated extent of occurrence

- 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, data suggests this range of decline
- 95–100% -high level of certainty, data indicates a decline within this range
- 99–100% - very high level of certainty, data are accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Area of occupancy is estimated to be in the range of:

- <10 km<sup>2</sup>    11 – 500 km<sup>2</sup>    501 – 2000 km<sup>2</sup>    >2000 km<sup>2</sup>

Level of your confidence in this estimated extent of occurrence:

- 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- 31–50% - more than a guess, some level of supporting evidence
- 51–95% - reasonably certain, data suggest this range of decline
- 95–100% -high level of certainty, data indicate a decline within this range
- 99–100% - very high level of certainty, data are accurate within this range

## Past Distribution/range/extent of occurrence, area of occupancy

12. Do you consider that the way historical distributional information has been estimated is appropriate? Please provide justification for your response?

Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of: <input type="checkbox"/> <100 km <sup>2</sup> <input type="checkbox"/> 100 – 5 000 km <sup>2</sup> <input type="checkbox"/> 5 001 – 20 000 km <sup>2</sup> <input type="checkbox"/> >20 000 km <sup>2</sup>
Level of your confidence in this estimated extent of occurrence <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much data to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, data suggest this range of decline <input type="checkbox"/> 95–100% -high level of certainty, data indicate a decline within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of: <input type="checkbox"/> <10 km <sup>2</sup> <input type="checkbox"/> 11 – 500 km <sup>2</sup> <input type="checkbox"/> 501 – 2000 km <sup>2</sup> <input type="checkbox"/> >2000 km <sup>2</sup>
Level of your confidence in this estimated extent of occurrence: <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much data to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, data suggest this range of decline <input type="checkbox"/> 95–100% -high level of certainty, data indicate a decline within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range

### **Change in status/rate of change**

13. Is the information used to identify the nationally threatened status of the species robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.

### **General**

14. What are the implications in Victoria if the species is delisted?
15. Can you provide additional data or information relevant to this assessment?
16. Have you been involved in developing this nomination? If so, in what capacity?

### **Threats**

17. Is the species still threatened in any part of its range? If so, where and in what way?
18. Do you agree that the threats listed are correct and can you comment on their effect(s) on the species?
19. To what degree, if any, are the identified threats likely to impact on the species in the future?
20. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this species at any stage of its life cycle?
21. Can you provide supporting data/justification or other information for your responses to these questions about threats?

### **Management**

22. To what extent have the current planning, management and recovery actions been effective in supporting protection and recovery of the species?
  23. Are there any additional planning, management and recovery actions currently in place supporting protection and recovery of the species? To what extent have they been effective?
- 

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Viewed 7 August 2015

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