# Survey Guidelines for Australia’s Threatened Orchids

# Guidelines for detecting orchids listed as ‘threatened’ under the *Environment Protection and Biodiversity Conservation Act* 1999

Authorship and acknowledgements

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# Glossary

**Department:** Australian Government agency responsible for the administration of the Commonwealth’s *Environment Protection and Biodiversity Conservation Act 1999*.

**EPBC Act:** Environment Protection and Biodiversity Conservation Act 1999.

**Epiphytic orchids:** Orchids growing on other plants.

**False negative observation:** The failureto detect a target species when it is present.

**False positive observation:** The misidentification of a similar species as the target species during survey.

**Lithophytic orchids:** Orchids growing on rock outcrops, boulders, cliffs and escarpments.

**Terrestrial orchids:** Orchids growing in soil.

# 1. How to use these Guidelines

The purpose of this document is to provide guidelines for surveying Australia’s threatened orchids listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There are 228 orchids listed under the EPBC Act (as at 2013) which include terrestrial, epiphytic and lithophytic orchids. It is possible that additional species may be added to this list in the future, and if that happens, surveys for these species should consider these guidelines.

These guidelines are applicable to all those interested in surveying for orchid species, however, they are primarily aimed at proponents (those proposing to undertake development, activities or actions), consultants (those who conduct and/or report on threatened species in surveys and assessments) and decision makers (those who are responsible for assessing impacts on threatened orchid species). The information in these guidelines has been designed for those with sound understanding, experience and skills in conducting ecological surveys, in particular, surveys for orchids.

In view of the differences in the biology and ecology of terrestrial, epiphytic and lithophytic orchids, these three groups are considered separately in the survey methodology. It should be noted, however, that some orchid species can grow in multiple locations, for example, perched on both trees and rocks, or in soil in the ground and in the forks of trees.

These guidelines include a supporting table (Table 1) with information on each of the 228 orchids listed in the EPBC Act. It should be noted that very little is known about the habitat needs and ecology of some orchids, making it difficult to determine adequate levels of survey effort. In addition, species' habitat needs may vary across different regions. Local information should always be sought, and you should use your professional judgement, backed up by sound reasoning and scientific information.

The taxonomic names used in this document are in line with the most current version endorsed by the Council of Heads of Australasian Herbaria, however, it is acknowledged that orchid taxonomy is transitory. Australian orchids are likely to be subject to future taxonomic review, however, a review would not necessarily change the threat or listing status of the species under the EPBC Act. This can only change if the minister has approved a change consistent with the requirements of the Act. Current taxonomic listing status should be checked with the department and state/territory agencies as appropriate.

These survey guidelines are not mandatory. Proposals failing to meet these guidelines for reasons of efficiency, cost or validity will not necessarily default to a judgement that a significant impact is likely, especially where the proponent provides an evidence-based rationale for a different survey technique. Furthermore, alternative methods to a dedicated survey may also be appropriate. You should consider the proposal’s impact in the context of the species’ national, regional, district and site importance to establish the most effective survey approach. If you deviate from the survey effort or methods outlined in these guidelines, the Department of the Environment recommends that a scientifically valid justification that refers to scientific literature or expert testimony evidence be provided.

It is recommended that this document be read in conjunction with the Australian Government [EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance](http://www.environment.gov.au/epbc/publications/nes-guidelines.html). Note that executing a survey to the standard within these guidelines and identifying the presence of listed species does not in itself predict a ‘significant impact’. The presence or absence of a listed species is one of many factors taken into account when deciding on the likelihood of a ‘significant impact’. You should use the presence of a species as a consideration in establishing whether a ‘significant impact’ is likely or certain. As part of the assessment process, sufficient information is usually required to determine if a species’ presence at a site constitutes a ‘population’ and/or ‘important population’ as defined in the *Significant Impact Guidelines 1.1* publication. Surveys conducted using these survey guidelines will not necessarily generate information on whether the species’ occurrence constitutes a ‘population’ or ‘important population’. Should scientifically based information on these aspects be known, its inclusion in a referral can help inform the assessment process.

Information on species that occur at very low abundance or in very small populations, such as some orchids, may be important when considering the likelihood of a significant impact from the proposed actions. These survey guidelines do not establish or assess species’ abundance, as determining abundance would require greater temporal and spatial survey effort than determination of presence/absence and different design within a given site. Before undertaking a survey you may wish to contact the department to discuss your project.

These survey guidelines were developed using the best available information at the time of writing. Consultation with orchid experts from tertiary institutions, state and territory departments and agencies, and orchid societies was undertaken to determine the most appropriate survey techniques and survey effort for the detection of nationally listed threatened orchids.

The Species Profiles and Threats Database (SPRAT) profiles for these orchid species provide further detailed information on the biological and ecological context for survey guidelines, ‘significant impact’ guidance and mitigation measures. SPRAT profiles can be accessed at the department’s website: [www.environment.gov.au/cgi-bin/sprat/public/sprat.pl](file:///C%3A%5CUsers%5CFilomena%5CDocuments%5Cfilomena%27s%20folder%5Cwww.environment.gov.au%5Ccgi-bin%5Csprat%5Cpublic%5Csprat.pl) State and territory government agencies also hold relevant information including habitat and species’ distribution information. Further information on these orchids may also be found in various state conservation agency and state herbaria websites:

|  |  |
| --- | --- |
| State | Relevant websites |
| Commonwealth | S[pecies Profile and Threats](http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl) Database  Atlas of Living Australia [Protected Matters Search Tool](http://www.environment.gov.au/erin/ert/epbc/index.html) Australia’s Virtual Herbarium (<http://avh.ala.org.au/>) |
| New South Wales | Office of Environment and Heritage (<http://www.environment.nsw.gov.au/>)Threatened species website (<http://www.environment.nsw.gov.au/threatenedspecies/index.htm>)Bionet (<http://www.bionet.nsw.gov.au/>)NSW Flora online (http://plantnet.rbgsyd.nsw.gov.au/) |
| Victoria | Department of Environment and Primary Industries (<http://www.dse.vic.gov.au/>)Threatened species website (http://www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/threatened-species-and-communities)Victorian Biodiversity Atlas (http://www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/victorian-biodiversity-atlas)National Herbarium of Victoria (http://www.rbg.vic.gov.au/science/information-and-resources/national-herbarium-of-victoria) |
| South Australia | Department of Environment, Water and Natural Resources (<http://www.environment.sa.gov.au/Home>)Threatened species (<http://www.environment.sa.gov.au/Plants_Animals/Threatened_species_ecological_communities>)State Herbarium (<http://www.environment.sa.gov.au/Science/Science_research/State_Herbarium>)Consensus of SA plants, algae and fungi, vertebrates ([http://www.environment.sa.gov.au/Knowledge\_Bank/Information\_data/](http://www.environment.sa.gov.au/Knowledge_Bank/Information_data/Census_of_SA_plants_algae_fungi)) |
| Western Australia | Department of Environment and Conservation (<http://www.dec.wa.gov.au/>)Threatened species (<http://www.dec.wa.gov.au/management-and-protection/threatened-species.html>)Western Australian Herbarium (<http://www.dec.wa.gov.au/our-environment/science-and-research/wa-herbarium.html>)FloraBase (http://florabase.dec.wa.gov.au/) |
| Northern Territory | Department of Land Resource Management (<http://www.lrm.nt.gov.au/>)State Herbarium (<http://www.lrm.nt.gov.au/>) |
| Queensland | Department of Environment and Heritage Protection (<http://www.ehp.qld.gov.au/>)Threatened species (<http://www.ehp.qld.gov.au/wildlife/threatened-species/index.html>)Queensland Herbarium (http://www.ehp.qld.gov.au/plants/herbarium/) |
| Australian Capital Territory | Department of Environment and Sustainable Development (<http://www.environment.act.gov.au/>)Threatened species (<http://www.environment.act.gov.au/cpr/conservation_and_ecological_communities>)Australian National Botanic Gardens (http://www.anbg.gov.au/gardens/plantinfo/index.html) |
| Tasmania | Department of Primary Industry, Parks, Water and Environment (<http://www.dpiw.tas.gov.au/inter.nsf/Home/1?Open>)Threatened Species Link (<http://www.threatenedspecieslink.tas.gov.au/>)Flora of Tasmania Herbarium (http://demo1.tmag.tas.gov.au/) |

It is strongly advised that you consult with state and local experts prior to conducting your surveys. State governments and community groups such as orchid societies are often helpful in such situations. State threatened-species lists may contain species not listed at the national level and vice versa.

These guidelines do not provide guidance on requirements under state and local government laws. Information on state, territory and local government regulations can be obtained from the [New South Wales Office of Environment and Heritage](http://www.environment.nsw.gov.au/); the [Queensland Department of Environment and Heritage Protection](http://www.ehp.qld.gov.au/), [Parks](http://www.dec.wa.gov.au/) and Wildlife; the [Northern Territory Department of Land Resource Management](http://www.lrm.nt.gov.au/) or the [Parks and Wildlife Commission NT](http://www.parksandwildlife.nt.gov.au/); the [Victorian Department of Environment and Primary Industries](http://www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/victorian-biodiversity-atlas); the [South Australian Department of Environment, Water and Natural Resources](http://www.environment.sa.gov.au/Home); the Australian Capital Territory Environment and Sustainable Development Directorate; the [Tasmanian Department of Primary Industry, Parks, Water and Environment](http://www.dpiw.tas.gov.au/inter.nsf/Home/1?Open); and local councils in or near the proposed project area.

## 1.1 Key characteristics of orchids

Orchids are diverse in form, are widely distributed and adapted to a variety of habitats. Their specificity to particular environmental conditions and sensitivity to habitat changes makes orchids excellent indicators of ecosystem health and effectiveness of conservation work.

Orchids have a collective suite of characteristics that can be used to identify them. These can include:

* a highly modified third petal known as a labellum, the exception being the sun orchids (*Thelymitra*) where all petals are about the same size and shape
* highly modified stamens and style fused into a column—this organ is situated centrally on the flower and is often quite conspicuous
* pollen aggregated into packets known as pollinia, each of which can contain thousands of pollen grains—these are dispersed by pollinators as one unit except in the case of the greenhoods (*Pterostylis*) where the pollen can be in granulate clusters
* upside-down flowers with the labellum below the column: in a few genera, such as the leek orchids (*Prasophyllum*) and duck orchids (*Paracaleana*), the labellum is above the column
* dust-like seeds which are barely one millimetre across, often lacking food reserves and usually relying on a beneficial fungus for germination and growth particularly in orchids lacking conspicuous chlorophyll
* the production of a protocorm (a tuberous mass of cells) upon germination from an un-differentiated pro-embryo contained in the seed (some non-orchid *Lobelia* species also produced protocorm-like bodies from their seeds)
* unusual life cycles compared to most other plants—orchid seeds can germinate and grow first into a protocorm, then a seedling with a leaf and finally a mature flowering plant with a leaf/leaves and tuber (underground potato-like structure); this can take up to three or more years depending on the growing conditions of the orchid involved
* a varying capacity to grow tubers as some produce only one while others produce two or more each year: orchids that multiply through the development of multiple new tubers often form large colonies, however, most orchids do not multiply this way and instead rely on seed germination to increase their numbers.

## 1.2 Survey challenges

Surveying for cryptic species such as orchids presents many challenges.

### 1.2.1 Response to the environmental conditions

* Most terrestrial orchids remain dormant, in the form of an underground tuber, for up to six months of the year when they cannot be detected during surveys. Some terrestrial orchid species have the potential to survive for up to three years before more favourable environmental conditions allow for them to emerge.
* Orchids may not respond immediately to seasonal conditions such as recent rain.
* The flowering of most winter and spring flowering southern terrestrial orchids is triggered by late autumn and winter rains. In prolonged droughts they may not appear at all, or if leaves do appear they may be very small or wither before flowering or the young flower spike may abort. The failure to find orchids in drought years or when rainfall events do not occur at the right time does not necessarily mean that they are truly absent.
* The proportion of flowering to non-flowering plants is influenced by environmental conditions; therefore, the species may be present but overlooked when only non-flowering plants are present. In addition, not all plants in a population or different populations are likely to flower at the same time.
* Once mature, most southern terrestrial orchids are dormant in summer, surviving as an underground tuber from which they re-sprout in autumn following the onset of rain and a drop in temperature. These orchids will only be visible above ground while in active growth. A feature of these orchids is their capacity to persist underground for one or more years as tubers without producing above-ground parts. This is most common in the drier, inland regions and makes surveys of some rare orchids difficult as more plants are dormant, rather than flowering, most years.

### 1.2.2 Flowering

* Most orchids flower over a short period, usually in the order of weeks. Some flower only for a few days, making detectability dependent on the accurate timing of surveys. The exceptions are those few species with distinctive leaves (such as *Drakaea elastica*) that are recognisable over a longer period.
* Surveys early or late in the flowering period may miss those plants that are in bud or have finished flowering. For most species several surveys are required during the species’ flowering period to pick up all plants.
* Some species only flower after certain disturbance events, notably summer fire.
* Most orchids do not flower every year and in any population there may be more vegetative plants than flowering plants. This means flowering plants will be in different places each year.

### 1.2.3 Life history

* Some species are extremely difficult to find, such as subterranean or very small orchids. For example, in *Rhizanthella gardneri* (Western Australian Underground Orchid) and *R. slateri* (Eastern Underground Orchid), the tips of the involucral bracts break the surface of the soil but are still hidden under the leaf and bark litter, making plants almost impossible to see. These orchids require very careful searches and specialist knowledge of the species.
* Identification can be complicated by the occurrence of natural hybridisation and variation in floral morphology. Some species may co-occur with closely related species with which they could be mistaken and require specialist skills to identify. Surveys for these species may not locate them or they may be recorded in much higher numbers if confused with a more common species.
* When underground tubers re-sprout, leaves usually emerge many months before flowering. The leaves may be difficult to distinguish from other vegetation and, when found, difficult to identify to species level.
* Orchid seedlings are very small for the first growing season and are difficult to locate and identify. Seedling leaves are typically less than 20 millimetres long and only a few millimetres wide.
* Many threatened orchid species occupy specific habitats. Knowledge and survey of the appropriate habitat is required to locate them.
* Some animals eat orchid leaves, flower buds and/or flower heads. Losses of plant parts can affect detection.

# 2. Detectability and Survey Considerations

Detectability is defined as the probability of detecting the target species during the survey of a site at which it is present. Detectability is an important aspect of survey methodologies, with observed absence often treated as a true absence, ignoring the possibility that a species was present but just not detected (Cypher 2002, MacKenzie 2002, Royle & Nichols 2003, Cunningham & Lindenmayer 2005, MacKenzie et al. 2005).

When the target species is present at the site being surveyed, detection can be thought of as a result of two processes: first, the observer encounters the species; and second, the observer sees or identifies the species. Whether an observer encounters an orchid is influenced by the abundance, density and distribution of the species at the site—the larger the population size the more likely the observer is to encounter an individual.

The probability of the observer seeing and/or identifying the orchid is influenced by factors such as morphology or lifeform, observer (level of training, education, experience, interest, eyesight, height, fatigue level or number of surveyors), sampling strategy, habitat quality, and climatic variables at the time of survey (wind speed, temperature, precipitation, time of sunrise, time of day). Other factors that may influence detectability include habitat type, season of year, vegetation height and density, human disturbance or cloud cover (Garrard & Wintle 2011 and references therein). These detectability aspects must be considered when undertaking the survey.

When carrying out a survey, all appropriate steps should be taken to maximise detectability and consider detectability in the analysis and reporting. Some species are always cryptic, while others may be hard to find during certain life stages. If the target species is considered to be too cryptic to be adequately surveyed, it may be more appropriate to assume presence. It must be noted that although the species itself may be cryptic, signs may be relatively easy to find and can often be a good surrogate (or proxy) for presence.

## The precautionary principle

Many decisions under the EPBC Act are guided by the principles of ecologically sustainable development (section 3A). One of these principles (s. 3A(b)) is commonly known as the precautionary principle:

“if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

This principle is particularly relevant to assessing the impacts of actions on cryptic species such as orchids. In general, the department will assume that an orchid species known from the region is present on a site unless a robust evaluation has been undertaken to support the case that the species is absent. A robust evaluation could involve application of these survey guidelines, other survey techniques, including a state’s guidelines or accepted industry guidelines, or drawing on relevant expertise.

# 3. Planning considerations

## 3.1 Select appropriate personnel to conduct surveys

An essential component of any survey is experienced personnel. Experienced surveyors increase field detection and reduce false ‘negatives’ and ‘positives’ as well as significantly increasing the efficiency of surveys and the reliability of results. In the case of orchids, experienced experts may be required in order to address issues such as identification.

Surveys should be conducted by experienced observers with appropriate experience and qualifications such as:

* demonstrated experience as a field botanist including knowledge of designing and implementing surveys
* experience in field identification of the threatened orchid species and similar species that might be encountered in the area
* having encountered the target species growing in its natural habitat (although team members can be trained to recognise target species using photographs and/or herbarium specimens, it is still preferable that at least one member who has seen the species growing in the wild accompanies field teams at all times).Recent experience of the target species that occur in similar habitats to those being investigated is also of benefit when surveying orchids
* the ability to anticipate potential identification issues and consult with specialists, when necessary, to understand and flag them for resolution (if there is any uncertainty regarding identification of a plant species including threatened species, consultation with local orchid experts should be sought)
* desire to conduct field surveys and the physical capability to work in the terrain involved
* understanding of the legislative regulations and permits required.
* inexperienced surveyors should be taking photographs to show to experts or taking specimens if enough individuals are found.

## 3.2 Identify species that are likely to or may occur in the study area

Pre-planning of threatened terrestrial orchid surveys should include a thorough examination of existing information to assist with survey design, including the identification of threatened orchids that occur in the survey area, best times to survey, occupancy patterns and habitat, and the most appropriate techniques for particular orchids, if available.

An initial strategy for the desktop review is suggested below.

### (i) Characterise the survey area

The boundaries of the survey area must be clearly established. A detailed map of the survey area should show the type, location and broad condition of native vegetation and important habitat features for orchids. This characterisation is not only critical to establishing which threatened species may occur in the area, but also in the selection of appropriate survey methods and effort. An appropriate map will aid almost every survey regardless of survey technique. However, this map should be used only as a guide as a desktop survey will not determine the ground cover condition or detailed habitat features which are both important factors influencing the presence of terrestrial orchids.

### (ii) Establish the regional context

This stage requires an assessment of the habitat frequency and function. However, the desktop survey does not assess the distribution of microhabitats which are essential for many terrestrial orchids. The regional context will help develop judgements of significance associated with the loss or disturbance of habitat. A useful test will involve the following questions:

* Is the habitat rare or common?
* Is the habitat likely to be permanent or ephemeral?
* Is the habitat likely to be ‘habitat critical to the survival of the species’?
* Is the habitat likely to comprise an important population?

### (iii) Identify those threatened orchids that are known to, likely to, or may, occur in the survey area

This stage involves consulting a range of sources to determine which threatened orchids could occur in the habitat surrounding and including the study area. There are a range of sources that should be consulted to create a list of species. These include:

* databases maintained by the Australian Government Department of Environment, including the S[pecies Profile and Threats (SPRAT)](http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl) database and the [Protected Matters Search Tool](http://www.environment.gov.au/erin/ert/epbc/index.html) (see information box below)
* state and territory conservation agencies and local government databases and predictive models
* national and state/territory threatened species [recovery plans](http://www.environment.gov.au/biodiversity/threatened/recovery.html) and teams
* reference books including orchid-identification guides
* herbarium and other specimen collections
* previously published or unpublished flora surveys, field studies and environmental impact reports
* aerial photographs and satellite images, topographic maps, vegetation maps, geological maps and soils maps
* historic records of flora and vegetation communities in the area
* lists of threatened species, populations or ecological communities in the area
* literature about the ecology of the species, communities and habitats found or likely to be found in the area (species profiles, scientific papers)
* consultation with local community groups, researchers and orchid experts.

#### The Protected Matters Search Tool (PMST)

* The [PMST](http://www.environment.gov.au/epbc/pmst/index.html) generates reports that help to determine whether matters of national environmental significance or other matters protected by the Environment Protection and Biodiversity Conservation Act are likely to occur in the area of a proposed action. The reports can be generated using a drawn polygon, coordinates or region. When referring to nationally-listed threatened or migratory species, three terms are used to indicate the likelihood of occurrence of a species, or species’ habitat:
1. **known** to occur
2. **likely** to occur
3. **may** occur.
* The likelihood rating assigned to various listed species in the action footprint is one source of information to assess whether targeted ecological surveys are required.
* NB: When generating a PMST report a broad view of action and impacts must be taken to account for indirect, downstream and facilitated impacts. See Significant Impact Guidelines 1.1 for further information. If the report is not generated for all relevant areas, results cannot be considered as indicative of the matter of national environmental significance that may be affected.

When surveys are undertaken outside the optimal survey period, the desktop report would include a predictive list that is dependent on the species records in databases and other (un)published sources. Consultation with the data collector (if possible) and/or local experts is recommended.

There are some instances where it may be considered unlikely that a species is present, but the available desktop or expert information is not adequate to justify a claim of absence. In this situation it may be cost-effective to carry out a survey to confirm absence so that unnecessary mitigation measures are not required.

If the data for the project area are found to be inadequate, or deficiencies in the information required to determine the significance of impacts are identified, the decision must then be made whether to carry out surveys or assume presence. Targeted surveys will be required to assist in the decision-making process (larger volume or better quality information allows for more confidence in decisions).

## 3.3 Determine optimal timing for surveys of ‘target’ species

Modelling of survey effort for cryptic plant species such as terrestrial orchids shows the importance of conducting surveys under appropriate survey conditions (or avoiding sub-optimal conditions) (Garrard et al. 2008). Table 1 provides information on peak detectability of particular orchids listed under the EPBC Act. The flowering times in this document should be taken as a guide only because there are always exceptions to the rules. However, we have drawn on as much published information and expert knowledge as possible. Orchids are usually not recorded when surveys are conducted outside optimal periods for their detection. Therefore, the timing of fieldwork is critical to the surveying and reporting process for this flora as well as increasing the confidence in survey results and assessment of significance. However, if proponents are unable to conduct surveys at the appropriate times, the species should be presumed to be present.

With some exceptions (species which can be identified from their leaves) the optimal recommended time to survey for terrestrial orchids is during their flowering period as the presence of flowers makes the species easier to locate and flowers enable positive identification. Often, as some plants will flower before others, several surveys are required to locate all flowering plants over the species’ flowering period. A survey conducted when some mature individuals are in bud is acceptable provided the locations of discovered leaves or rosettes are marked for positive identification during the flowering period. In some cases, surveys taken when leaves or rosettes are present (without flower stalks) are acceptable, but only if undertaken by an orchid expert who is familiar with the species and the species has distinctive leaves that are readily identifiable. However, many species cannot be uniquely identified from leaves only.

Surveying for terrestrial orchids should not be undertaken during the dormant period when plants have lost their leaves and are present only as underground tubers and, therefore, would not provide an acceptable identification or indication of the presence or absence of the orchid. If surveys are conducted at an inappropriate time of year (summer for southern Australian terrestrial orchids and winter for northern Australian orchids), the survey results would not be considered to be adequate evidence of a species’ absence. Some species have known seasonal variation in presence. In such a case it will be assumed that the species is present.

In some cases survey timing may be able to take advantage of opportunistic disturbance conditions. Most terrestrial orchids are not affected by, or respond favourably to, summer fire when they are dormant, but they are adversely affected if it occurs during their active growing period. Finding orchids post-fire is therefore highly dependent on the time of the fire. For some species this may be the best time to conduct a survey.

In contrast to terrestrial orchids, epiphytic and lithophytic orchids can generally be seen and identified relatively easily at any time of the year.

An important consideration when surveying orchids in an area is that the optimal survey period for each species may differ in terms of:

* length of flowering time
* time of year and seasonality
* weather conditions and climatic variability
* disturbances prior to or during the survey
* density changes in over-storey vegetation
* changes in hydrology of the area
* fire history, logging, grazing, and weed-infestation history
* condition of the vegetation community.

When designing the survey, careful consideration should be given to all the above factors.

## 3.4 Determine optimal location of surveys

Targeted surveys for threatened orchid species should be carried out on sites that are known to, or may, support orchid populations, orchid microhabitats and within potential orchid habitats.

An effective strategy to maximise the likelihood of detecting a particular orchid species is to target search efforts within habitat favoured by that species (Resources Inventory Committee 1998). This approach relies on the habitat preferences of target species being adequately known, which for many threatened species may not be the case. The fewer the number of habitat-association records reported for a species, the more likely it is that any apparent habitat preference will be an artefact of the small sample size. Furthermore, subsequent surveys tend to focus on these apparently preferred habitats, which can further distort the perception of habitat preference. Consequently, investigators should not exclude particular habitat strata from survey designs unless it is well established that these habitat types are consistently less favoured by the target species than other types within the study area. In addition, the presence of all, or any, suitable habitat and associated species may indicate the presence of some ecological conditions that could be associated with the orchid (Dell & Bester 2006).

All vegetation communities considered to be habitat for the target species should be searched, noting variation in vegetation, canopy coverage, under-storey condition and orchid microhabitat indicators. Both open and closed habitat as well as areas of disturbance should be included where habitat limitations are not already known. Table 1 provides broad-scale information of likely habitats for orchids listed in the EPBC Act. These habitat descriptions are broad; therefore, advice should be sought from orchid specialists in the region to narrow the survey area so as to optimise the survey effort and increase the likelihood of detecting the orchid(s).

Where a threatened orchid has been reliably recorded in the vicinity of the survey site, a detailed survey should be conducted to confirm the extent of the population on the site and in adjacent areas.

## 3.5 Establish sampling design and survey effort

Orchids are often found sporadically scattered throughout habitat or found in micro-habitats. Quadrat or transect-based surveys are considered inadequate as they may miss these scattered occurrences. In addition, some orchid species are found naturally in very low numbers/densities and so it is difficult to detect them without significant survey effort. Survey for these species may fail to find them even if they are present unless carried out by people with knowledge of the biology and ecology of the species.

Surveys should be undertaken when the nearest known population of the target orchid is flowering to maximise the likelihood of detecting target orchid plants present on the survey site (J Briggs 2011, pers. comm.,). It is also recommended that surveyors visit other known populations nearby to become familiar with the appearance of the target species and its habitat.

It must be noted that a survey should never be approached with a bias or be carried out in a manner likely to influence the results. Surveys should be carried out in line with the department’s survey guidelines for threatened species (or provide justification why not) considering detectability and its implications. Use of a habitat surrogate or proxy has been suggested as a viable alternative to extensive surveys. However, this technique relies on a well-developed knowledge of the species’ ecology and habitat requirements. Some species are not well-studied or have ongoing knowledge gaps in their habitat requirements or movements. In such cases, use of a habitat proxy may not be considered a robust enough approach and surveys are likely to be required to inform future decisions on the significance of impacts.

### 3.5.1 Survey effort

Survey effort is a measure of the effort expended during a survey and may refer to the number of visits made to a site or the duration of survey visits. In simple terms, effort = time x people.

An important note about allocating effort in ecological surveys is that, in many cases, a trade-off must be made between minimising the chance of false absences and maximising the efficiency of the survey given budgetary or time constraints. Terrestrial orchids are cryptic in that they ‘disappear’ and ‘reappear’ on a site over time, often remaining underground or inconspicuous at a site for long periods of time and only flower for very short periods. Replicated sampling will often be required either to reveal the target species/taxon or adequately justify claims that the taxon is absent or occurs at very low abundance within the study area. Sampling can be replicated in space (different locations at the same time), time (same location at different times), a combination of both (different locations at different times) or with use of several surveyors. Results from a failure-time analysis method (Garrard et al. 2008) indicate that for species with low occupancy, the duration for the survey will need to be significantly longer than for a more common species. Extra resources may be needed to determine a realistic sampling time (Garrard et al. 2008).

### 3.5.2 Stratification

In some circumstances the study area of interest will be small enough to allow a comprehensive search of the entire area within a reasonable period of time. The size of such a searchable area will depend critically on the nature of the target taxa/taxon and the habitat and topography of the study area. For example, searching for highly cryptic species in dense scrub will take far longer than searching for large, conspicuous species in open grassland. If a comprehensive search is feasible then sampling will not be required and the data collected will be representative of the entire area. In many cases, however, the study area will be too large to permit a complete search within a reasonable time frame, and selective searches or sampling procedures will be required (Bibby et al. 1992; Royle & Nichols 2003).

Many study sites will include a variety of distinct habitat types, especially if the area is extensive. Some of these habitats may be unsuitable for occupancy by the targeted taxa/taxon. An effective strategy to maximise the likelihood of detecting a particular taxon is to concentrate search effort within habitat that is favoured by the targeted taxon (Bibby et al. 1992; Resources Inventory Committee 1998a). This will require the study area to be divided up, or stratified, into regions of similar habitat types.

When stratifying a study area, the area is usually partitioned first on biophysical attributes (e.g. landform, geology, elevation, slope, soil type, aspect, water depth), followed by vegetation structure (e.g. forest, woodland, shrubland, sedgelands). Strata can be pre-determined based on landscape features indicative of habitat which can be derived from topographic maps, aerial photographs that reveal habitat types, or existing vegetation maps. Preliminary assessment of the study area prior to commencing the surveys will be useful to check stratification units and further stratify the area if necessary (Bibby et al. 1992; NSW DEC 2004). In other situations, such as the inundation of vast floodplains, there may be little alternative but to implement a form of stratified sampling based on observation of habitat during the course of the survey.

### 3.5.3 Sampling

Temporal sampling is particularly relevant when surveying for orchid species, as populations may fluctuate in abundance, occurrence or detectability over time, especially when these fluctuations are unpredictable, which is the case with many orchid species. Replicated sampling will often be required either to reveal the target species or satisfy the argument that the taxon is either absent or occurs at very low abundance within the study area.

For many plant species there may be no be advantage to increasing the number of times particular locations are surveyed, especially when seasonality is taken into account, as in the case of orchids where the peak time of detectability is the flowering season. This is an important consideration when travel costs and other overheads are associated with repeated visits. In such circumstances the probability that a species is detected will depend on the amount of time spent at the survey location. Therefore, it may be more efficient to increase the amount of time spent at survey locations rather than to increase the number of times a location is surveyed (Brown et al. 2004). This latter point will depend on the species being surveyed at its optimal flowering time. If surveyed just once early or late in the flowering period then plants may be missed.

Surveys over multiple years may be required where a single year’s data are not adequate to detect the species or to address the environmental factors. As many orchids do not emerge or flower every year (that is, species that flower only following fire or are reliant on good winter rainfall) or can only be identified for a brief period when in flower, it can be difficult to assess the impact of proposed developments through one-off impact assessment surveys. If surveys are undertaken outside optimal survey periods, additional species-specific surveys may need to be undertaken at optimal times.

The most reliable way to demonstrate that the surveys were conducted at an appropriate time is to coincide the survey with the flowering time of another known nearby population of the target species. The extent of the flowering within the known population compared to other years will give an indication of how favourable the current season is and thus whether, although surveyed at flowering time, there was still a low possibility of detection due to poor seasonal conditions.

# 4. Minimal survey requirements for terrestrial orchids

Given the cryptic nature of terrestrial orchids and their often rare, scattered appearance in bushland, quadrat-based surveys or meandering searches alone are not considered to be an adequate survey technique. However, a random ‘meander’ survey may be conducted initially during the flowering period to ascertain the presence of the orchid species. This is to cover large areas of potential habitat if the species has not been detected previously at the site. Records are taken using GPS and on-ground markers along transects where the target species is located. A more thorough search should then be undertaken in the vicinity of plants detected using area search and targeted parallel transects.

## 4.1 Area search

The area search is an effective method for detecting many orchid species, regardless of whether the study area is small enough to permit a complete search or whether sampling of a larger site is required. Area searches usually involve searching a plot of predetermined size for a predetermined period of time. The ideal amount of time that is allocated to search plots of a given size will depend on the aim of the search and the habitat type. Each selected area is searched systematically. Area searches should also take into consideration optimal habitat for the targeted species. The larger the area of habitat that will be impacted, the larger the survey effort needed to ensure a representative sample is gathered. Larger surveys generally equate to higher cost. In this case it may be appropriate to assume that a species is present rather than survey for it.

Longer times increase the number of species detected at each point location, and increase the probability of detecting more cryptic species. Free movement through an area allows the investigator to explore more thoroughly any indicative signs or favoured habitat features than other more structured searches such as transects and point counts. Furthermore, the shape of the sample area can usually be tailored easily to target preferred habitat compared with transect methods.

### 4.1.1 Systematic targeted search parallel transects

Orchid plants can be difficult to see from any distance away particularly by inexperienced searchers. Individual observers should systematically traverse the survey site in parallel transects five to 10 metres apart. Transect separation will depend on the density of vegetation and the size of the target species. Experienced searchers will be able to identify microhabitats more likely to contain the orchid. When some orchids are found, more may often be discovered nearby. However, some orchids occur as scattered individuals or discrete clumps, sometimes separated by large distances. Sometimes a small number is all that is present in an area.

Once the species is detected, or there are known areas where the species has previously occurred, targeted surveys should be conducted along parallel line transects approximately five to 10 metres apart, depending on the visibility of the orchid and the density of vegetation (J Briggs 2011, pers. comm.,). Searches are conducted on foot and are focused between two-and-a-half and five metres either side of each transect walked (it is not easy to detect most orchid species more than five metres away). In some cases, recognition of the orchid requires the observer to be virtually on top of the plants. Distances between transects greater than 10 metres apart often will fail to detect plants.

In potential habitat for the species, transects should be walked at six metre intervals, searching within three metres on either side. All suitable native vegetation within 500 metres of known and historical populations should be surveyed.

Transect surveys usually involve recording the orchid while travelling a pre-determined path between two fixed points of known distance apart. Alternatively, transects may be travelled for a fixed period of time without regard for distance. Transects are typically conducted along a straight path, but can follow roads, rivers, coastlines or contours. Transect lengths may be variable and dictated by the dimensions of patches of habitat favoured by the target species/taxon. Transects should be conducted at a speed appropriate for the habitat and purpose of the study. Generally, the number of detected species will increase with slower travel speed because there will be more time to detect less conspicuous species. Consequently, the optimal travel speed will be a trade-off between covering as much terrain as possible and detecting individuals of the target species. Increasing the time spent searching per survey is more likely to detect a target plant species (Garrard et al. 2008).

### 4.1.2 Minimal survey requirements for epiphytic and/or lithophytic orchid species

The minimal survey methodology for epiphytic and lithophytic species includes the random meander and systematic transects techniques. The random meander (Cropper 1993) covers areas that appear likely to have rare species, based on habitat and the judgement of the investigator.This technique involves traversing the entire survey site and recording any species. This survey methodology, prescribed by Cropper (1993), is considered appropriate for this type of work.

# 5. Document survey methods and results

Survey methods and level of search effort vary widely between studies. For this reason it is essential that survey reports include detailed information on the methods used and the level of search effort adopted. This should include who was involved, what work was carried out and where, when the survey was conducted (both date and time of day) and how the survey was conducted, as well as the climatic conditions at the time. The survey report should follow the standard aims, methods, results and discussion format common to all scientific research. Without this information it is difficult to interpret the survey results and impossible to replicate the study for comparative purposes (Resources Inventory Committee 1998).

It is useful to record the GPS location of all sampling units and the report must provide maps of the study area as well as a site description. A detailed description of the habitat should also be provided. Information on the condition of the habitat at the time of the survey should be included as this may be useful in later analysis (for example, determining whether species presence/absence is due to temporary factors such as drought) (NSW DEC 2004).

Documentation of all orchid species recorded is essential as it can provide a measure of survey effort and effectiveness. Species that are found need to be identified to species level, not just to genus. There have been cases where the presence of a threatened species was not recognised because of a failure to complete its identification to a species level. Documentation of observers and their skills is also important.

In order to allow a better understanding and interpretation of survey effort, findings should be supported wherever possible by information such as:

* site photos showing the location of transect paths and equipment placement, such as survey grid
* photos/records of habitat present including structure and diversity—these photographs should be taken and shown to an orchid expert for confirmation
* summary tables with measurements, diagnostic observations and photos of orchids (and/or if a sufficient number of individuals are found)
* maps showing the location of planned infrastructure over the top of aerial photographs (ideal) or other geographical layers that represent the habitats present in the area
* a description of how detectability has been addressed.
* In addition, survey data should be made available to Commonwealth (SPRAT@environment.gov.au) state and territory environment departments for inclusion in orchid databases where appropriate.

Reports should also carry some justification of the survey design, whether it is opportunistic, systematic or focused on certain likely habitats. This would include information on the habitat types present and the survey effort given to each. For species that might be present at very low abundance it is important to describe the likelihood of presence based on habitat descriptions made as part of the survey. Explanations on the timing of the survey, suitability of the weather and tabulated duration of transects and recordings should also be given.

The report should detail the location and size of each population found of target orchid species. GPS coordinates must be recorded for centroids of small populations and the boundaries of each larger population must be mapped. The report should also note if any suspected or known non-flowering individuals were observed within confirmed populations.

The significance of any detected populations must be discussed in relation to the total known population and other regional populations. The potential size of detected populations in good flowering seasons should be discussed based on current and previously known sizes of other known populations of the target species.

# 6. Checklist

## Survey design

□ Have I sought expert advice to optimise the survey effort and detecting the species?

□ Have I considered the detection probability of the species and the factors that may influence the detection of the species during any survey? Have I recorded these factors?

□ What technique have I used to survey for the orchids? If different from these guidelines, have I justified the choice of the survey technique?

□ Have I noted any constraints in the survey design?

□ Have I included a description of consultation with key stakeholders?

□ Have I described the data sources I have used and explained how data was handled?

□ Have I noted the sampling dates, times and weather conditions?

□ Have I described the survey techniques utilised and the intensity of sampling in each strata?

□ Have I described the data-analysis methods, including any criteria used to categorise areas of high biodiversity?

□ Have I considered the national, regional, district and site context of the most effective survey approach?

## Survey considerations

Appropriate personnel to conduct surveys

□ Are the surveys being conducted by appropriately experienced surveyors with suitable experience and qualifications for orchids?

□ Have I included the details of the surveyors in the report?

□ Is all field equipment (such as GPS, camera) in working order?

□ Are all legislative regulations and permits are in place?

□ If I require orchid identification who have I contacted and what information did I supply them?

## Desktop review considerations

□ Have I prepared a map of the survey area showing its boundaries and type, location and broad condition of the native vegetation and important orchid habitat features?

□ Have I considered the regional context—habitat type, frequency and function?

 □ Is the habitat rare or common?

 □ Is the habitat likely to be permanent or ephemeral?

□ Is the habitat likely to be habitat critical to the survival of the species?

□ Is the habitat likely to comprise an important population of a species of orchid?

□ Have I consulted with relevant information sources to generate a list of threatened orchids that are known to, likely to, or may, occur in the survey area that are identified and documented?

□ Do I need to consult with federal, state and local government, orchid societies, orchid experts to ensure the list is accurate?

□ If the data is inadequate have I considered whether to carry out the survey or assume presence. Have I justified this decision?

□ Have I checked the current taxonomic listing status and name?

## Optimal timing for surveys

□ Have I determined the optimal flowering period for each ‘target’ species following consultation with published and unpublished reliable information sources?

□ Have I considered all the factors that can influence the flowering of the species within the known optimal flowering period and put aside necessary lead time to account for these factors?

□ Have I conducted several surveys to locate flowering periods over the recommended survey period?

□ Have I noted other considerations when determining the optimal survey period?

□ Have I put aside sufficient lead-in time to account for optimal detectability in the survey methodology?

□ If I am conducting the survey outside the optimal survey period what options have I considered and have I justified the methodology?

## Optimal location for surveys

□ Have I described the location and extent of threatened species, populations, ecological communities and their habitat recorded in the study area?

□ Have I described the vegetation communities such as structure, spatial distribution, conditions, integrity, disturbance regime, hydrology?

□ If the study requires stratification, how have I partitioned the study area?

□ Have I described the precise location and layout of the stratification units, quadrats, traverses and sampling sites, vegetation types, and relevant species distribution (presented as grid references and maps)?

□ Have I provided a description of each stratification unit, the vegetation types in terms of structure and floristics, and a list of the dominant plant species in each growth stratum (trees, under-storey, shrubs and groundcover)?

□ Have I included a description of the area’s disturbance (prior clearing/logging, fire regime, flooding), a description of the weeds present and their density, and comments on the suitability of the area as habitat for species, populations and ecological communities of conservation significance?

□ Have I surveyed all vegetation communities/microhabitats that are considered habitat for the threatened orchid species?

## Survey report considerations

□ Have I provided a survey report which includes the following: aims, methods, results, discussion?

□ Have I included information on the survey sheet including:

* a description of the proposal
* site location and description
* the regional context, location, geology, soils, landforms, climate
* disturbance history and other relevant information relating to stratification requirements
* any constraints or limitations on the study
* how the report is structured
* the study’s aim and objectives
* dates of survey
* details about the survey personnel qualifications and experience
* references (e.g. map and/or GPS; altitude, slope, aspect)
* habitat description (plant litter, rock, fallen logs, vegetation type, fire history, land use, evidence of weeds/feral animals; soil type, topography, vegetation structure, microhabitats, flora species recorded (in particular targeted species))
* a list of all plant and animal species recorded
* a list of all threatened species, populations, ecological communities recorded or known or likely to occur in the locality
* summaries of the data, including which species were found at which sites, strata vegetation or habitat types, and by which methods they were located
* maps of survey method locations
* any general or unusual observations
* maps of environmental features, vegetation types and habitat types
* results of any modelling or statistical analysis of data
* maps of any areas of high biodiversity or other areas of special significance
* photos of the study area and subject site
* raw data (copies of original data sheets are acceptable) should be included in an appendix
* publications used in the report (cited within the report with author, year of publication, title of publication, journal volume and pages and/or name of publisher).

# 7. Useful References

Backhouse, G N & Jeanes, J A 1995, *The Orchids of Victoria*, The Miegunyah Press, Melbourne.

Bates, R J & Weber, J Z 1990, *Orchids of South Australia*., Flora and Fauna of South Australia Handbooks Committee, Adelaide. Bishop, A 1996, *Field Guide to Orchids of New South Wales and Victoria*, University of New South Wales Press, Sydney.

Brown, J, Harris, S & Timmins, S M 2004, ‘Estimating the maximum interval between repeat surveys’, *Austral Ecology*, vol. 29, pp. 631–6.

Brown, A P, Dundas, P, Dixon, K W & Hopper, S D 2008, *Orchids of Western Australia*, University of Western Australia Press, Perth.

Brown, A P, Thomson-Dans, C & Marchant, N 1998, *Western Australia’s threatened flora*, Department of Conservation and Land Management, Perth.

Council of Heads of Australasian Herbaria 2013, Council of Heads of Australasian Herbaria, viewed 15 December 2013, avh.chah.org.au.

Cropper, S C 1993, *Management of Endangered Plants*, CSIRO, Melbourne.

Cunningham, R B & Lindenmayer, D B 2005, ‘Modelling count data of rare species: some statistical issues’, *Ecology*, vol. 85, pp. 1135–42.

Cypher, E A 2002, *General Rare Plant Survey Guidelines*, California State University, Bakersfield.

Davies, R J P 1986, *Threatened Plant Species of the Mt Lofty Ranges and Kangaroo Island Regions of South Australia*, Conservation Council of South Australia, Adelaide.

Davies, R J P 1992, *Threatened Plants of the Murray Mallee, Mt Lofty Range and Kangaroo Island Region of South Australia*, Conservation Council of South Australia, Adelaide.

Department of Environment and Conservation (New South Wales) 2004, ‘Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities’ (Working draft), Department of Environment and Conservation, Sydney.

Department of Parks and Wildlife (Western Australia) 2013, Department of Parks and Wildlife, viewed 15 December 2013, http://www.dec.wa.gov.au/management-and-protection/threatened-species.

Dell, M D & Bester, L R 2006, *Management and status of Leafy Greenhood* (Pterostylis cucullata) *populations within Mornington Peninsula Shire*, report to Mornington Peninsula Shire Council, Universal Ecology Services, Melbourne.

Garrard, G E, Bekessy, S A, McCarthy, M A & Wintle, B A 2008, ‘When have we looked hard enough? A novel method for setting minimum survey effort protocols for flora surveys’, *Austral Ecology*, vol. 33, pp. 986–98.

Garrard, G E & Wintle, B A 2011, Minimum survey effort requirements for impact assessments under the EPBC Act 1999; a review of methods for estimating and managing detectability in biological surveys, a report to the Australian Department of Sustainability, Environment, Water, Populations and Communities, Canberra.

Harden, G J (ed.) 1993, *Flora of New South Wales, Volume Four*, UNSW Press, Sydney.

Hoffman, N & Brown, A P 2011, *Orchids of Southwest Australia*, 3rd edn, published by author, Perth.

Jones, D L 2006, *A complete guide to Native Orchids of Australia, including the island Territories*, New Holland Publishers (Australia), Sydney.

Jones, D L, Wapstra, H, Tonelli, P & Harris, S 1999, *The Orchids of Tasmania*, Melbourne University Press.

MacKenzie, D I & Kendall, W L 2002, ‘How should detection probability be incorporated into estimates of relative abundance?’, *Ecology*, vol. 83, pp. 2387–93.

MacKenzie, D I, Nichols, J D, Sutton, N, Kawanishi, K & Bailey, L L 2005, ‘Improving inferences in population studies of rare species that are detected imperfectly’, *Ecology*, vol. 86, pp. 1101–13.

MacKenzie, D I, Nichols, J D, Lachman, G B, Droege, S, Royle, J A & Langtimm, C A 2002, ‘Estimating site occupancy rates when detection probabilities are less than one’, *Ecology*, vol. 83, pp. 2248–55.

Resources Inventory Committee 1998, *Species Inventory Fundamentals: Standards for Components of British Columbia’s Biodiversity No. 1*, report prepared by Resources Inventory Branch, Ministry of Environment, Lands and Parks, Vancouver.

Royle, J A & Nichols, J D 2003, ‘Estimating abundance from repeated presence-absence data or point counts’, *Ecology*, vol. 84, pp. 777–90.

*South Australia’s Native Orchids* 2011, DVD-ROM, Native Orchid Society of South Australia, Adelaide.

State Herbarium of South Australia, *Adelaide Herbarium Database*, data provided to the Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra, 2009.

Thompson, S K & Seber, G A F 1994, ‘Detectability in conventional and adaptive sampling’, *Biometrics*, vol. 50, pp. 712–24.

Western Australian Herbarium 1998–, FloraBase—the Western Australian Flora, Department of Parks and Wildlife, Perth, viewed 16 December 2013, http://florabase.dpaw.wa.gov.au/.

Wapstra, M, Roberts, N, Wapstra, H & Wapstra, A 2012, *Flowering Times of Tasmanian Orchids: A Practical Guide for Field Botanists*, self published, Hobart.

# Attachment 1: orchid detectability information

| **Species name** | EPBC threatened status | Distribution | Landscape-scale habitat  | Peak detectability  | Similar species |
| --- | --- | --- | --- | --- | --- |
| ***Acianthus ledwardii* R.Br.** (Ledward’s mosquito orchid) | Extinct | Queensland | South-east Queensland  | Peak flowering period: not specified | Similar species: not specified |
| *Acriopsis emarginata* (*javanica*) D.L.Jones & M.A.Clem. (pale chandelier orchid) | Vulnerable | Queensland | Rainforests and swamps growing on trees  | Peak flowering period: July to October  | Similar species: not specified |
| ***Arachnorchis actensis* D.L.Jones & M.A.Clem. (Canberra spider orchid)**  | Critically endangered | ACT | Transitional vegetation zones between open grassy woodland and dry sclerophyll forest. Associated with *Allocasuarina verticillata* at some sites  | Vegetative growth: late autumn or early winter following good rainsFlower bud production: late winter or early springPeak flowering period: late September to mid October | Similar species: *Caladenia concinna* |
| ***Bulbophyllum globuliforme* Nicholls (miniature moss-orchid, hoop pine orchid)**  | Vulnerable | Queensland, NSW | *B. globuliforme* is host specific, and will only grow on upper branches of the Hoop Pine (*Araucaria cunninghamii*) | Peak flowering period: September to November but also recorded for May and August  | Similar species: not specified |
| ***Bulbophyllum gracillimum* (Rolfe) wispy umbrella orchid)** | Vulnerable | Queensland | Notophyll vine forests growing low on rainforest trees usually close to creeks, in shaded, sheltered and constantly humid situations  | Peak flowering period: flowering spasmodic, from August through to March with the main flowering period being November to February  | Similar species: not specified |
| ***Bulbophyllum longiflorum* Thouars** (pale umbrella orchid) | Vulnerable | Queensland | Notophyll vine forests in wet tropical rainforests. It usually grows on the trunks of rainforest trees, but has also been seen growing on rocks | Peak flowering period: January to March  | Similar species: unlikely to be confused with any other Australian species |
| ***Caladenia amoena* D.L.Jones** (charming spider orchid) | Endangered | Victoria | Ridge tops and sheltered slopes in dry sclerophyll forest  | Peak flowering period: late August to late September  | Similar species: not specified |
| ***Caladenia anthracina* D.L.Jones** (black-tipped spider orchid) | Critically endangered | Tasmania | Grassy eucalypt woodland with *Acacia dealbata* and *Pteridium esculentum* on well-drained sandy soil; areas of low rainfall in the northern midlands | Peak flowering period: late September to early November. A strong peak in flowering in latter half of October  | Similar species: not specified |
| ***Caladenia arenaria* Fitzg. (sand-hill spider-orchid)**  | Endangered | NSW | *Callitris*-covered sandy ridges and dunes, especially in the vicinity of watercourses | Vegetative growth: autumn to early winterPeak flowering period: late August to early OctoberIt flowers best after fires or on disturbed corridors throughout mallee heath | Similar species: *Caladenia colorata*. Part of the *C. patersonii* complex. Hybrids with *C. cardiochila* have been observed |
| ***Caladenia argocalla* D.L.Jones** (white-beauty spider-orchid) | Endangered | SA | Open grassy herbland under light, mixed *Eucalypt* and *Callitris* woodland or forest | Vegetative growth/leaf production: April to MayFlower-bud formation: mid-August to mid-SeptemberPeak flowering period: mid-September, October and early November Flowers profusely without fires  | Similar species: albino flowers of the pink-lipped spider-orchid (*Caladenia behrii*); and winter spider-orchid (*C. brumalis*) |
| ***Caladenia atroclavia* D.L.Jones & M.A.Clem.** (black-clubbed spider-orchid) | Endangered | Queensland | Open forest on heavy loams derived from granite  | Peak flowering period: October  | Similar species: not specified |
| ***Caladenia audasii* R.S.Rogers** (McIvor spider-orchid) | Endangered | Victoria, SA | Variety of woodland and open forest habitats  | Peak flowering period: mid-September to mid-October  | Similar species: *Caladenia leptochila*  |
| ***Caladenia barbarella* Hopper & A.P.Br.** (small dragon orchid) | Endangered | WA | Margins of seasonal creek lines and damp lands absent in areas of dense heath or tall scrub of *Melaleuca uncinata* or *Acacia* spp. or more rarely on rocky ledges | Peak flowering period: late August to mid September Poor flowering occurring in dry yearsDormant between November and April  | Similar species: *Caladenia barorossa*, *C. mesocera* and *C. drakeoides*. However, *C. barbarella* is geographically isolated from these species |
| ***Caladenia behrii* Schltdl. (pink-lipped spider-orchid)**  | Endangered | SA | *Eucalyptus* woodlands and forests | Vegetative growth/leaf production: April to AugustFlower-bud formation: August to SeptemberPeak flowering period: late August to October Occurs as small, scattered populations  | Similar species: *Caladenia colorata, C. fulva, C. rigida, C. woolcockiorum*  |
| ***Caladenia brachyscapa* G.W.Carr** (short spider-orchid) | Extinct | Victoria (extinct) Tasmania (extant) | Heathland and sparse coastal scrub on well-drained sandy loam | Peak flowering period: in mainland Australia is September to November; in Tasmania, late October to early November  | Similar species: not specified |
| ***Caladenia brumalis* D.L.Jones** (winter spider-orchid) | Vulnerable | SA | Among grass and shrubs in open forest or sedgeland, light woodland and mallee vegetation  | Peak flowering period: late June to September  | Similar species: *Caladenia argocalla*, *C*. sp. South East, *C. colorata*, *C. fragrantisima*, *C. intuta*. Forms hybrids with *Caladenia latifolia*, *C. macroclavia* and *C. conferta*  |
| ***Caladenia bryceana* R.S.Rogers subsp. *bryceana***(dwarf spider-orchid) | Endangered | WA | Open wandoo woodland to mallee shrubland, often adjacent to watercourses  | Peak flowering period: mid August to early October Dormant between late October and late April | Similar species: *Caladenia bryceana* subsp. *cracens* and other members of the *Caladenia roei* complex. Note that *Caladenia bryceana* subsp. *cracens* is geographically isolated from the subspecies *cracens* and occurs in habitat where most other related species are absent |
| ***Caladenia bryceana* subsp. *cracens* Hopper & A.P.Br.** (northern dwarf spider-orchid) | Vulnerable | WA | Low heath in shallow soil pockets on coastal limestone hills; winter-moist flats or in swales beneath thickets of broom bush (*Melaleuca uncinata*). Northern populations are found in tall open shrubland will mallee on deep red sand | Peak flowering period: mid August to early SeptemberDormant between late October and late April | Similar species: *Caladenia bryceana* subsp*. bryceana*, members of the *Caladenia roei* complex. Note that *Caladenia bryceana* subsp. *cracens* is geographically isolated from these species and occurs in different habitat. |
| ***Caladenia busselliana* Hopper & A.P.Br.** (Bussell’s spider-orchid) | Endangered | WA | In marri (*Eucalyptus calophylla*) and jarrah (*E. marginata*) woodland often on the margins of winter-wet swamps | Peak flowering period: mid September late to October Dormant between late November to late AprilFlowering is stimulated by summer fires with fewer flowering plant found other years  | Similar species: Dunsborough Spider-orchid, *Caladenia paludosa* (swamp spider-orchid), *Caladenia huegelii* group |
| ***Caladenia caesarea* subsp. *maritima* Hopper & A.P.Br.** (cape spider-orchid) | Endangered | WA | In shallow soil on coastal granite outcrops  | Peak flowering period: August to early September Dormant between late October and late AprilThe flowers are strongly metallic scented. Plants flower most years  | Similar species: *Caladenia luteola*. Differs from the typical subspecies in having an earlier flowering period, smaller flowers and a coastal distribution |
| ***Caladenia calcicola* G.W.Carr** (limestone spider-orchid) | Vulnerable | Victoria, SA | In open forest and woodland on low ridges overlaying limestone | Peak flowering period: mid September to early November with an early to mid-October peak | Similar species: *Caladenia hastata, C reticulata, C. valida, C. stellata, C. lowanensis, C. cruciformis*. Frequent hybridation occurs |
| ***Caladenia campbellii* D.L.Jones** (thick-stem caladenia) | Critically endangered | Tasmania | Slopes and ridges on rolling hills among shrubs in stunted coastal and near-coastal scrub | Peak flowering period: October and November (particularly around 1 to 15 November) | Similar species: *Caladenia alata* |
| ***Caladenia carnea*** var. *subulata*Nicholls (striped pink-fingers) | Endangered | Victoria | In damper forest, woodland and scrubs | Peak flowering period: October to November Known to occur after site disturbance | Similar species: *Caladenia coactilis, C. fuscata, C. ornata, C. prolata, C. vulgaris*  |
| ***Caladenia caudata* Nicholls** (tailed spider-orchid) | Vulnerable | Tasmania | Heathy eucalypt forest and woodland, often with sheoaks, and heathland on sandy and loamy soils; often found on sunny north-facing sites | Peak flowering period: plants on the east coast have been recorded flowering as early as August but with the main season being September. In the northern and north- western part of the state the flowering period is October to November This species responds with prolific flowering the first season after a hot fire, diminishing to few or none in subsequent seasons Can be hard to detect in its often dried-off grassy habitat  | Similar species: not specified |
| ***Caladenia christineae* Hopper & A.P.Br.** (Christine’s spider orchid) | Vulnerable | WA | Margins of winter-wet flats and freshwater lakes, often under *Melaleuca* species or mixed jarrah/marri forest  | Peak flowering period: mid September to early November Dormant between December to late AprilSummer fires stimulate flowering, and many populations have been found in flower only in the year after a summer fire  | Similar species: *Caladenia harringtoniae*, *C. longicauda* subsp. *redacta*. Occasionally hybridises with *C. harringtoniae* |
| ***Caladenia colorata* D.L.Jones** (coloured spider-orchid) | Endangered | SA | Mostly in *Callitris* or blue gum woodlands, sandy, fertile soils but also in rock outcrops and in mallee/broombush associations  | Vegetative growth: late May to early JunePeak flowering period: August to early October  | Similar species: *Caladenia behrii, C. brumalis, C. concolor, C. fulva, C. rosella, C. woolcockiorum*  |
| ***Caladenia concolor* Fitzg.** (crimson spider-orchid) | Vulnerable | NSW, SA, Victoria | Variety of woodland and open forest habitats (usually within Box-Ironbark ecosystems) often among low heathy shrubs | Peak flowering period: September and October  | Similar species: *Caladenia rosella, C. oenochila*  |
| ***Caladenia conferta* D.L.Jones** (coast spider-orchid) | Endangered | SA | Mallee woodlands or broombush on rock outcrops, favouring bare, open sites | Peak flowering period: July to SeptemberOccurs in areas of reliable winter rainfall | Similar species: *Caladenia toxochila*. Forms sporadic hybrids with *C. brumalis*. |
| ***Caladenia cremna* (D.L.Jones) G.N.Backh.** (Don’s spider orchid) | Critically endangered | Victoria | Heathy dry forest  | Peak flowering period: not specified | Similar species: not specified |
| ***Caladenia dienema* D.L.Jones** (windswept spider-orchid) | Endangered | Tasmania | Windswept low heathland, growing among dwarfed shrubs and sedges on moist to well-drained sandy and clay loams; usually associated with rocky outcrops but may also extend into shrubby forests, usually dominated by *Eucalyptus obliqua* | Peak flowering period: late October to early November  | Similar species: not specified |
| ***Caladenia dorrienii* Domin** (Cossack spider-orchid)Syn. *Calonema dorrienii* (Domin) Szlach. | Endangered | WA | Open wandoo (*Eucalyptus* wandoo)/jarrah (*E. marginata*)/*E. rudis* woodland | Peak flowering period: mid September to early November Dormant between December and late April | Similar species: *Caladenia vulgata* |
| ***Caladenia drakeoides* Hopper & A.P.Br.** (hinged dragon orchid) | Endangered | WA | Margins of salt lakes and flats beneath scrub  | Peak flowering period: late August to early October Dormant between late October and late April  | Similar species: *Caladenia barbarosiae, C. mesocera, C. barbarella**Caladenia drakeoides* occasionally co-occurs with *C. mesocera* |
| ***Caladenia elegans* Hopper & A.P.Br.** (elegant spider-orchid) | Endangered | WA | Grows among scattered *Acacia*, *Melaleuca* and *Grevillea* speciesin the winter-wet depressions. Some populations are found on slopes and hillsides | Peak flowering period: late July to mid AugustDormant between October and late April  | Similar species: *Caladenia vulgata*. *Caladenia elegans* often co-occurs and hybridises with *Caladenia vulgata* in some areas forming hybrid swarms |
| ***Caladenia excelsa* Hopper & A.P.Br.** (giant spider-orchid) | Endangered | WA | In sandy soils in banksia, jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) woodlands  | Peak flowering period: late September to early November Dormant between December and late April | Similar species: *Caladenia longicauda* |
| ***Caladenia formosa* G.W.Carr** (elegant spider-orchid) | Vulnerable | Victoria, SA | Diverse range of habitats including river red-gum flats, limestone hillocks and sandy heath-land. *Eucalyptus leucoxylon* (yellow gum) and *E. microcarpa* (grey box) with a low, somewhat open shrubby under-storey  | Peak flowering period: September and October  | Similar species: *Caladenia concolor*, *C. colorata*. Forms hybrids with other members of the *C. patersonii* complex  |
| ***Caladenia fulva* G.W.Carr** (tawny spider-orchid) | Endangered | Victoria, SA | Woodlands dominated by *Eucalyptus leucoxylon* sens. lat. with open under-storey  | Peak flowering period: September to early October  | Similar species: can be confused with *Caladenia behrii* and *C. formosa*. Member of the *C. patersonii* complex  |
| ***Caladenia gladiolata* R.S.Rogers (bayonet spider-orchid)**  | Endangered | SA | Woodland, grassland and grassy, open forest  | Vegetative growth: May to JuneFlower-bud formation: July to SeptemberPeak flowering period: late August to early November  | Similar species: *Caladenia toxochila* (bow-lip spider-orchid); *C. longiclavata* (clubbed spider-orchid). Forms hybrids with the star spider-orchid (*Caladenia saxatilis*), the sand spider-orchid (*C. flindersica*), the greencomb spider-orchid (*C. tensa*), and the mount remarkable spider-orchid (*C. woolcockiorum*). This occurs particularly following disturbance  |
| ***Caladenia harringtoniae* Hopper & A.P.Br.** (Harrington’s spider-orchid) | Vulnerable | WA | Paperbark (*Melaleuca* spp.) and flooded gum (*Eucalyptus rudis*) swamps and flats and along creek lines in jarrah (*Eucalyptus margninata*) and karri (*Eucalyptus diversicolor*) forest  | Peak flowering period: late September to early November Dormant between December and late AprilSummer fires often stimulate flowering  | Similar species: *Caladenia startiorum, C. winfieldii; C. christineae*Occasionally hydridises with *C. christineae* |
| ***Caladenia hastata* (Nicholls) Rupp** (Melblom’s spider-orchid)  | Endangered | Victoria, SA | Dense coastal heathland and heathy woodland on flat, seasonally waterlogged sites | Peak flowering period: mid-October to late November Summer fires promoting flowering for several seasons | Similar species: not specified |
| ***Caladenia hoffmanii* Hopper & A.P.Br.** (Hoffman’s spider-orchid) | Endangered | WA | On the tops and slopes of rocky hills growing in woodland and heath communities. Populations also found in winter-wet depressions | Peak flowering period: mid August mid September Dormant between late October and late April | Similar species: *Caladenia graniticola*. Note the two species are geographically isolated |
| ***Caladenia huegelii* Rchb.f.** (king spider-orchid) | Endangered | WA | Mixed banksia/jarrah woodlands  | Peak flowering period: mid September to October Dormant between late November and late April | Similar species: *Caladenia paludosa, C. arenicola, C. thinicola, C. georgei* |
| ***Caladenia insularis* G.W.Carr** (French Island spider-orchid) | Vulnerable | Victoria | Dense wet heathland or heathy woodland  | Peak flowering period: September and October  | Similar species: not specified |
| ***Caladenia intuta* (D.L.Jones) R.J.Bates** (ghost spider-orchid) | Critically endangered | SA | Mallee Box (*Eucalyptus porosa*)—drooping sheoak (*Allocasuarina verticillata*) woodland | Vegetative growth: July to AugustFlower-bud formation: early to late AugustPeak flowering period: late August to mid September  | Similar species: *Caladenia brumalis, C. rigida*  |
| ***Caladenia lindleyana* (Rchb.f.) M.A.Clem. & D.L.Jones** (Lindley’s spider-orchid) | Critically endangered | Tasmania | Lowland open eucalypt forest and woodland. The species' potential habitat is poorly understood | Peak flowering period: form mid October to early November in the northern midlands  | Similar species: *Caladenia patersonii* |
| ***Caladenia lodgean* (Lodge’s spider-orchid)** | Critically endangered | Western Australia | Seasonally moist to wet clay on the margins of rock outcrops in low scrub; and seasonally wet sand on the margins of ephemeral wetlands in open forest | Peak flowering period: mid September to October (Collie area) and late October to early December (Augusta area)  | Similar species: not specified |
| ***Caladenia lowanensis* G.W.Carr** (Wimmera spider-orchid) | Endangered | Victoria, SA | Woodlands dominated by *Eucalyptus leucoxylon* sens. lat. and *Callitris gracilis* | Peak flowering period: September and October  | Similar species: not specified |
| ***Caladenia macroclavia* D.L.Jones** (large-club spider-orchid) | Endangered | SA | Mallee-broombrush woodland  | Vegetative growth: May to JuneFlower-bud formation: July to SeptemberPeak flowering period: late August to early November Usually present where other orchids are numerous | Similar species: *Caladenia dilatata*, *C. stricta* and *C. verrucosa*; hybrids *with C. stricta* and *C. vurrucosa*. Hybrids rarely seen with *C. brumalis* (winter spider-orchid) and *C. fragrantissima* (scented spider-orchid) |
| ***Caladenia melanema* Hopper & A.P.Br.** (ballerina orchid) | Critically endangered | WA | Swamp mallet (*Eucalyptus spathulata*), and *Melaleuca* scrub on rises above salt lakes and flats | Peak flowering period: August to mid September Dormant between October and late April | Similar species: *Caladenia dimidia, C. vulgata*  |
| ***Caladenia orientalis (*G.W.Carr) Hopper & A.P.Br.** (cream spider-orchid) | Endangered | Victoria | Coastal heathland and heathy woodland  | Peak flowering period: one or two flowers between September–October and early November–December | Similar species: not specified |
| ***Caladenia ornata* (Nicholls) D.L.Jones** (ornate pink fingers) | Vulnerable | Victoria, SA | Seasonally inundated heathlands, woodlands and heathy woodlands | Peak flowering period: mainly in October sometimes as late as December Occurs as sparse individuals and small clumps | Similar species: *Caladenia carnea, C. coactilis, C. fuscata, C. vulgaris*  |
| ***Caladenia ovata* R.S.Rogers** (Kangaroo Island spider-orchid) | Vulnerable | SA | Brown stringybark (*Eucalyptus baxteri*) tall shrubland and tall open-shrubland in a medium-density under-storey  | Peak flowering period: late September and in October Seldom flowers except after bushfires  | Similar species: narrow lipped spider-orchid (*Caladenia leptochila*); hybridisation between narrow lipped spider-orchid and the Kangaroo Island spider-orchid  |
| ***Caladenia pallida* Lindl.** (rosy spider-orchid) | Critically endangered | Tasmania | Open eucalypt forest in lowland areas with annual rainfall less than 1000 mm; the species' historical distribution may have included a more diverse range of habitats | Peak flowering period: October with peak in November  | Similar species: Caladenia patersonii? |
| ***Caladenia procera* Hopper & A.P.Br.** (Carbunup king spider orchid) | Critically endangered | WA | Jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*) and peppermint (*Agonis flexuosa*) woodland amongst low-dense shrubs  | Peak flowering period: mid September to late October  | Similar species: *Caladenia pectinata, Caladenia decora*Known to hybridise with forest mantis orchid (*Caladenia attingens*) |
| ***Caladenia pumila* (dwarf spider-orchid)** | Critically endangered | Victoria | Endemic to the Geelong area  | Peak flowering period: not specified | Similar species: not specified |
| ***Caladenia richardsiorum* D.L.Jones** (little dip spider-orchid) | Endangered | SA | Range of habitats from exposed limestone cliffs to sheltered coastal mallee vegetation, in closed forests and low coastal scrub  | Vegetative growth: June to AugustFlower-bud formation: AugustPeak flowering period: Late September to early November  | Similar species: *Caladenia valida, C. hastata, C. reticulata*  |
| ***Caladenia rigida* R.S.Rogers (stiff white spider-orchid)**  | Endangered | SA | In woodland, mostly on ridges and upper slopes, in open places amid sedges | Vegetative growth: June to JulyFlower-bud formation: early to late AugustPeak flowering period: late August to October This species seems to depend on appropriate fire regimes to keep its habitat open and is known to flower profusely after fire, but does not require fire to flower  | Similar species: *Caladenia intuta* (ghost spider-orchid); *C. behnii* (pink-lipped spider-orchid) may form hybrids with (*C. behrii*) and the veined spider-orchid (*C. reticulata*) |
| ***Caladenia robinsonii* G.W.Carr** (Frankston spider-orchid) | Endangered | Victoria | *Eucalyptus viminalis* ssp. *pryoriana* woodland with a grassy under-storey dominated by *Themeda triandra*  | Peak flowering period: mainly in October  | Similar species: not specified |
| ***Caladenia rosella* G.W.Carr** (rosella spider-orchid) | Endangered | Victoria | Box and ironbark forests, grassy dry forest and heathy dry forest  | Peak flowering period: August and SeptemberFlowering may be enhanced by fire | Similar species: crimson spider-orchid (*Caladenia concolor*), elegant spider-orchid (*C. formosa*) |
| ***Caladenia saggicola* D.L.Jones** (sagg spider-orchid) | Critically endangered | Tasmania | *Eucalyptus viminali*s woodland with a ground layer dominated by *Lomandra longifolia* on well-drained, grey sandy loams; also *Allocasuarina verticillata* and *Eucalyptus viminalis* woodland on yellow to grey sandy loams over sandstone | Peak flowering period: mid September and mid October This species responds well to disturbance (rabbits and horses) and is likely to respond strongly to fire  | Similar species: *Caladenia venusta* (does not occur in Tasmania), *C. patersonii* |
| ***Caladenia* sp. Kilsyth South (G.S.Lorimer 1253) Vic. Herbarium** (Kilsyth South spider-orchid) | Critically endangered | Victoria | *Eucalyptus radiata*–*Eucalyptus cephalocarpa* grassy open forest  | Peak flowering period: September and October  | Similar species: *Caladenia venusta* |
| ***Caladenia sylvicola* D.L.Jones** (forest fingers) | Critically endangered | Tasmania | Heathy *Eucalyptus tenuiramis* forest on a highly isolated hillside and also in open damp *Eucalyptus obliqu*a forest on a moist, south-facing slope, both with well-drained gravelly loam overlying mudstone; elevation range 160 m to 240 m | Peak flowering period: a few days either side of the 1 November  | Similar species: not specified |
| ***Caladenia tensa* G.W.Carr** (greenscomb spider-orchid) | Endangered | Victoria, SA | Dry open woodland in various habitats including dry cypress-pine (family *Cupressaceae*)/yellow gum woodland, pine/box woodland, mallee-heath sites, heathy woodland and mallee woodland, generally with rock outcrops | Peak flowering period: late August–November | Similar species: *Caladenia tentaculata* and *C. dilatata* Hybrids have been recorded with many members of the *Caladenia patersonii* complex i.e. *C. colorata, C. brumalis, C. woolcockiorum.* Hybrids have been recorded with members of the *C. diltaa* complex including *C. verrucosa* and *C. toxochila*  |
| ***Caladenia tessellata* Fitzg.** (thick-lipped spider-orchid) | Vulnerable | NSW, Victoria | Low, dry sclerophyll woodland with a heathy or sometimes grassy under-storey  | Vegetative growth: late autumn or early winterPeak flowering period: late September to early NovemberThe species’ summer dormancy is broken in response to soaking rains in autumnWhile plants in several populations flower regularly in the absence of fire, for others, especially those growing in dense heath, flowering is much more sporadic and probably relies on periodic fire to remove surrounding vegetation and stimulate flowering  | Similar species:thick-lipped spider-orchid is most similar to the heart-lipped spider-orchid (*Caladenia cardiochila*).Thick-lipped spider-orchid is also similar to the clubbed spider-orchid (*C. clavigera*) |
| ***Caladenia thysanochila* G.W.Carr (fringed spider-orchid)**  | Endangered | Victoria | *Eucalyptus viminalis* ssp. pryoriana woodland  | Peak flowering period: October  | Similar species: not specified |
| ***Caladenia tonellii* D.L.Jones** (robust fingers) | Critically endangered | Tasmania | *Eucalyptus amygdalina* dominated forest with a shrubby under-storey on shallow clay loam and shallow gravelly loam over clay; topography varies from flats to slopes up to about 80 m elevation | Peak flowering period: late October to early December but most records are from early late NovemberFinished flowers are distinctive due their stature and arrangementThe species has one of the longest leaves of *Caladenias* (up to 25 cm long, green and sparsely hairy) and could be used for species identification prior to flowering | Similar species: *Caladenia carnea* Member of the *Caladenia carnea* complex |
| ***Caladenia versicolor* G.W.Carr** (candy spider-orchid) | Vulnerable | Victoria, SA | River red gum flats of seasonally inundated woodland, amidst low sedges | Peak flowering period: September to November  | Similar species: *A. colorata*. Member of the *A. patersonii* complex |
| ***Caladenia viridescens* Hopper & A.P.Br.** (Dunsborough spider-orchid) | Endangered | WA | Marri (*Corymbia calophylla*), peppermint (*Agonis flexuosa*) woodlands, near coastal heath  | Peak flowering period: mid September to late October Dormant between late November and late April | Similar species: *Caladenia paludosa*. Occasionally hybridises with *C. busselliana* |
| ***Caladenia wanosa* A.S.George (Kalbarri spider-orchid)**  | Vulnerable | WA | Under shrubs alongside ephemeral streams and among sandstone outcrops | Peak flowering period: mid August to mid September Dormant between late October and late April | Similar species: *Caladenia radialis* |
| ***Caladenia williamsiae* Hopper & A.P.Br.** (Williams spider orchid) | Endangered | WA | In lateritic loamy soils on ridges under open wandoo shrubs  | Peak flowering period: early August to September Dormant between late October and late April | Similar species: *Caladenia longiclavata, C. ensata* |
| ***Caladenia winfieldii* Hopper & A.P.Br.** (majestic spider-orchid) | Endangered | WA | In damp areas alongside seasonal streams, growing among low shrubs under scattered *Banskia littoralis*  | Peak flowering period: late October to late November  | Similar species: *Caladenia harringtoniae, C. startiorum* |
| ***Caladenia woolcockiorum* D.L.Jones** (Woolcock’s spider-orchid) | Vulnerable | SA | Grassy, open *Eucalyptus* woodland and forest clearings; on rocky ledges amid *Callitris*  | Peak flowering period: August and September Seasonally variable in its flowering  | Similar species: *C saxatilis* and the *C. patersonii* complex, especially *C. behrii* and *C. brumalis*. Hybrids have been recorded with *C. gladiolata*, *C saxatilis* and *C. tensa* in disturbed sites  |
| ***Caladenia xanthochila* D.Beardsell & C.Beardsell** (yellow-lip spider-orchid) | Endangered | Victoria, SA | Riparian open forest dominated by *Eucalyptus* species  | Peak flowering period: late August to late September  | Similar species: *Caladenia stellata, C. rigida* |
| ***Caladenia xantholeuca* D.L.Jones** (white rabbits) | Endangered | SA | Grows in moss pockets on shaded rock ledges under *Callitris glaucophylla* | Peak flowering period: September and October  | Similar species: *C. carnea*, *C. coactilis*. This is an outcrossing species |
| ***Calochilus psednus* D.L.Jones & Lavarack (Cardwell beard** orchid) | Endangered | Queensland | Occurs in *Melaleuca* woodland with an under-storey of dense sedges and scattered low shrubs. Soils are seasonally inundated sandy loams  | Peak flowering period: December to February  | Similar species: *C. caeruleus* |
| ***Calochilus richiae* Nicholls** (bald-tip beard-orchid) | Endangered | Victoria | Dry heathy woodland under-storey of low shrubs  | Peak flowering period: mid to late October  | Similar species: not specified |
| ***Corunastylis brachystachya* (Lindl.) D.L.Jones & M.A.Clem.** (short-spiked midge-orchid) | Endangered | Tasmania | Heathland and heathy eucalypt woodland, near-coastal rocky areas | Peak flowering period: February to April  | Similar species: not specified |
| ***Corunastylis ectopa* (D.L.Jones) D.L.Jones & M.A.Clem.** (Brindabella midge-orchid) | Critically endangered | ACT | Tall *Eucalyptus radiata* forest | Peak flowering period: late January to mid MarchThe buds develop rapidly and flowering is in progress about six weeks after the initialising rain event. In the absence of rain at the appropriate season the plants remain dormant | Similar species: not specified |
| ***Corunastylis firthii* (Cady) D.L.Jones** & M.A.Clem. (Firth’s midge-orchid) | Critically endangered | Tasmania | Low coastal scrub and tall open banksia shrubland with a heathy and sedgy under-storey | Peak flowering period: December to March  | Similar species: not specified |
| *Corunastylis littoralis* (D.L.Jones) D.L.Jones & M.A.Clem. (Tuncurry midge orchid) | Critically endangered | NSW | Low dense heath, in sparse shrubland and Daphne heath (*Brachyloma daphnoides*), and in teatree (*Leptospermum* spp.) thickets woodland | Peak flowering period: between February and April | Similar species: not specified |
| ***Corybas dentatus* D.L.Jones** (Finniss helmet-orchid) | Vulnerable | SA | Woodland in damp sandy soil, under bracken in woodland and native pines or in shaded gorges | Peak flowering period: July to August  | Similar species : *C. incurvus* |
| ***Corybas montanus* D.L.Jones** (small helmet-orchid) | Vulnerable | Queensland, NSW | Mountain tops in open forest  | Peak flowering period: June to July  | Similar species: not specified |
| ***Corybas sulcatus* (grooved helmet-orchid)** | Critically endangered | Tasmania | Endemic to Macquarie IslandGrows on wet grassy seepage areas | Peak flowering period: late spring through to early summer | Similar species: not specified |
| ***Crepidium lawleri* (Lavarack & B.Gray) Szlach.**  | Endangered | Queensland | Margin of a *Pandanus* swamp in a shady moist situation | Peak flowering period: September  | Similar species: not specified |
| ***Cryptostylis hunteriana* Nicholls** (leafless tongue-orchid) | Vulnerable | Victoria, NSW and Queensland | Wide variety of habitats including coastal districts, heathlands, heathy woodlands, sedgelands, forests, and Spear Grass-tree (*Xanthorrheoa resinosa*) plains  | Peak flowering period: Victoria/NSW: December to FebruaryQueensland: AugustAustralia: August to FebruaryNSW: December to January | Similar species: large tongue-orchid (*Cryptostylis subulata*) and the small tongue-orchid (*Cryptostylis* *leptochila*) |
| ***Dendrobium antennatum* Lindl.** | Endangered | Queensland | Riverine areas in lowland gorges, growing on rainforest trees  | Peak flowering period: erratic but usually March to November or possibly throughout the year, with an emphasis on winter  | Similar species: not specified |
| ***Dendrobium bigibbum* Lindl.** | Vulnerable | Queensland | Epiphyte, lithophyte; branches of small trees, or on rocks, in open monsoon forests, often occurring along creeks or on rocky hillsides where fire cannot penetrate  | Peak flowering period: may occur between January and October, with an emphasis on March to August and the flowers last about a month | Similar species: not specified |
| ***Dendrobium brachypus* (Endl.) Rchb.f.** (Norfolk Island orchid) | Endangered | Norfolk Island | Occurs on tree branches in forests on mountain slopes  | Peak flowering period: not specified | Similar species: not specified |
| ***Dendrobium callitrophilum* B.Gray & D.L.Jones (thin feather orchid)** | Vulnerable | Queensland, Norfolk Island | Epiphyte in rain forest and rainforest margins  | Peak flowering period: August and September Flowers lasts about a week, changing colour from greenish-yellow to apricot as they age  | Similar species: *D. aemulum* |
| ***Dendrobium carronii* Lavarack & P.J.Cribb**  | Vulnerable | Queensland | Epiphyte on paper-barked species of *Melaleuca* in mixed open forests, but also on *Xanthostemon crenulatus* and *Lophostemon suaveolens* in swamp forests  | Peak flowering period: late winter or early spring  | Similar species: closely related to *D. canaliculatum* R.Br. and the two species are difficult to separate when not in flower |
| ***Dendrobium johannis* Bateman ex Rchb.f**  | Vulnerable | Queensland | Epiphyte in moist, open forests, mixed open forests and semi-deciduous notophyll vine forests and swamp forests  | Peak flowering period: March to May  | Similar species: not specified |
| ***Dendrobium lithocola* (D.L.Jones & M.A.Clem.) M.A.Clem. & D.L.Jones**  | Endangered | Queensland | Lithophytic, growing in rainforest  | Peak flowering period: autumn and the flowers last for about a month  | Similar species: not specified |
| ***Dendrobium mirbelianum* Gaudich**  | Endangered | Queensland | Epiphytic in coastal swamps and mangroves; may grow on boulders  | Peak flowering period: variable and sporadic in this species, but generally occurs from August to November | Similar species : *Dendrobium discolor* |
| ***Dendrobium nindii* W.Hill**  | Endangered | Queensland | Mostly epiphytic in coastal swamps where it grows on a range of trees including palms and mangroves | Peak flowering period: July to October  | Similar species: not specified |
| ***Dendrobium phalaenopsis* (Fitzg.) M.A.Clem. & D.L.Jones** (Cooktown orchid) | Vulnerable | Queensland | Epiphyte; open forests and dry scrubs often near beaches, in areas with a hot climate and extremely seasonal rainfall  | Peak flowering period: autumn and the flowers last about a monthOccasional white flowered plants have been found  | Similar species: not specified |
| ***Dendrobium* x *superbiens* Rchb.f.** (curly pinks) | Vulnerable | Queensland | Stunted coastal scrubs on low trees or on rocks, often in exposed conditions occurring along creeks or on rocky hillsides where fire cannot penetrate  | Peak flowering period: February to June  | Similar species: not specified |
| ***Diplocaulobium masonii* (Rupp) Dockrill** syn. *Dendrobium stelliferum* | Extinct | Queensland  | On trees on the edge of mangrove swamps in conditions of high humidity and relatively strong light  | Peak flowering period: not specified | Similar species: not specified |
| ***Dipodium pictum* (Lindl.) Rchb.f.**  | Endangered | Queensland | Grows in or near rainforest, climbing up trees | Peak flowering period: July and December  | Similar species: not specified |
| ***Diuris aequalis* F.Muell. ex Fitzg.** (buttercup doubletail) | Vulnerable | NSW | Montane and tableland eucalypt forest with a grassy-heathy under-storey | Peak flowering period: October to December  | Similar species: *Diuris maculata* |
| ***Diuris basaltica* D.L.Jones** (small golden moths orchid) (syn. *Diuris* sp. aff. *lanceolata* (Laverton)) | Endangered | Victoria | *Themeda triandra* grassland  | Peak flowering period: September to October Stimulated by regular fire or light grazing  | Similar species: not specified |
| ***Diuris bracteata* Fitzg.**  | Extinct | NSW | Dry sclerophyll woodland  | Peak flowering period: September  | Similar species: not specified |
| ***Diuris drummondii* Lindl.** (tall donkey orchid) | Vulnerable | WA | Low-lying depressions in peaty and sandy, clay swamps | Peak flowering period: late October to mid January. Note: flowers earlier in the north and later in the southDormant between late January and late April Summer fires stimulate flowering in most populations  | Similar species: has often confused with *Diuris emarginata* and *D. heberle* |
| ***Diuris fragrantissima* D.L.Jones & M.A.Clem.** (sunshine diuris) | Endangered | Victoria | *Themeda triandra* dominated grasslands  | Vegetative growth: autumn, usually after the beginning of seasonal rains. Peak flowering period: mid-October to early November, and is over by early December. Hot summer fires are likely to enhance flowering in the following flowering season | Similar species: Wedge Diuris (*Diuris dendrobioides*) |
| ***Diuris lanceolata* Lindl. (snake orchid)** | Endangered | Tasmania, NSW and Queensland | Coastal scrub and windswept coastal grassland and heathland among dwarfed shrubs and sedges on moist to well-drained sandy and clay loam, sometimes on rocky outcrops | Peak flowering period: November to January predominantly in November | Similar species: *Diuris chryseopsis* and *D. behrii* |
| ***Diuris micrantha* D.L.Jones** (dwarf bee-orchid) | Vulnerable | WA | Winter-wet depressions or swamps | Peak flowering period: August to early OctoberDormant between November and late April | Similar species: Bee orchid (*Diuris laxiflora*) |
| ***Diuris ochroma* D.L.Jones** (pale golden moths) | Vulnerable | NSW, Victoria | Montane riparian grassland; wet open grassland  | Peak flowering period: November and December  | Similar species: not specified |
| ***Diuris pedunculata* (small snake orchid)** | Endangered | NSW, Victoria | Open areas of dry scherophyll forests with grassy understories, in riparian forest, swamp forests, subalpine grassland and herbfields | Peak flowering period: August to October | Similar species: *Diuris longifolia* and *D. subalpina* |
| ***Diuris praecox* D.L.Jones** (Newcastle doubletail) | Vulnerable | NSW | Near-coastal districts open heathy forests  | Vegetative growth: winter Peak flowering period: late July to early September  | Similar species: Lemon doubletail (*D. abbreviata)* |
| ***Diuris purdiei* Diels** (Purdie’s donkey-orchid) | Endangered | WA | Grows among native sedges in areas subject to winter inundation | Peak flowering period: late September to mid October Dormant between late November and late AprilFlowers only after a summer fire | Similar species: *Diuris laevis* |
| ***Diuris venosa* Rupp** (veined doubletail) | Vulnerable | NSW | Semi-swampy area and low-lying sites, swamp margins in tall open forest | Peak flowering period: November to January  | Similar species: not specified |
| ***Drakaea concolor* Hopper & A.P.Br.** (kneeling hammer-orchid) | Vulnerable | WA | Sandy soils in open areas among heath and sedges  | Peak flowering period: mid August to SeptemberDormant between November and late April | Similar species: glossy-leaved hammer orchid (*Drakaea elastica*) |
| ***Drakaea confluens* Hopper & A.P.Br.** (late hammer-orchid) | Endangered | WA | Open areas in mixed jarrah- banksia woodland  | Peak flowering period: late October to November Dormant between December and late April | Similar species: *Drakaea isolata* and *D. livida* |
| ***Drakaea elastica* Lindl. (glossy-leaved hammer-orchid)**  | Endangered | WA | In sandy soil adjacent to winter-wet depressions, swamps and water courses, growing in mixed woodlands, often under *Kunzea* species | Peak flowering period: late September to early November Dormant between December and late April*Drakaea elastica* likes open sites and is often found on old, disused tracks and firebreaks | Similar species: Kneeling hammer orchid (*Drakaea concolor* |
| ***Drakaea isolata* Hopper & A.P.Br.** (lonely hammer-orchid) | Endangered | WA | Grows with the broad-billed duck orchid (*Paracalaena triens*) among low shrubs and mallee eucalypts on a rise above a salt lake | Peak flowering period: September to early October Dormant between late November and late April | Similar species: late hammer orchid (*Drakaea confluens*) |
| ***Drakaea micrantha* Hopper & A.P.Br.** (dwarf hammer-orchid) | Vulnerable | WA | Jarrah (*Eucalyptus marginata*) and common sheoak (*Allocasuarina fraseriana*) woodland or forest associated with *Banksia* species  | Peak flowering period: early September to October Dormant between late November and late April | Similar species: King-in-his-carriage (*Drakaea glyptodon*) |
| ***Epiblema grandiflorum* N.Hoffman & A.P.Br.** [nom. inval.] (baby blue orchid) | Endangered | WA | Among dense sedges and *Astartea fascicularis* under tall paperbarks (*Melaleuca preissiana* and *M. rhaphiophylla*) in a winter-wet swamp often with its base in water | Peak flowering period: late November the species appears to require a water depth of 10–20 cm during spring to initiate flowering, followed by a drying out during summer | Similar species: not specified |
| ***Genoplesium plumosum* (Rupp) D.L.Jones & M.A.Clem.** (plumed midge-orchid) | Endangered | NSW | Low-heath heathland, with associated moss/lichen beds over sandstone rock sheets | Peak flowering period: late February to March | Similar species: *G. sagittiferum* |
| ***Eria paleata* Rchb.f. ex Kraenzl.**  | Endangered | Norfolk Island | Epiphyte on tree branches  | Peak flowering period: not specified | Similar species: not specified |
| ***Genoplesium rhyoliticum* D.L.Jones & M.A.Clem.** (Pambula midge-orchid) | Endangered | NSW | Rhyolite outcrops with low open heath and skeletal soils | Vegetative growth: late spring to early summer and is stimulated by rain. Peak flowering period: December to late January  | Similar species: *G. morrisii* |
| ***Genoplesium tectum* D.L.Jones** (cardwell midge orchid) | Endangered | Queensland | Dense sedges and low shrubs in woodland near creeks | Peak flowering period: November to March  | Similar species: No |
| ***Genoplesium vernale* D.L.Jones** (East Lynne midge-orchid) | Vulnerable  | NSW | Low, open eucalypt forest | Peak flowering period: November to December  | Similar species: *Genoplesium woollsii* |
| ***Grastidium tozerense* (Lavarack) M.A.Clem. & D.L.Jones**  | Vulnerable | Queensland | On scattered small trees growing on open rocky areas with occur in the midst of the rainforest; occasionally growing on rocks | Peak flowering period: the flowering time appears to be during the summer in cultivation, but plants were collected in flower in September and it is possible if flowers spasmodically throughout the year  | Similar species: *D. baileyi* |
| ***Habenaria macraithii* Lavarack**  | Endangered | Queensland | Tall gallery forest with an open under-storey; evergreen notophyll vine forest  | Peak flowering period: late autumn and winter  | Similar species: *Habenaria dryadum* and *H. dracaenifolia* (PNG species) *H. hymenophylla* (NT species) |
| ***Microtis angusii* D.L.Jones** (Angus’s onion orchid) | Endangered | NSW | Among grass in low woodland  | Peak flowering period: May to October Flower prolifically after fire  | Similar species: *Microtis parviflora* and *Microtis unifolia* |
| ***Microtis globula* R.J.Bates** (south-coast mignonette orchid) | Vulnerable | WA | In seasonally swampy areas which burnt the previous summer, growing, in peaty soils and damp sand | Peak flowering period: mid December to mid January, only after hot summer fires Dormant between February and late April | Similar species: none |
| ***Nematoceras dienemum* (D.L.Jones) D.L.Jones, M.A.Clem. & Molloy** (windswept helmet-orchid) | Critically endangered | Macquarie Island (Tasmania) | Lower coastal terraces (less than 30 m above sea level) and peat wetlands  | Peak flowering period: November to January  | Similar species: not specified |
| ***Oberonia attenuata* Dockrill**  | Extinct | Queensland | *Oberonia attenuata* grew on trees in lowland rainforests, particularly those in gorges or near watercourses | Peak flowering period: May and September  | Similar species: other Australian *Oberonia* species |
| ***Paracaleana dixonii* Hopper & A.P.Br.** (sandplain duck orchid) | Endangered | WA | Open sandy areas in heathland  | Peak flowering period: late October to late November Dormant between December and late April. | Similar species: *Paracaleana graniticola, P. brockmanii* |
| ***Phaius australis* F.Muell.** (lesser swamp-orchid) | Endangered | Queensland, NSW | Coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest; swamp-forest margins | Peak flowering period: September to November  | Similar species: greater swamp-orchid *(Phaius tancarvilleae*) |
| ***Phaius bernaysii* Rowland ex. Rchb.f** | Endangered | Queensland | Protected swampy areas  | Peak flowering period: September to November  | Similar species: *Phaius australis* |
| ***Phaius pictus* T.E.Hunt**  | Vulnerable | Queensland | Rainforest close to streams or in localised patches of seepage  | Peak flowering period: April to June  | Similar species: not specified |
| ***Phalaenopsis amabilis* subsp. *rosenstromii* (F.M.Bailey)** (native moth orchid) | Endangered | Queensland | Epiphyte; humid rainforest areas, close to waterfalls or streams, in deep gorges, sheltered slopes or gullies in notophyll vine thickets, deciduous vine thickets and in open forest | Peak flowering period: December to April  | Similar species: not specified |
| ***Plexaure limenophylax Endl.* (Endl.) Benth.** (Norfolk Island phreatia) | Critically endangered | Norfolk Island | Epiphyte on tree branches  | Peak flowering period: not specified | Similar species: *Phreatia paleata* |
| ***Pomatocalpa marsupiale* (Kraenzl.) J.J.Sm.**  | Vulnerable | Queensland | Grows high up on trees and on exposed rocks in rainforest  | Peak flowering period: not specified | Similar species: not specified |
| ***Prasophyllum affine* Lindl.** (Jervis Bay leek orchid) | Endangered | NSW | Low, grassy heathland and sedgeland communities, often in a mosaic with clumps of a mallee form of red bloodwood (*Corymbia gummifera*)  | Peak flowering period: early to mid-November  | Similar species: maroon leek-orchid (*Prasophyllum frenchii*) and *P. litorale.* (*P. litorale* only occurs in Victoria and SA) |
| ***Prasophyllum amoenum* D.L.Jones** (dainty leek orchid) | Endangered | Tasmania | Buttongrass moorland habitat on damp stony loam; alpine sedgeland, sedgey heathland and bolster heathland | Peak flowering period: late December to early March (depending on altitude). Species may respond favourably to disturbance but not necessarily fire  | Similar species: not specified |
| ***Prasophyllum apoxychilum* D.L.Jones** (tapered leek-orchid) | Endangered | Tasmania | Coastal heathland or grassy and scrubby open eucalypt forest on sandy and clay loams, often among rocks; occurs at a range of elevations and seems to be strongly associated with dolerite in the east/south-east of its range | Peak flowering period: October to DecemberFlowering is stimulated by fire and slashing | Similar species: part of the *P. truncatum* complex |
| *Prasophyllum atratum* D.L. Jones & D.T. Rouse (three hummock leek-orchid) | Critically endangered | Tasmania | Sedgey heathland on grey sandy loam beside an airstrip; single known population | Peak flowering period: October to November with peak in first two weeks of November The species may require disturbance to stimulate emergence and flowering and is currently only found in areas that are slashed or burned regularly  | Similar species: not specified |
| Prasophyllum bagoense (Bago leek-orchid) | Critically endangered | NSW | Subalpine treeless plain at an elevation of approximately 1200 m that comprises at least four plant communities: Fen I; Aquatic sedgeland—alpine bog community; tall wet heathland and McPhersons Plains open heathland; adjacent eucalypt woodland  | Peak flowering period: December to January and fruits from December to March (season dependent)Flowering may be stimulated by fire | Similar species: not specified |
| ***Prasophyllum castaneum* D.L.Jones** (chestnut leek-orchid) | Critically endangered | Tasmania | Coastal areas in damp shrubby and sedgey heath on sandy loam or skeletal rocky soils; subject to exposure by strong sea winds | Peak flowering period: late November to January with peak in December Flowering is probably stimulated by fire and likes disturbance  | Similar species: *P. frenchii* (can be confused with *P. concinnum*) |
| ***Prasophyllum colemaniae* R.S.Rogers** (lilac leek-orchid) | Vulnerable | Victoria | Grassy woodlands  | Peak flowering period: October to November  | Similar species: *P. spicatum* and *P. truncatum* |
| ***Prasophyllum correctum* D.L.Jones** (gaping leek-orchid) | Endangered | Victoria | Central Gippsland Plains kangaroo grass (*Themeda triandra*) grassland and forest red gum (*Eucalyptus tereticornis*) grassy woodland | Vegetative growth: mid April and mid JuneFlower buds develop: mid OctoberPeak flowering period: third week of October, when the first flowers open from the centre of the spike, followed by flowers at the base of the spike and then those at its apex. Flowering is complete by early NovemberThere is a high degree of annual variability in flowering and emergence of *P. correctum*  | Similar species: tawny leek-orchid (*Prasophyllum fuscum*) |
| ***Prasophyllum crebriflorum* D.L.Jones** (crowded leek-orchid) | Endangered | Tasmania | Montane tussock grassland dominated by *Poa labillardierei*, with scattered patches of the woody shrub *Hakea microcarpa;* native grassland dominated by *Poa gunnii* and grassy woodland with a sparse overstorey of *Eucalyptus gunnii* | Peak flowering period: early December to mid January | Similar species: golfers leek-orchid (*Prasophyllum incorrectum*) |
| ***Prasophyllum diversiflorum* Nicholls** (Gorae leek-orchid) | Endangered | Victoria | Open forest along watercourses and around swamp margins which are in seasonally inundated  | Peak flowering period: December to February  | Similar species: *Prasophyllum* sp. aff. *frenchii* 1, also known as *P*. sp. Aff. *frenchii* A |
| ***Prasophyllum favonium* D.L.Jones** (western leek-orchid) | Critically endangered | Tasmania | Windswept, dense, low heathland on moderately drained dark grey to black sandy peaty loams | Peak flowering period: October and November with peak in November | Similar species: not specified |
| ***Prasophyllum frenchii* F.Muell.** (maroon leek-orchid) | Endangered | Victoria, NSW, south-east SA | Open sedge swampland or in wet grassland and wet heathland generally bordering swampy regions | Peak flowering period: October to December  | Similar species: *Prasophyllum litorale* R.J. Bates (coastal leek-orchid), *P. niphopedium* D.L. Jones (alpine marsh leek-orchid), *P. rogersii* Rupp (marsh leek-orchid), *P. canaliculatum* D. L. Jones (channelled leek-orchid), *P. appendiculatum* Nicholls (tailed leek-orchid), *P. murfetii* D. L. Jones (Murfets leek-orchid) and *P. fosteri* D.L. Jones (Shelford leek-orchid)  |
| ***Prasophyllum fuscum* R.Br.** (tawny leek-orchid) | Vulnerable | NSW | Wet, low heathland on gentle slopes or in moist heath, often along seepage lines  | Peak flowering period: October to December  | Similar species: *Prasophyllum pallens* and *P. uroglossum* |
| ***Prasophyllum goldsackii* J.Z.Weber & R.J.Bates** (Goldsack’s leek-orchid) | Endangered | SA | Limestone ridges in mallee woodlands or in open scrublands  | Peak flowering period: late September to October. Only flowers occasionally and the flowers rarely open  | Similar species: *Prasophyllum* sp. Enigma (R.Bates 2350) |
| ***Prasophyllum incorrectum* D.L.Jones** (golfers leek orchid) | Critically endangered | Tasmania | Damp native grassland and grassy eucalypt and banksia woodland on sandy loam | Peak flowering period: October and November (with peak around late October; very short flowering periodLikes disturbance, specifically slashing and would most likely respond strongly to grassland fires | Similar species: crowded leek-orchid (*P. crebriflorum*) |
| *Prasophyllum limnetes* D.L.Jones (marsh leek-orchid) | Critically endangered | Tasmania | Ecotone between low-lying marshy heath/sedgeland dominated by rushes and sedges with scattered patches of *Lomandra longifolia* and *Themeda triandra*, and coastal *Eucalyptus amygdalina* woodland with a heathy/grassy under-storey; single known population | Peak flowering period: late November to December being in full flower mid DecemberResponds strongly to fire disturbance | Similar species: not specified |
| ***Prasophyllum milfordense* D.L.Jones** (Milford leek-orchid) | Critically endangered | Tasmania | *Eucalyptus viminalis* woodland with sagg-dominated ground layer on well-drained, grey sandy loams; single known populationRestricted distribution in southern Tasmania | Peak flowering period: late October to early December with a peak in November  | Similar species: part of the *P. truncatum* complex |
| ***Prasophyllum morganii* Nicholls** (mignonette leek-orchid) | Vulnerable | Victoria | Open forest of *Eucalyptus pauciflora* ssp. *pauciflora* and *Eucalyptus rubida*  | Peak flowering period: October and November  | Similar species: *Prasophyllum retroflexum* |
| ***Prasophyllum murfetii* D.L.Jones** (Fleurieu leek orchid) | Critically endangered | SA | Swampy sites in low-lying areas around the margins of permanent swamps or lakes  | Peak flowering period: November to January  | Similar species: *Prasophyllum frenchii* |
| ***Prasophyllum olidum* D.L.Jones** (pungent leek-orchid) | Critically endangered | Tasmania | Damp *Themeda* grassland on sandy loam; single known population | Peak flowering period: late November and December Very short flowering period  | Similar species: *P. rostratum*; *P. diversiflorum* (note: *P. diversiflorum* is a Victorian species) |
| ***Prasophyllum pallidum* Nicholls** (pale leek-orchid) | Vulnerable | SA | South Australian blue gum (*Eucalyptus leucoxylon*) open forest, low open-forest and low woodland; long-leaved box (*Eucalyptus goniocalyx*) woodland; pink gum (*Eucalyptus fasciculosa*) low woodland and low open-woodland; grey box (*Eucalyptus microcarpa*) woodland; slender cypress pine (*Callitris gracilis*) pink gum low open-forest  | Peak flowering period: late September to early NovemberRegeneration is thought to be stimulated by fire  | Similar species: *Prasophyllum fitzgeraldii* |
| ***Prasophyllum perangustum* D.L.Jones** (Knocklofty leek-orchid) | Critically endangered | Tasmania | Grassy *Eucalyptus pulchella* forest on well-drained clay loam and skeletal clay loam derived from dolerite; single known population in the foothills of Mt Wellington at an altitude of about 350 m | Peak flowering period: November and December  | Similar species: *P. rogersii* (note: this is a NSW species) |
| ***Prasophyllum petilum* D.L.Jones & R.J.Bates** (Tarengo leek orchid) | Endangered | ACT, NSW | Grassy woodland or natural grassland  | Peak flowering period: late October and early November in the Ilford/Boorowa/Hall areas, and in early December in the Delegate/Captains Flat areas Associated with damp depressions which pool water after rain | Similar species: Prasophyllum campestre |
| ***Prasophyllum pruinosum* R.S.Rogers** (plum leek-orchid) | Endangered | SA | Open woodland habitats; usually with an overstorey of pink gum (*Eucalyptus fasciculosa*), South Australian blue gum (*E. leucoxylon*), and *Callitris gracilis*  | Peak flowering period: late September to November  | Similar species: *P. patens* complex |
| ***Prasophyllum pulchellum* D.L.Jones** (pretty leek-orchid) | Critically endangered | Tasmania | Dense, low sedgy heath with pockets of paperbark or tea-tree on poorly to moderately-drained sandy or peaty loam; widely scattered coastal and near-coastal sites in the north, north-west and south-east | Peak flowering period: late October to December Flowering is stimulated by fire  | Similar species: not specified |
| ***Prasophyllum robustum* (Nicholls) M.A.Clem. & D.L.Jones** (robust leek-orchid) | Critically endangered | Tasmania | Grassy and shrubby *Eucalyptus amygdalina* forest on well-drained brown loam derived from basalt | Peak flowering period: early November  | Similar species: *P. stellatum* |
| ***Prasophyllum secutum* D.L.Jones** (northern leek-orchid) | Endangered | Tasmania | Dense coastal scrub in the swales of stabilised sand dunes on white to grey sands and sandy loam; the species has only ever been detected in the first few flowering seasons after high-intensity summer fires | Peak flowering period: October to December Emergence and flowering is highly dependent on a hot summer fire the preceding season. In the absence of fire chances of seeing plants is extremely low  | Similar species: *Prasophyllum secutum* is most similar to *P. favonium* |
| ***Prasophyllum* sp. Wybong (C.Phelps ORG 5269) Australian National Herbarium**  | Critically endangered | NSW | Open eucalypt woodland and grassland  | Vegetative growth: over winter and spring. Peak flowering period: spring  | Similar species: not specified |
| ***Prasophyllum spicatum* R.J.Bates & D.L.Jones** (dense leek-orchid) | Vulnerable | Victoria, SA | Grassland, heathland and heathy woodland  | Peak flowering period: September to November Flowering is enhanced by disturbance such as burning or slashing of the habitat, during the previous summer  | Similar species: *P. odoratum* and *P. patens* (*P. patens* is a NSW species) |
| ***Prasophyllum stellatum* D.L.Jones** (Ben Lomond leek-orchid) | Critically endangered | Tasmania | *Eucalyptus delegatensis* forest (with *Eucalyptus dalrympleana* as a minor canopy component), with a shrubby to grassy under-storey; most sites have a relatively high surface rock cover with deep clay-loam soils; elevation range 555 m to 960 m | Peak flowering period: January to March with peak flowering of the species occurring mid to late February | Similar species: *P. truncatum* complex most similar to *P. robustum* |
| ***Prasophyllum suaveolens* D.L.Jones & R.J.Bates** (fragrant leek-orchid) | Endangered | Victoria | Grassland and open grassy woodland | Peak flowering period: October and November  | Similar species: *P. fuscum*, *P. correctum* and *P. rostratum* (note: *P. fuscum* is a NSW species, *P. rostratum* is a Tasmanian species) |
| ***Prasophyllum subbisectum* Nicholls** (Pomonal leek-orchid) | Endangered | Victoria | Heathy woodlands and heathy open forests dominated by *Eucalyptus leucoxylon* sens. lat. and *Eucalyptus goniocalyx*  | Peak flowering period: October and November  | Similar species: not specified |
| ***Prasophyllum taphanyx* D.L.Jones** (graveside leek-orchid) | Critically endangered | Tasmania | Native grassland on well-drained basaltic soils; single known population | Peak flowering period: late October and early November  | Similar species: not specified |
| ***Prasophyllum tunbridgense* D.L.Jones** (Tunbridge leek-orchid) | Endangered | Tasmania | Native grassland on well-drained loams derived from basalt | Peak flowering period: October to NovemberVery brief flowering period  | Similar species: *Prasophyllum milfordense* and *P. truncatum* |
| ***Prasophyllum validum* R.S.Rogers** (sturdy leek-orchid) | Vulnerable | SA | *Eucalyptus microcarpa* woodland and low woodland; *Eucalyptus leucoxylon* woodland and open-forest; *Eucalyptus cladocalyx* association | Peak flowering period: October and November | Similar species: not specified |
| ***Prasophyllum wallum* R.J.Bates & D.L.Jones** (wallum leek-orchid) | Vulnerable | Queensland | Wallum communities and on stabilised dunes | Peak flowering period: August and September  | Similar species: not specified |
| ***Pterostylis arenicola* M.A.Clem. & J.Stewart** (sandhill greenhood orchid) | Vulnerable | SA | Mallee box (*Eucalyptus porosa*) and drooping sheoak (*Allocasuarina verticilla*); golden wattle (*Acacia pycnantha*) +/- drooping sheoak; mallee pine (*Callitris gracilis*) +/- drooping sheoak; soap mallee (*Eucalyptus deiversifolia*) +/- golden wattle +/- drooping sheoak on sand-hills in near coastal areas  | Vegetative growth: JuneFlower-bud formation: July to AugustPeak flowering period: September to December Highly variable species with no two plants looking the same in flower morphology and colouring | Similar species: rufa greenhood (or baggy britches) *Pterostylis boormanii* |
| ***Pterostylis atriola* D.L.Jones** (snug greenhood) | Endangered | Tasmania | Dry to damp sclerophyll forest on generally stony soils, typically with an open under-storey; the species occurs at a range of elevations but is most strongly associated with 'winter-cold' sites (e.g. Snug Tiers) or areas receiving a moderately consistent rainfall (e.g. Wielangta, Railton) | Peak flowering period: January to March, peaking in February, may flower as late as May at some sitesSome level of disturbance is thought to be required for persistence  | Similar species: leafless greenhood (*Pterostylis aphylla;* baby greenhood (*Pterostylis parviflora*); marsh greenhood (*Pterostylis uliginosa*) |
| ***Pterostylis basaltica* D.L.Jones & M.A.Clem.** (basalt greenhood) | Endangered | Victoria | Grows among rocks on basalt outcrops, which are scattered in grassland and sparse woodland | Peak flowering period: November to January Even at flowering time the orchids can be difficult to sight  | Similar species: not specified |
| ***Pterostylis bicornis* D.L.Jones & M.A.Clem.**  | Vulnerable | Queensland | Growing in small humus pockets on bare rock  | Peak flowering period: June and July  | Similar species: not specified |
| ***Pterostylis bryophila* D.L.Jones** (Hindmarsh Valley greenhood) | Critically endangered | SA | South Australian blue gum (*Eucalyptus leucoxylon*) and pink gum (*E. fasciculosa*) open forest or woodland; grassy woodland in mossy gullies along drainage lines; on steep slopes and ridges near creeks  | Vegetative growth: March to AprilFlower-bud formation: April to MayPeak flowering period: May to July Flowering abundance is known to vary significantly from year to year depending on autumn rainfall | Similar species: coastal greenhood (*Pterostylis alveata*) and *P. obtusa*. (Note: *P. obtusa* does not occur in SA) |
| ***Pterostylis cheraphila* D.L.Jones & M.A.Clem.** (floodplain rustyhood) | Vulnerable | Victoria | Floodplain in riverine woodland dominated by *Eucalyptus largiflorens*  | Peak flowering period: October and November  | Similar species: not specified |
| ***Pterostylis chlorogramma* D.L.Jones & M.A.Clem.** (green-striped greenhood) | Vulnerable | Victoria, SA | Moist open forest among herbs and shrubs  | Peak flowering period: July to September  | Similar species: not specified |
| ***Pterostylis cobarensis* M.A.Clem.** (Cobar greenhood orchid) | Vulnerable | NSW, Qld, SA | Grows among rocks on low hills, on slopes above streams, on rocky hills, sheltered locations between rocks and under trees  | Peak flowering period: September to November  | Similar species: not specified |
| ***Pterostylis commutata* D.L.Jones** (midland greenhood) | Critically endangered | Tasmania | Native grassland and *Eucalyptus pauciflora* grassy woodland on well-drained sandy soils and basalt loams; occurs in small, loose colonies | Flowering occurs from December to January usually in full flower around Christmas time The rosette is present at flowering although usually withering | Similar species: *P. biseta* (mainland species) |
| ***Pterostylis cucullata* subsp. *cucullata* D.L.Jones** (leafy greenhood) | Listed at species level | SA, Victoria and Tasmania | Calcareous dunes and sand-sheets in near-coastal areas, within closed scrubs dominated by either *Leptospermum laevigatum* or *Beyeria lechenaultii* var. *latifolia*; sites are typically sheltered, facing south or south-easterly to westerly, with seasonally damp but well-drained humus-rich sandy loams, often with moss and deep leaf litter | Flower-bud formation: AugustPeak flowering period: mid October to mid November Although this species can form massive colonies it can be difficult to detect because plants can occur among dense grass and beneath low coastal scrub Has distinctive rosettes that can be easily counted | Similar species: not specified |
| ***Pterostylis despectans* (Nicholls) M.A.Clem. & D.L.Jones** (lowly greenhood) | Endangered | SA, Victoria and NSW | Peppermint box *(Eucalyptus odorata*) grassy woodland; flat or undulating woodland or open forest of yellow gum (*Eucalyptus leucoxylon*) and grey box (*E. microcarpa*) or yellow gum and yellow box (*E. melliodora*); adjacent to red gum (*E. camaldulensis*) woodland; adjacent to red box (*E. polyanthemos*) open forests  | Vegetative growth: rosettes develop in winter to early spring but generally wither before the flower spike matures. Peak flowering period: late October into summer, but mostly in November and DecemberThe species is usually found in open areas where it is well camouflaged by grass and leaf litter, and may sometimes be hidden away under low shrubs; forms quite extensive colonies; flowers open up to a month after the leaves have withered away  | Similar species: *Pterostylis mirabilis*, *O. bisetus* complex  |
| ***Pterostylis gibbosa* R.Br.** (Illawarra greenhood) | Endangered | NSW, Qld | Flat, gently sloping sites on the coastal plain; woodlands with a native grass under-storey | Peak flowering period: late August to early September and can last until early December under favourable conditions It has been noted that orchids that have withered due to dry conditions early in the growing season may resprout in response to good rains later in the season | Similar species: not specified |
| ***Pterostylis oreophila*** Clemesha (Kiandra greenhood) | Critically endangered | NSW, ACT, Victoria | Small montane and subalpine streams under tall dense thickets of *Leptospermum grandiflorum* (mountain tea tree), and sphagnum mounds  | Peak flowering period November to January Pod development to ripening occurs from December to March  | Similar species: not specified |
| ***Pterostylis pratensis* D.L.Jones** (Liawenee greenhood) | Vulnerable | Tasmania | Subalpine *Poa labillardierei* tussock grassland with patches of often stunted *Olearia algida* and *Hakea microcarpa* scrub on red–brown loamy to clay soils derived from basalt; grows in very exposed conditions at altitude of 850 m to 1100 m above sea level | Peak flowering period: mid-November to mid-December  | Similar species: the *P. mutica* complex (*P. mutica, P. rubenachii, P. wapstratum*) and *P. cycnocephala* complex (*P. pratensis, P. ziegeleri*)  |
| ***Pterostylis pulchella* Messmer** (pretty greenhood) | Vulnerable | NSW | Escarpments close to waterfalls, on moist, sheltered ridges, and creek banks  | Peak flowering period: February to May  | Similar species: *P. grandiflora, P. ophioglossa, P. reflexa* and *P. obtusa* |
| ***Pterostylis rubenachii* D.L.Jones** (Arthur River greenhood) | Endangered | Tasmania | Dry sandy slopes of sparsely vegetated stabilised sand dunes, and also in permanently wet to moist scrubby and sedgey coastal heath converted to semi-improved pasture by regular slashing | Flowering period: October to November with the peak in early November | Similar species: not specified |
| ***Pterostylis saxicola* D.L.Jones & M.A.Clem.** (Sydney Plains greenhood) | Endangered | NSW | Heathy forests, in shallow sandy soil over flat sheets of sandstone and also in crevices between sandstone boulders, often in close proximity to streams | Peak flowering period: October to December  | Similar species: *P. gibbosa, P. chaetophora* |
| ***Pterostylis* sp. Botany Bay (A.Bishop J221/1-13) NSW Herbarium** (Botany Bay bearded greenhood orchid) | Endangered | NSW | Grows in low coastal heathland, in moist level sites | Flower bud production: July Peak flowering period: August to September  | Similar species: *Pterostylis plumosa*, *P.* sp. aff. *plumosa* (Mallee) and *P.* sp. aff. *plumosa* (Anglesea), *P. tasmanica.* Both *P.* sp. aff. *plumosa* (Mallee) and *P.* sp. aff. *plumosa* (Anglesea) are Victorian species |
| *Pterostylis* sp. Eyre Peninsula **R.J.Bates** syn. *P. mirabilis* (nodding rufoushood) | Vulnerable | SA | Scrublands of broombush (*Melaleuca uncinata*); woodland of *Callitris* and *Eucalypt* spp. | Vegetative growth: May to JuneFlower-bud formation: SeptemberPeak flowering period: October to December | Similar species: late flowering lowly greenhood (*Pterostylis despectans* |
| ***Pterostylis* sp. Flat Rock Creek (D.L.Jones 15873 & K.J.Fitzgerald). Now named as *P. vernalis* Australian National Herbarium** (spring tiny greenhood) | Critically endangered | NSW | Heath and heathy forests, beneath taller shrubs | Vegetative growth: late autumn or early winter following good rainsFlower bud production: late winterPeak flowering period: August to OctoberFlowering may be enhanced by summer fires  | Similar species: not specified |
| ***Pterostylis* sp. Halbury (R.Bates 8425) (Halbury greenhood) syn. *P. lepida*** | Endangered | SA | In open mossy clearings, gaps and pathways between trees and shrubs | Vegetative growth: rosette in May to JuneFlower bud production: July to OctoberPeak flowering period: mid-August and early November  | Similar species: Boormans rustyhood (*Pterostylis boormanii*), morphologically similar ruddyhood (*Pterostylis pusilla*) |
| ***Pterostylis* sp. Hale (R.Bates 21725) SA Herbarium**) (Hale dwarf greenhood) | Endangered | SA | Mallee and in heathy woodland  | Peak flowering period: August to September  | Similar species: *Pterostylis nana* complex |
| ***Pterostylis* sp. Northampton (S.D.Hopper 3349) WA Herbarium** (Northampton midget greenhood), syn *P. sinuata* | Endangered | WA | Winter-wet areas among low scrub heath. Populations also found on sandy loam slopes with low shrubs  | Peak flowering period: early August to early September Dormant between October and late AprilPrefers open, well lit, moist areas and disappears when density of vegetation increases | Similar species: *Pterostylis mutica* |
| ***Pterostylis tenuissima* Nicholls** (swamp greenhood) | Vulnerable | Victoria and south-east SA | *Leptospermum lanigerum* tall closed shrubland in swamps or along watercourses that are seasonally inundated with freshwater | Peak flowering period: mainly between October and February, but has been observed throughout the year  | Similar species: not specified |
| ***Pterostylis valida* (Nicholls) D.L.Jones** (robust greenhood) | Critically endangered | Victoria | Granite slopes in shallow pockets of soil in open woodland  | Peak flowering period: October and November  | Similar species: those of the *Pterostylis excelsa* complex |
| ***Pterostylis wapstrarum* D.L.Jones** (fleshy greenhood) | Critically endangered | Tasmania | Native grassland and grassy woodland (*Eucalyptus pauciflora* and *Eucalyptus viminali*s) on basalt and dolerite soils | Peak flowering period: October to November | Similar species: species in the *P. mutica* complex (*P. mutica, P. rubenachii, P. wapstrarum*) and *P. cycnocephala* complex (*P. pratensis, P. ziegeleri*)  |
| ***Pterostylis* x *aenigma* D.L.Jones & M.A.Clem.** (enigmatic greenhood) | Endangered | Victoria | Floodplains of montane watercourses among grasses and sedges in woodland and open forest | Peak flowering period: November and December  | Similar species: *Pterostylis falcata* and *Pterostylis cucullata* |
| ***Pterostylis xerophila* M.A.Clem.** (desert greenhood) | Vulnerable | SA, Victoria | Semi-arid regions in open mallee scrublands, on ‘buckshot’ rise under thickets of *Melaleuca uncinata* and on sand dunes under *Leptospermum coriaceum*  | Flower-bud formation: August to SeptemberPeak flowering period: August to December, but mostly in October and November Morphology of the flowers of Victorian plants varies considerably between populations | Similar species: *P. xerophila* |
| ***Pterostylis ziegeleri* D.L.Jones** (grassland greenhood) | Vulnerable | Tasmania | Slopes of low, stabilised sand dunes and in grassy dune swales in coastal areas, while in the midlands it grows in native grassland or grassy woodland on well-drained clay loams derived from basalt | Peak flowering period: September to December, with peak in October | Similar species: the *P. mutica* complex (*P. mutica, P. rubenachii, P. wapstrarum*) and *P. cycnocephala* complex (*P. pratensis, P. ziegeleri*)  |
| ***Rhinerrhizopsis matutina* D.L.Jones & M.A.Clem.**  | Vulnerable | Queensland | Epiphyte in notophyll vine forests and in semi-deciduous mesophyll vine forest | Peak flowering period: flowering is erratic with the main period being from July to September  | Similar species: No |
| ***Rhizanthella gardneri* R.S.Rogers** (Western Australian underground orchid) | Endangered | WA | Grows in thickets with broom bush (*Melaleuca* spp.) | Peak flowering period: May to June (northern populations) and June to July (southern populations)Dormant between October and late April | Similar species: has been confused for the underground fungi stink-horn fungus (*Colus pusillus*) and earthstar fungus (*Geastrum* spp.) as well as a parasitic angiosperm *Orobanche minor* |
| ***Rhizanthella slateri* (Rupp) M.A.Clem. & P.J.Cribb** (eastern underground orchid) | Endangered | NSW | Terrestrial saprophytic; *Eucalyptus* forest  | Peak flowering period: October and November  | Similar species: not specified |
| ***Sarcochilus fitzgeraldii* F.Muell.** (ravine orchid) | Vulnerable | NSW, Queensland | Epilithic or terrestrial herb, rarely an epiphyte. On rocks or escarpments in moist, heavily shaded conditions in ravines; usually near streams and waterfalls; in wet sclerophyll forest and subtropical rainforest | Peak flowering period: October to November  | Similar species: *S. hartmannii* |
| ***Sarcochilus hartmannii* F.Muell.** (waxy sarcochilus) | Vulnerable | NSW, Queensland | Lithophytic herb, occasionally epiphytic. Exposed, rocky bluffs and slopes, or sclerophyll forests, but sometimes grows near creeks  | Peak flowering period: September to November  | Similar species: *S. aequalis* and *S. fitzgeraldii* |
| ***Sarcochilus hirticalcar* (Dockrill) M.A.Clem. & B.J.Wallace**  | Vulnerable | Queensland | Rainforest species, grows on rainforest trees, favouring flaky-barked trees  | Peak flowering period: November and December  | Similar species: not specified |
| ***Sarcochilus roseus* (Clemesha) Clemesha** | Vulnerable | Queensland | Epiphytic evergreen; in dryish exposed or semi-exposed  | Peak flowering period: October to December  | Similar species: *S. ceciliae* |
| ***Sarcochilus weinthalii* F.M. Bailey (blotched sarcochilus)** | Vulnerable | NSW, Queensland | Epiphytic on trees in dry rainforest at altitudes  | Peak flowering period: August to October  | Similar species: not specified |
| ***Spathoglottis plicata* Blume**  | Vulnerable | Queensland | Grows in or near swamps and in grassy patches near streams  | Peak flowering period: any time between July and April but the main season is from September to April  | Similar species: *S. paulinae* |
| ***Taeniophyllum muelleri* Lindl. ex Benth.** (minute orchid) | Vulnerable | NSW, Queensland, Norfolk Island | Epiphyte of rainforest and vine forest (open and closed) | Peak flowering period: not specified | Similar species: *Taeniophyllum norfolkianum* |
| ***Taeniophyllum norfolkianum* D.L.Jones, B.Gray & M.A.Clem.** (minute orchid) | Vulnerable | Norfolk Island | Epiphytic orchid. Underside of branches of the Norfolk Island pine in shaded gullies and lower slopes in closed forests  | Peak flowering period: August to October  | Similar species: very similar to *T. muelleri* |
| ***Thelymitra cyanapicata* Jeanes** (blue top sun-orchid) | Critically endangered | SA | Manna gum (*Eucalyptus viminalis*), messmate (*Eucalyptus obliqua*), open swampy woodland  | Peak flowering period: October and early NovemberThe flowers open only in warm, humid weather | Similar species: others in the *Thelymitra pauciflora* complex |
| ***Thelymitra epipactoides* F.Muell.** (metallic sun-orchid) | Endangered | SA, Victoria | Mesic coastal heathlands, grasslands, sedgelands and woodlands, but is also found in drier inland heathlands, open forests and woodlands | Vegetative growth: leaves can be seen as early as April and continue to grow throughout winter. Peak flowering period: August to November Flowering plants are often only found after fires Flowers open when the relative humidity is lower than 52%, air temperature is above 15 °C, and there are clear skies  | Similar species: *T. grandiflora* |
| ***Thelymitra jonesii* Jeanes (sky-blue sun-orchid**) | Endangered | Tasmania | Moist coastal heath on sandy to peaty soils and *Eucalyptus obliqua* forest in deep loam soils over dolerite | Peak flowering period: about a week either side of 1 November This species responds strongly to hot fires | Similar species: *Thelymitra azurea* and *Thelymitra occidentalis* |
| ***Thelymitra* *kangaloonica* Jeanes**  | Critically endangered | NSW | Seasonally swampy sedgeland, highly localised, being restricted to the [Temperate Highland Peat Swamps on Sandstone](http://apps.internal.environment.gov.au/cgi-bin/sprat/intranet/%20http%3A/draft.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=32&status=Endangered%20) | Peak flowering period: late October and early November The strongly scented flowers open fairly readily on sunny days. Surveys within the known locations require methodical surveying of the main swamps (Butler's Swamp and Stockyard Swamp) | Similar species: species of sun-orchids (*Thelymitra* spp.) |
| ***Thelymitra manginii* R.S.Rogers** (cinnamon sun orchid) | Endangered | WA | Open wandoo woodland in granite areas | Peak flowering period: early NovemberDormant between December and late April | Similar species: *Thelymitra stellata*, *T. jacksonii* and *T. yorkensis* |
| ***Thelymitra matthewsii* Cheeseman** (spiral sun-orchid) | Vulnerable | SA, Victoria | Open forests and woodlands | Peak flowering period: late August to early OctoberIt is a post-disturbance coloniser  | Similar species: *T. spiralis* (WA) |
| ***Thelymitra psammophila* C.R.P.Andrews (sandplain sun-orchid**) | Vulnerable | WA | Sandy-clay and lateritic claysoil in open heath and sedges  | Peak flowering period: September to early October Dormant between November to late April | Similar species: *Thelymitra flexuosa* |
| ***Thelymitra stellata* Lindl.** (star sun-orchid) | Endangered | WA | Lateritic soil, growing amongst low heath and scrub in jarrah (*Eucalyptus marginata*) woodland, on ridges, slopes, and breakaways  | Peak flowering period: late September in northern populations and October to November near Perth. Flowers remain closed overnight and during cool overcast weather | Similar species: *Thelymitra magnifica* |
| ***Thelymitra xmackibbinii* F.Muell.** (brilliant sun-orchid) | Vulnerable | Victoria | Woodlands within box-ironbark associations | Flowering occurs from early September to early October | Similar species: not specified |
| ***Thynninorchis nothofagicola (D.L. Jones) D.L Jones & M.A,Clem.*** (myrtle elbow orchid) | Critically endangered | Tasmania | Tall, open *Eucalyptus delegatensis* forest with a rainforest under-storey of *Nothofagus cunninghamii*, *Atherosperma moschatum* and *Dicksonia antarctica*; grows in leaf litter; single known site | Peak flowering period: late February  | Similar species: not specified |
| ***Trichoglottis australiensis* Dockrill**  | Vulnerable | Queensland | Grows on rainforest trees  | Peak flowering period: March but flowering time is possibly variable or blooming may occur several times a year  | Similar species: not specified |
| ***Vanda hindsii* Lindl.** (Cape York vanda) | Vulnerable | Queensland | Epiphyte, lithophytes rain forest margins, notophyll vine forest, deciduous vine thicket and open forest | Peak flowering period: erratic but mostly in the summer months  | Similar species: *Pomatocalpa marsupiale* |
| ***Vrydagzynea grayi* D.L.Jones & M.A.Clem.**  | Endangered | Queensland | Dense, lowland rainforest  | Peak flowering period: September to October  | Similar species: not specified |
| ***Zeuxine polygonoides* (F.Muell.) P.J.Cribb** (velvet jewel orchid) | Vulnerable | Queensland | Moist shady sites in rainforests (mesophyll vine forests and simple notophyll vine forests) in leaf litter on the ground or on large boulders adjacent to streams  | Vegetative growth: late summer to spring The velvet jewel orchid is readily recognised when in leaf (late summer to spring) by the white central band on the leaf blades  | Similar species: not specified |