



Consultation Document on Listing Eligibility and Conservation Actions

***Paralucia pyrodiscus lucida* (Eltham copper – a butterfly)**

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

- 1) the eligibility of *Paralucia pyrodiscus lucida* (Eltham copper) for inclusion on the EPBC Act threatened species list in the endangered category; and
- 2) the necessary conservation actions for the above subspecies.

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

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

Draft information for your consideration of the eligibility of this subspecies for listing as endangered starts at page 6 and information associated with potential conservation actions for this subspecies starts at page 11. To assist with the Committee's assessment, the Committee has identified a series of specific questions on which it seeks your guidance at page 13.

Responses are to be provided in writing either by email to:
species.consultation@environment.gov.au

or by mail to:

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

Responses are required to be submitted by 15 January 2016.

Contents of this information package	Page
General background information about listing threatened species	2
Information about this consultation process	2
Draft information about the Eltham copper and its eligibility for listing	3
Conservation actions for the subspecies	11
Collective list of questions – your views	13
References cited	18

General background information about listing threatened species

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

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

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

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

Information about this consultation process

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

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

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

Paralucia pyrodiscus lucida

Eltham copper (a butterfly)

Taxonomy

Conventionally accepted as *Paralucia pyrodiscus lucida* Crosby, 1951 (family Lycaenidae).

Species/Sub-species Information

Description

The Eltham copper is small, with a wingspan of 25 to 27 mm (Braby, 2000). The uppersides of the wings are dark brown in males and females (Braby, 2000), with both fore- and hind wings bearing a yellow-copper area (Braby, 2000). The underside of both wings is brown of various shades, with a series of darker brown, irregular, 'zig zag' lines (Braby, 2000).

Eggs are white, 0.9 mm in diameter, generally dome-shaped and flattened at the top (Braby, 1990). Larvae are yellowish-brown, and a prominent dark reddish mid-dorsal line extends from the thorax to near the end of the abdomen in later stages (Braby et al., 1999). The end of the abdomen is considerably flattened in mature larvae (Braby et al., 1999). First stage larvae are 2-2.5 mm long; final (eighth) stage larvae are approximately 18 mm long (Braby, 1990). Pupae are 10-14 mm long (Braby, 1990), yellowish-brown, with numerous small dark brown flecks and a mid-dorsal line along the abdomen (Braby et al., 1999).

Distribution

The Eltham copper is endemic to Victoria, where it is known from 25 sites/colonies (Borton pers. comm., 2014), distributed in three remnant areas, which are likely to be separate populations (Braby et al., 1999): in the Eltham-Greenborough area of Melbourne, in the Castlemaine-Bendigo area of central Victoria, and in the Kiata-Nhill-Dimboola area in northwest Victoria. The three remnant areas/populations across Victoria are widely separated, with no possibility of natural genetic interchange (Braby et al., 1999), given the likely limited dispersal ability of the butterfly.

Most of the 25 sites are protected in Conservation Reserves and that are actively managed for conservation; either by the Victoria Department of Environment, Land, Water and Planning, or Nillumbik Shire Council (Borton pers. comm., 2014). The Eltham copper is highly localised within the three remnant areas: colonies occupy only around 3-26% of available habitat (Braby et al., 1999).

Like many butterflies from the Lycaeidae, the Eltham copper has an intricate and likely obligate relationship with ants (Braby et al., 1999) (see Biology/Ecology section, below). At least three species from the ant genus *Notoncus* are hosts to the butterfly larvae: *Notoncus capitatus*, *N. enormis* and *N. ectatommoides*, which occur in southeastern Australia (Braby, 1990; Braby et al., 1999). Around Eltham the host ant is *N. capitatus* (previously part of *N. enormis*), and around Kiata it is *N. ectatommoides* (Braby et al., 1999). Generally, the two ant species occur separately, with *N. capitatus* often found in wetter areas than *N. ectatommoides* (Braby et al., 1999). Apparently, suitable colonies of the host ants are distributed much more widely than the butterfly they attend (Braby et al., 1999). However, populations of the butterfly are more patchy, each comprising a number of localised colonies, probably reflecting the the low incidence of suitable combinations of larval food plant and attendant ants (Braby, 2000).

The only host plant on which the butterfly larvae feed (*Bursaria spinosa* subsp *spinosa*) is common in coastal regions of southeastern Australia (Atlas of Living Australia, 2015).

The Eltham copper occurs in more exposed, drier sites, generally along ridge-tops, whereas in the Eltham-Greensborough area the butterfly inhabits dry *Eucalyptus* forest with grassy understorey and scattered patches of the larval food plant (Braby et al., 1999; Borton pers.

comm., 2014). Most colonies in this area occur on elevated, well-drained areas, often adjoining moister gullies (Braby et al., 1999). In the Castlemaine-Bendigo area the butterfly inhabits heathy dry forest (Borton pers. comm., 2014). In Kiata, colonies are found on flatter, very gently sloping ground dominated by *Allocasuarina luehmannii* (Braby et al., 1999).

Biology/Ecology

The Eltham copper is wholly dependent on its association with ants of the genus *Notoncus*, such that the butterfly has not been found in areas where *Notoncus* ant colonies do not occur (Vaughan 1988, cited in Borton pers. comm., 2014). *Notoncus* species are ground-nesting ants and construct small chambers around the bases of the *Bursaria* plants on which they forage, mainly at night, for nectar and honeydew from insects (Braby et al., 1999).

The Eltham copper breeds only on *Bursaria spinosa* subsp *spinosa* (Pittosporaceae) and is restricted to juvenile plants (Borton pers. comm., 2014) or small, stunted plants with juvenile foliage (Braby et al., 1999), which are generally less than 0.5m high at Eltham, while at Kiata and Castlemaine plants that are utilised may approach 2m in height (Braby et al., 1999). Most eggs are laid on the host plant near the ground, very rarely on leaf litter near the plant base (Braby, 1990).

Upon hatching, larvae enter the *Notoncus* ant nest at the base of the host plant, where the larvae are guarded by the ants, which also lead the larvae to and from the ant colony to browse on the host plant leaves (Borton pers. comm., 2014). In return, the ants feed on sugars in the larval excretions (Braby et al., 1999). Larvae overwinter in the ant nest, and intensive grazing over late summer-autumn can lead to severe defoliation of some plants (Braby, 1990), which quickly regenerate over late autumn-winter (Braby et al., 1999). Larvae generally pupate in the ants' nest, with pupae usually attached to the main root or stem of the host plant (Braby, 1990).

It is likely that within sites there is local movement and dispersal of the colonies among the larval food plants (Braby et al., 1999). Research conducted in 1987-1988 and 1994-1995 indicated that a substantial proportion of food plants used for oviposition may not be utilised in subsequent years, so that larval distribution within a site may vary between years (Braby et al., 1999).

There is generally one generation each year in Eltham, but occasional prolonged flight periods are thought to represent a partial second generation or prolonged emergence period in some years (Borton pers. comm., 2014). A similar pattern may also occur at Castlemaine (Braby, 1990). There are two discrete generations per year at Kiata (Braby, 1990). Adult butterflies readily feed on flowers of *B. spinosa*, and also feed opportunistically on the flowers of several other species associated with *B. spinosa* (Braby et al., 1999). Adults require open areas among and near the larval food plants on which to perch and so that males can establish territories for mating.

In captivity, one generation is approximately three months during warmer parts of the year and with high abundance and quality of food, including a 3-5 week pupal stage (Braby et al., 1999). In natural habitat, eggs hatch after about two weeks, and first stage larvae generally develop rapidly over late summer and autumn before overwintering as mature larvae, with adults emerging the following summer (Braby et al., 1999). Although there are no quantitative estimates of adult longevity (Braby et al., 1999), they likely live for a few weeks, like many species (Common and Waterhouse, 1981).

Threats

The Eltham copper was noted as being of conservation concern by Braby (2000). Fragmentation and loss of habitat, especially in urban areas due to subdivision, roadworks and building construction (Borton pers. comm., 2014). The impetus to conserve the Eltham copper arose from its discovery in 1987 on a site in Eltham threatened with imminent housing subdivision (Braby et al., 1999). Broadacre clearing for agriculture and urban development has removed most of the suitable habitat on private land, and the butterfly is generally restricted to remnant

habitat on public land (Borton pers. comm., 2014). The threat is exacerbated by the species' preference and attachment to a particular habitat type, and so dispersal is limited and more localised as fragmentation increases (Borton pers. comm., 2014). The Eltham-Greensborough sites are surrounded by private property, and many property owners extend their boundaries into the reserves. This has the potential to introduce weeds to the site and reduce the overall area of available habitat (Borton pers. comm., 2014).

In addition to direct clearing of habitat, urbanisation also causes additional pressures such as: trampling, weed invasion and unplanned fires, which lead to further habitat degradation (Vaughan 1988, cited in Borton pers. comm., 2014). This is particularly a threat to the Eltham-Greensborough population and increasingly to the Bendigo and Castlemaine populations (Borton pers. comm., 2014). Woody weeds such as Cape broom (*Genista monspessulana*), radiata pine (*Pinus radiata*) and blackberry (*Rubus fruticosus*) have the potential to outcompete *Bursaria spinosa* (Mays pers. comm. 2015), although weeds across the Eltham-Greensborough sites are actively managed (Borton pers. comm., 2014). Urbanisation leads to the increased presence of some introduced predators, such as the honey bee (*Apis mellifera*) and European Wasp (*Vespula germanica*) (Vaughan 1988, cited in Borton pers. comm., 2014).

Slashing and burning of vegetation as preventative measures for wildfires (Borton pers. comm., 2014). Since the Black Saturday Bushfires in 2009 that devastated large areas in central and southern Victoria, there has been increased pressure on land managers to reduce fuel loads within conservation reserves by slashing and controlled burning of vegetation and the creation of fire breaks (Borton pers. comm., 2014). This is a current threat to the Eltham copper and is likely to continue into the future (Borton pers. comm., 2014).

Grazing of newly germinated larval food plants by rabbits. This has the potential to significantly reduce the number of juvenile *Bursaria* plants available to the Eltham copper (Borton pers. comm., 2014).

Rubbish dumping. The dumping of rubbish, including garden clippings has the potential to introduce weeds into butterfly habitat, particularly in urban areas (Borton pers. comm., 2014).

Unmanaged native vegetation. It has been observed that thick growth of shrubs is detrimental to the Eltham copper (Vaughan 1988, cited in Borton pers. comm., 2014), which has a preference for clear flight paths and areas to sun itself (Braby et al., 1999). Thick regrowth of *Cassinia* spp. and *Acacia* spp. after drought and fire may particularly threaten the Eltham-Greensborough population (Borton pers. comm., 2014).

Despite management activities, wildfires have the potential to destroy sites where the Eltham copper occurs due to the subspecies' limited distribution and presence in fire prone areas (Borton pers. comm., 2014). The key issue of wildfire and its ability to threaten populations of the Eltham copper refers to the seasonality of the fire and the area burnt (Mays pers comm.. 2015). Given that the subspecies has a low dispersal capability and occupies discrete patches of *Bursaria spinosa* within the reserves it is extremely vulnerable to the impacts of uncontrolled fires (Mays pers comm.. 2015), especially in middle to late summer, when fires would destroy adults, eggs, and plants, which would remove the larval food source and adult oviposition sites (New et al. 2000). However, an appropriate fire regime that maintains open habitat and facilitates regeneration of the larval foodplant may be an important management tool for sustaining butterfly populations (New et al. 2000).

Collection of adults is cited as a potential threat (Borton pers. comm., 2014), although there is no supporting evidence. If it does occur, numbers collected are likely to be low, and the impact on the subspecies is likely to be minor.

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

Criterion 1. Population size reduction (reduction in total numbers)

Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.	based on any of the following: <ul style="list-style-type: none"> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites 		
A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.			
A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]			
A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.			

Evidence:

*Note: the listing guidelines for this criterion consider decline over the longer of 10 years or three generation lengths. The average generation length—egg to emerged adult—for *Paralucia pyrodiscus lucida* has been estimated at approximately three months during favourable conditions, meaning three generations are approximately nine months. Therefore, consideration of decline over 10 years is more appropriate for this subspecies.*

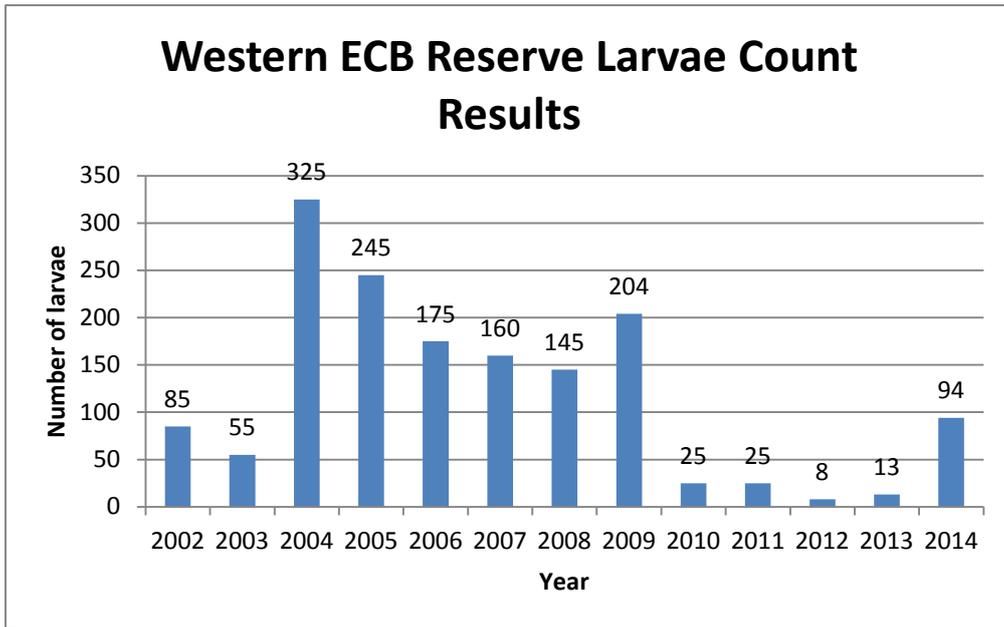
Surveys of abundance of Eltham copper larvae are undertaken in several reserves in the Eltham-Greensborough area of Melbourne (Mays pers. comm. 2015). The method used to undertake larval surveys follows the protocol described in Braby et al. (1999). Field counts involve a small team of surveyors walking in pairs approximately ten metres apart, along north-south and east-west transects throughout the whole reserve (Mays pers. comm. 2015). Surveys commence in the first week of October, and occur in two episodes over four weeks, depending on weather conditions. When conditions are ideal (dry nights with air temperatures greater than 14°C), each episode/count is undertaken over two nights separated by two weeks (Mays pers. comm. 2015). If weather conditions are not favourable (during or after rain, air temperatures less than 10°C) surveys may occur in November.

Individual *B. spinosa* plants encountered along the transect are searched. Using a spotlight, the plant is searched from the base upward, scanning each branch for larvae and ant activity. The surveyor moves around the plant to search it at different angles and records the number of larvae on a plant. The larvae are easy to detect because they are always associated with *Notoncus* ants, which occur in groups of between five and 20 ants with each larva (Mays pers. comm. 2015).

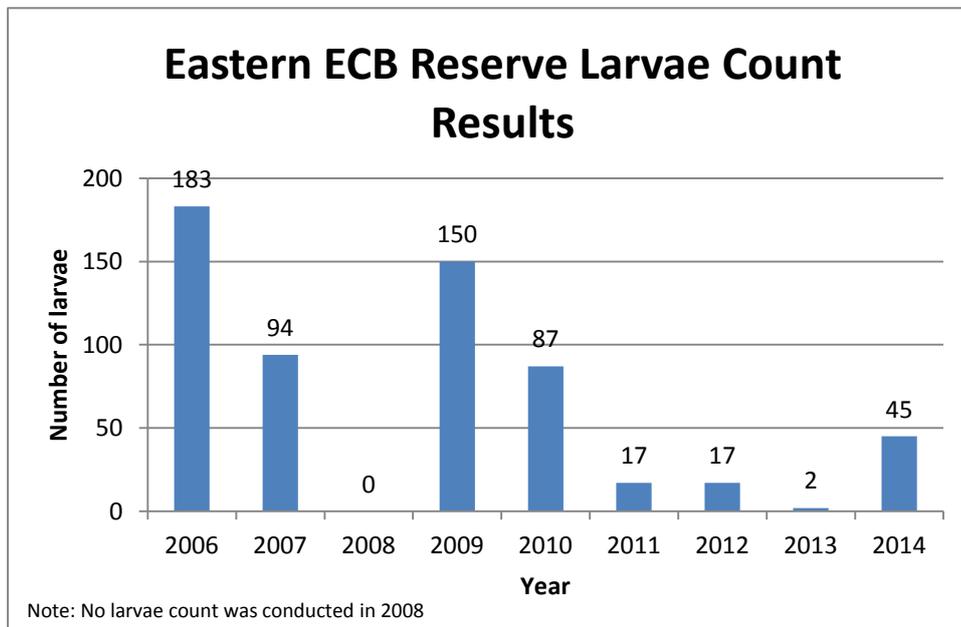
Abundance data are provided for three reserves (Borton pers. comm., 2014): the Western Eltham Copper Butterfly Reserve (data since 2002), the Eastern Eltham Copper Butterfly Reserve (since 2006), and the Yarra Valley Water Eltham Copper Butterfly Reserve (also since 2006) (see graphs, below). Data show the sum of larvae counted over both survey episodes (i.e. over four nights in October/November) for each year.

Annual counts of larvae at the Western Reserve show evidence of decline between 2004 and 2013, although there was a marked increase in abundance in 2014 (Borton pers. comm., 2014,

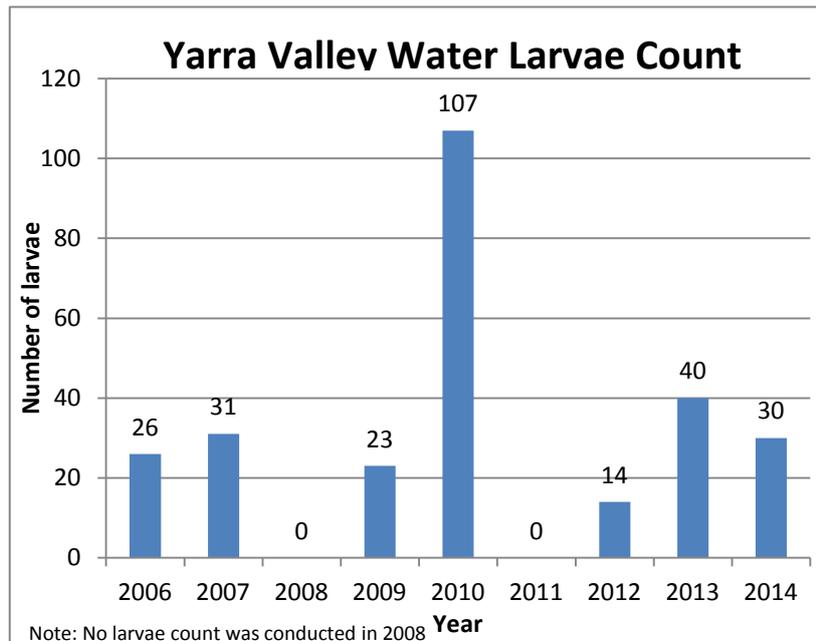
2015) (see below). A total of 325 larvae was observed at the Western Reserve colony in Eltham in 2004, and only 13 in 2013 (Borton pers. comm., 2014, 2015).



Annual counts of larvae at the Eastern Reserve indicate a net decline between 2006 and 2013, and a marked increase in abundance in 2014 (Borton pers. comm., 2014, 2015) (see below).



No pattern in abundance (decline or increase) was observed at the Yarra Valley Water Reserve (see below). A total of 107 larvae was observed at the Yarra Valley Water site in 2010; none were observed in 2011, and 14 were observed in 2012 (Borton pers. comm., 2014, 2015).



Note: In 2011 a survey was conducted at Yarra Valley Water Reserve, but no larvae were found.

The cause of these patterns of abundance decline is unclear; these records may be more representative of natural fluctuation over the stated time periods. Notwithstanding the likely fluctuation over shorter time periods, the reported abundance records may be indicative of a much longer period of decline over the last approximately 25-30 years. The following table shows larval abundance records for the Eastern and Western Reserves in Eltham in 1988, 1994 and 1995 (from Braby et al. 1999).

Site	Date	Population size
Eastern and Western colonies combined	1988	990
Eastern Reserve	10 Oct 1994	150
	9 Oct 1995	144
	26 Oct 1995	101
Western Reserve	6 Oct 1994	81
	12 Oct 1995	90
	24 Oct 1995	129

It is possible that decline has occurred since 1988; however, the values in 1994/5 are similar to those reported over the last 10-12 years, especially when the values from 2014 are also considered. On balance, and taking into account all the abundance values above, there has not been a clear decline in abundance over the last ten years; the values are more indicative of fluctuation. Annual counts of larvae over the last ten years are not available for the Castlemaine, Bendigo and Kiata populations (Borton pers. comm., 2014).

The data presented above appear to demonstrate the subspecies is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be

considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

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

Evidence:

The total extent of occurrence (EOO) of the Eltham copper is calculated to be 6,514 square kilometres (ERIN, 2015), using the IUCN convex hull/minimum convex polygon method, in which the smallest polygon is drawn in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence) (IUCN 2001, 2012). The total area of occupancy (AOO) of the Eltham copper is calculated to be 76 square kilometres (ERIN, 2015), using a 2x2 km grid cell method based on the IUCN Red List Guidelines 2014.

A value for EOO was also provided by Borton (pers. comm., 2014), who reported a total EOO area of 1.65 km², with the Kiata population occupying 1.41 km², the Castlemaine- Bendigo population 0.19 km², and the Eltham-Greensborough population 0.05 km² (Borton pers. comm., 2014). The particular area of a reserve or patch of vegetation that the Eltham copper occupies can change from year to year; i.e. the butterfly will move around habitat reserves (Borton pers. comm., 2014). Therefore, the EOO in this case was calculated by including all the available habitat within the proximity of sightings from the past 10 years, which is generally the reserve or property boundary, or mapped patches of *Bursaria spinosa* (Borton pers. comm., 2014). The calculated EOO in Eltham-Greensborough was based on Banyule Council GIS data and Nillumbik Shire Council GIS data, relating to reserve boundaries. Yandell Reserve in Greensborough has a total of <1 hectare of suitable habitat, and the Eltham Reserves and private properties have a total of <4 hectares of suitable habitat. The EOO at Castlemaine-Bendigo was based on mapped patches of *Bursaria spinosa* in the reserves where Eltham copper occurs, and the EOO at Kiata was based on reserve boundaries and sightings in the past 10 years sourced from the Victorian Biodiversity Atlas (Borton pers. comm., 2014).

The three populations of the Eltham copper are geographically severely fragmented and isolated, with no interbreeding. Urbanisation has led to further fragmentation within the three populations, although any genetic work would determine which if any of the colonies interbreed.

There is evidence of extreme fluctuation in the number of larvae, and fluctuations in larval abundance within the reserves are indicative of the fluctuations in the number of mature individuals (Canzano, 2013).

The extent of occurrence is <20 000 km² and area of occupancy <500 km², with three severely fragmented populations and severe fluctuation in the number of immatures, which likely also reflects decline in the number mature individuals.

The data presented above appear to demonstrate that the subspecies is **eligible for listing as endangered** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3. Population size and decline			
	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

The estimated total number of mature individuals is approximately 250 (Borton pers. comm., 2014). This was the consensus view of members of the Eltham Copper Butterfly Recovery Working Group, and resulted from a meeting hosted by the Nillumbik Shire Council in February 2014, involving those who could best estimate the subspecies' recent abundance (Borton pers. comm., 2014, 2015). This group meets twice a year to discuss the outcomes of both management of Eltham copper populations and survey results from larval counts (Mays pers comm., 2015).

As discussed in criterion 1, there is no clear evidence of decline over the last 10 years, and no indication of projected continuing decline.

In summary, the estimated population is low (and could be very low), at approximately 250 mature individuals. Geographic distribution is somewhat precarious as it is severely fragmented. However, no recent data have been provided on the number of mature individuals at each location.

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

Criterion 4. Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

Evidence:

The estimated total number of mature individuals is approximately 250 (Borton pers. comm., 2014). This was the consensus view of members of the Eltham Copper Butterfly Recovery Working Group, and resulted from a meeting hosted by the Nillumbik Shire Council in February 2014, involving those who could best estimate the subspecies' recent abundance (Borton pers. comm., 2014, 2015). This group meets twice a year to discuss the outcomes of both management of Eltham copper populations and survey results from larval counts (Mays pers comm., 2015).

The estimate presented above appears to demonstrate that the subspecies is **eligible for listing as endangered** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the subspecies' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

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

Evidence:

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

Conservation Actions

Recovery Plan

A decision about whether there should be a recovery plan for this species has not yet been determined. The purpose of this consultation document is to elicit additional information to help inform this decision.

Conservation and Management Actions

Habitat loss disturbance and modifications

- Maintain habitat quality at all sites, to counter the continuing impacts of urban isolation, such as removal of rubbish and debris, buffering of run-off from roads, control of destructive human activities such as accidental fires, construction of pathways, and trampling (Sands and New, 2002).

- Ensure local planning decisions do not adversely impact on known habitat of the Eltham copper.
- Continue the collaborative approach of Nillumbik Shire Council and Banyule Council in thinning native vegetation on reserves in the Eltham-Greensborough area (Borton pers. comm., 2014). Expand such activities at all relevant locations.

Invasive species (including threats from grazing, trampling, predation)

- Maintain and control succession of *Bursaria spinosa* plants by controlling weeds (Sands and New, 2002).
- Continue the collaborative approach of Nillumbik Shire Council and Banyule Council in weed and rabbit control activities on Eltham copper reserves in the Eltham-Greensborough area (Borton pers. comm., 2014).
- Identify and remove any weeds in the local area that could become a threat to the Eltham copper, using appropriate methods. An example is the hand pulling of broom, which should be undertaken on an ongoing basis (Sands and New, 2002).

Fire

- Develop and implement an appropriate fire management regime that does not negatively impact the Eltham copper, its host ant colonies or the *Bursaria* plants that support the ant nests. New et al. (2000) and Sands and New (2002) described a protocol for effective control burning, which should include elements of:
 - late season burning, at the time when the caterpillars are already well-advanced, and the more vulnerable stages—eggs, young caterpillars, reproducing adults—are absent;
 - the hottest possible burn to eliminate exotic weeds and encourage regeneration of native vegetation;
 - mosaic burning, whereby areas with particularly high numbers of adults are left unburnt; and
 - extending the fire into the canopy to ‘open’ the system (New et al. 2000; Sands and New, 2002).

Avoid adverse impacts of planned burning on surrounding housing through careful planning and execution (Sands and New, 2002).

- Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigation measures in bush fire risk management plan/s, risk register and/or operation maps.

Stakeholder Management

- Establish a working group to coordinate state-wide action and recommend conservation management priorities. Such a group could include representatives of Nillumbik Shire Council, Banyule City Council, Parks Victoria, La Trobe University, Victoria Department of Environment, Land, Water & Planning, non-government organisations, local zoos, and other individuals and organisations as appropriate (DSE, 2003).
- Encourage the already high public awareness of the Eltham copper. Increase awareness at known sites on public and private land where threats continue to impact on the subspecies. Erect or improve signage describing the butterfly, its biology and habitat, and threats.
- Continue the partnerships involving local councils and other reserve owners/managers, with non-government organisations based in Eltham such as the ‘Friends of the Eltham Copper Butterfly’, to protect and enhance the butterfly’s habitat (Nillumbik Shire Council, 2011). Expand the network and activities to include all areas where the Eltham copper occurs and owners of private land.
- Encourage use of online social networks to disseminate information and conservation activities relating to the Eltham copper.

- Continue the community education activities in the Eltham-Greensborough and Bendigo areas (Borton pers. comm., 2014). Expand such activities to include the Kiata-Nhill-Dimboola area in northwest Victoria.
- Ensure appropriate signage is erected at all locations where the Eltham copper occurs, informing members of the local community of the presence of the butterfly, its habitat, threats and conservation.

Survey and Monitoring priorities

- Continue the monitoring of larval and adult abundance at all current locations (Borton pers. comm., 2014). Expand such programmes to include locations in central and northwest Victoria.
- Continue to undertake targeted survey work in suitable habitat and potential habitat across Victoria to locate any additional populations/occurrences. Ensure surveys account for any likely seasonal variation in the flight period, such as an additional generation. Increase survey effort in private and crown remnant potential habitat in surrounding districts.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities

- Ensure that a conservation management plan is completed for each of the reserves that harbour colonies of the Eltham copper (Borton pers. comm., 2014). Priority should be given to the colonies in the Kiata Flora Reserve and Wail State Forest in northwest Victoria, as these sites are not actively managed (Borton pers. comm., 2014).
- Investigate the influence of drought on abundance and life history such as adult emergence, especially in the Kiata area (Sands and New, 2002).
- Develop and implement a programme in reserves for annual monitoring of adult abundance.
- Investigate further the ecological relationship between the Eltham copper, colonies of host ant, and host plant species (Sands and New, 2002). Focus on why *Bursaria spinosa* and the ants *Notoncus* spp. occur in many areas where the Eltham copper is absent.
- Investigate the possibility of reintroducing the Eltham copper into appropriate secure habitat where the host ant colonies and larval food plant already occur. Assess the feasibility and need for translocation to secure habitat already managed for conservation purposes; assess the feasibility and need for captive breeding at a suitable butterfly breeding facility.
- Identify the genetic structure within and between the three likely populations. Such information will inform the conservation and management at all locations.
- Identify optimal fire regimes for regeneration (vegetative regrowth and/or seed germination) of *Bursaria* plants.

Collective list of questions – your views

Consultation questions for *Paralucia pyrodiscus lucida* (Eltham copper)

*Note: the listing guidelines for criterion 1 consider decline over the longer of 10 years or three generation lengths. The average generation length—egg to emerged adult—for *Paralucia pyrodiscus lucida* has been estimated at approximately three months during favourable conditions, meaning three generations are approximately nine months. Therefore, consideration of decline over 10 years is more appropriate for this subspecies.*

Biological information

1. Can you provide any additional or alternative references or information on the life history of this subspecies?
2. Are you able to provide any additional information on the identity of any other host ant species on which the butterfly may depend?

- Are you able to provide any additional information on the ecology/relationship of the Eltham copper, host plant and host ants that may help explain the butterfly's distribution?

Population size

- Has the survey effort for this subspecies been adequate to determine its national adult population size? If not, please provide justification for your response.
- Do you agree that there are three main locations/populations of this subspecies? Do you know of any other current populations of this subspecies? If so, please provide information on the distribution, abundance and population size/area.
- Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Do you accept the estimate of the total population size of the subspecies? If not, please provide justification for your response.
- Can you provide any abundance data for larvae at other reserves, sites or locations?
- Can you provide any abundance data of adults that can be used to estimate national population size? Can you provide an estimate of the current population size of adults of this subspecies (national extent)? Please provide supporting justification or other information.

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

<p>Number of mature individuals is estimated to be in the range of:</p> <p> <input type="checkbox"/> 1–50 <input type="checkbox"/> 51–250 <input type="checkbox"/> 251–1000 <input type="checkbox"/> >1000 <input type="checkbox"/> >10 000 </p>
<p>Level of your confidence in this estimate:</p> <p> <input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much information to go on <input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence <input type="checkbox"/> 51–95% - reasonably certain, information suggests this range <input type="checkbox"/> 95–100% -high level of certainty, information indicates quantity within this range <input type="checkbox"/> 99–100% - very high level of certainty, data are accurate within this range </p>

Evidence of total population size change

- Do you think the interpretation of the trend (if any) in the total population is substantiated by the larval count data?
- Are you able to comment on the extent of decline in the subspecies' total population size over the last approximately 10 years? Please provide justification for your response.

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

Decline estimated to be in the range of:

- 1–30% 31–50% 51–80% 81–100% 90–100%

Level of your confidence in this estimated decline:

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

11. Please provide (if known) any additional evidence which shows the subspecies or any individual population is stable, increasing or declining.

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

12. Has the survey effort for this subspecies been adequate to determine its national distribution? If not, please provide justification for your response.
13. Do you agree that the way the current extent of occurrence and/or area of occupancy has been estimated is appropriate? Please provide justification for your response.

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

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

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

- <100 km² 100 – 5 000 km² 5 001 – 20 000 km² >20 000 km²

Level of your confidence in this estimated extent of occurrence

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

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested

in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

<p>Area of occupancy is estimated to be in the range of:</p> <p><input type="checkbox"/> <10 km² <input type="checkbox"/> 11 – 500 km² <input type="checkbox"/> 501 – 2000 km² <input type="checkbox"/> >2000 km²</p>
<p>Level of your confidence in this estimated extent of occurrence:</p> <p><input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much data to go on</p> <p><input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence</p> <p><input type="checkbox"/> 51–95% - reasonably certain, data suggests this range of decline</p> <p><input type="checkbox"/> 95–100% -high level of certainty, data indicates a decline within this range</p> <p><input type="checkbox"/> 99–100% - very high level of certainty, data is accurate within this range</p>

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

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

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

<p>Past extent of occurrence is estimated to be in the range of:</p> <p><input type="checkbox"/> <100 km² <input type="checkbox"/> 100 – 5 000 km² <input type="checkbox"/> 5 001 – 20 000 km² <input type="checkbox"/> >20 000 km²</p>
<p>Level of your confidence in this estimated extent of occurrence</p> <p><input type="checkbox"/> 0–30% - low level of certainty/ a bit of a guess/ not much data to go on</p> <p><input type="checkbox"/> 31–50% - more than a guess, some level of supporting evidence</p> <p><input type="checkbox"/> 51–95% - reasonably certain, data suggests this range of decline</p> <p><input type="checkbox"/> 95–100% -high level of certainty, data indicates a decline within this range</p> <p><input type="checkbox"/> 99–100% - very high level of certainty, data is accurate within this range</p>

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

<p>Past area of occupancy is estimated to be in the range of:</p> <p><input type="checkbox"/> <10 km² <input type="checkbox"/> 11 – 500 km² <input type="checkbox"/> 501 – 2000 km² <input type="checkbox"/> >2000 km²</p>
<p>Level of your confidence in this estimated extent of occurrence:</p>

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

Change in status/rate of change

15. Does the current and predicted rate of decline seem reasonable? Do you consider that the way this has been derived is appropriate? If not, please provide justification of your response.

General

16. Can you provide additional data or information relevant to this assessment?
17. Have you been involved in developing this nomination? If so, in what capacity?

Threats

18. Do you agree that the threats listed are correct and that their effect on the subspecies is significant?
19. To what degree are the identified threats likely to impact on the subspecies in the future?
20. What threats are impacting on different populations, how variable are the threats and their effects on the different populations? Please provide evidence and background information.
21. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this subspecies at any stage of its life cycle?
22. Is inbreeding a potential threat to the subspecies?
23. Can you provide supporting data/justification or other information for your responses to these questions about threats?

Management

24. What planning, management and recovery actions are currently in place supporting protection and recovery of the subspecies? To what extent have they been effective?
25. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the subspecies?
26. Do you think it is possible to create habitat in suburban areas?
27. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the subspecies?

References cited in the advice

- Braby MF (1990). The life history and biology of *Paralucia pyrodiscus lucida* Crosby (Lepidoptera: Lycaenidae). *Journal of the Australian Entomological Society* 29: 41–50.
- Braby MF (2000). *Butterflies of Australia: their identification, biology and distribution*. CSIRO Publishing, Collingwood, Victoria.
- Braby MF, Van Praagh BD and New TR (1999). The dull copper, *Paralucia pyrodiscus* (Lycaenidae). In 'Biology of Australian Butterflies' (eds RL Kitching, E Scheermeyer, RE Jones and NE Pierce). CSIRO Publishing. Collingwood Australia.
- Canzano A (2013). Eltham copper butterfly larvae and adult monitoring 2012/2013 at eleven sites in Eltham, Victoria. Final report. Ecology and Heritage Partners Pty Ltd, Ascot Vale, Victoria.
- Common IFB and Waterhouse, DF (1981). *Butterflies of Australia*, revised edition. CSIRO Publishing, East Melbourne.
- IUCN (International Union for Conservation of Nature) (2001). *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- IUCN (International Union for Conservation of Nature) (2012). *IUCN Red List Categories and Criteria: Version 3.1 Second edition*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- New TR, Van Praagh BD and Yen AL (2000). Fire and the management of habitat quality in an Australian lycaenid butterfly, *Paralucia pyrodiscus lucida* Crosby, the Eltham copper. *Metamorphosis* 11(3): 154-163.
- Sands DPA and New TR (2002). *The action plan for Australian butterflies*. Environment Australia, Canberra.
- Vaughan PJ (1988) *Management plan for the Eltham Copper Butterfly*. ARI Technical Report Series No. 79, Department of Conservation, Forests and Lands, Victoria.

Other sources cited in the advice

- Atlas of Living Australia (2015). *Bursaria spinosa* subsp. *spinosa*.
Viewed 29 October 2015
Available on the Internet at:
<http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:apni.taxon:375264>
- Borton K (2014). Personal communication by email, 9 April 2014, Nillumbik Shire Council.
- Borton K (2015). Personal communication by email, 3 August 2015, Nillumbik Shire Council.
- DSE (Victoria Department of Sustainability and Environment (2003). *Flora and Fauna Guarantee Action Statement: Eltham Copper butterfly, *Paralucia pyrodiscus lucida**.
Viewed 7 August 2015
Available on the Internet at:

http://www.depi.vic.gov.au/_data/assets/pdf_file/0018/250065/Eltham_Copper_Butterfly_Paralucia_pyrodiscus-lucida.pdf

ERIN (Environmental Resources Information Network) (2015). Personal communication by email, 10 September 2015.

Mays C (2015). Personal communication by email, 15 September 2015, Nillumbik Shire Council.

Nillumbik Shire Council (2011). Eltham Copper butterfly Reserves.

Viewed: 5 August 2015

Available on the Internet at:

http://www.nillumbik.vic.gov.au/Environment/Natural_Environment/Copy_of_Bushland_Reserves_and_Wetlands_2/Eltham_Copper_Butterfly_Reserves