

**Assessing the effectiveness of *Forest Practices Code*
provisions for the threatened chaostola skipper
*Antipodia chaostola leucophaea***

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FPA field training day ‘Butterfly habitat identification and conservation for forest planners and ecological consultants’ – Examining chaostola skipper larval shelter in tall sawsedge at Peter Murrell State Reserve

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Cover Photo

Chaostola skipper habitat in *Eucalyptus amygdalina* forest on dolerite at Hop Pole Bottom

Contents

1	SUMMARY	2
2	BACKGROUND	4
2.1	Conservation status	4
2.2	Description and taxonomy	4
2.3	Life history.....	5
2.4	Distribution	6
2.5	Habitat.....	7
2.6	Population biology and abundance	7
2.7	Aim of the current study	8
3	METHODS	9
4	RESULTS	12
4.1	Descriptions of new sites	12
4.1.1	Huonville	12
4.1.2	Ranelagh	13
4.1.3	Lenah Valley	13
4.1.4	Hop Hole Bottom.....	14
4.1.5	Freycinet	15
4.1.6	Bay of Fires.....	17
4.1.7	Mount William.....	18
5	DISCUSSION.....	23
6	RECOMMENDATIONS	25
7	REFERENCES	26
8	APPENDIX	27
8.1.1	Project Brief: Systematic survey of potential habitat within the potential range of chaostola skipper <i>Antipodia chaostola leucophaea</i>	27

1 Summary

- Little is known of the conservation ecology and distribution of chaostola skipper in Tasmania. Consequently, surveys of the range and habitat of the species were identified as a priority project by the Forest Practices Authority for monitoring the effectiveness of the biodiversity provisions of the forest practices system.
- The current potential range for chaostola skipper used in forest practices planning covers an extensive area along the east coast to Huonville, and along the north coast as far west as the Tamar valley. The inland extent of the potential range boundary reflects historic locality records of chaostola skipper and locality records of its key food plants, *Gahnia radula* (thatch sawsedge) and *G. microstachya* (slender saw sedge).
- The aim of the current project was to conduct a systematic survey for chaostola skipper in potential habitat throughout its potential range, and to gather additional information on the species' ecology to inform the development of appropriate management prescriptions for the forest practices system. The project was funded by the FPA in 2016–17.
- Until recently, chaostola skipper was known from only a few small and isolated locations in southeast Tasmania. However, in 2016 the species was discovered during a routine assessment of a proposed forest practices plan (FPP) at Bridport, 100 km outside its known range. This prompted a more systematic approach to survey for chaostola skipper across its potential range in Tasmania.
- To guide surveys for chaostola skipper, a simple habitat and distribution map was developed from locality records of the species, locality records of its foodplants, and the distribution of associated vegetation types. Fortunately chaostola skipper can be identified at any time of the year, not just when adults are flying, as the caterpillars build characteristic shelters in the foodplant that are present year round.
- A survey for chaostola skipper was conducted in July and August 2017 and involved searching in potential habitat on roadsides and on public land throughout the potential range of the species.
- The present survey substantially increased the number of known colonies and the known range of chaostola skipper. Chaostola skipper was rediscovered at Huonville and Hop Pole Bottom, and new locations were discovered at Ranelagh, Freycinet Peninsula, Binalong Bay and Mount William.
- Chaostola skipper was also found to occupy a broader range of vegetation types than previously thought, though most new locations supported habitat typical of its foodplants, *G. radula* and *G. microstachya*. Most new records were in *Eucalyptus amygdalina* coastal forest and woodland, on sands and gravels or on granite.
- Results of the survey suggest that chaostola skipper is more common across its range and more persistent at known sites than previously thought. This may reflect the apparent 'boom and bust' cycle suggested by some authors.

Recommendations

Management of chaostola skipper via the procedures agreed between FPA and DPIPW

Range and habitat descriptions

- Extend the core range of chaostola skipper to reflect the current extent on known colonies.
- Retain the current potential range boundary for chaostola skipper used in forest practices planning as it now more closely reflects the known range boundary for the species.
- Revise the description of potential habitat for chaostola skipper used in forest practices planning to include additional vegetation types where the species has now been found, particularly *Eucalyptus amygdalina* coastal forest and woodland (DAC), and any location supporting the foodplants, *Gahnia radula* and *G. microstachya*.

TFA management recommendations

- Request specialist surveys for chaostola skipper for proposed FPPs that involve clearance and conversion of potential habitat with the aim to protect habitat supporting the foodplants, *Gahnia radula* and *G. microstachya* within and around known colonies.
- Manage chaostola skipper in FPPs for plantation and native forestry by managing the cover of its foodplants, *Gahnia radula* and *G. microstachya* at the FPP level and where practical considering the cover and distribution of potential habitat at the broader landscape level.

Training

- The key to managing chaostola skipper within the forest practices system is to correctly identify the presence of its foodplants *Gahnia radula* and *G. microstachya* during the FPP planning process. Ensure that forest planners and ecological consultants can identify chaostola skipper potential habitat by continuing to provide specialist advice and practical training opportunities through the forest practices system.

Surveys

- Based on the results of the current survey it is likely chaostola skipper also occurs in the Furneaux Group and opportunistic searches for the species on the Furneaux islands is recommended.

2 Background

2.1 Conservation status

Tasmanian chaostola skipper *Antipodia chaostola leucophaea* (chaostola skipper) was listed as Endangered in 1995 under the Tasmanian *Threatened Species Protection Act 1995*. The reason for listing was a 'restricted distribution, low population density and degradation of sites causing population decline' (Invertebrate Advisory Committee 1994). The species was listed as Endangered in 2009 under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as its 'geographic distribution is restricted, and precarious for its survival given the nature of ongoing threats' (TSSC, 2009).

2.2 Description and taxonomy

Chaostola skipper *Antipodia chaostola leucophaea* belongs to the family HesperIIDae, a family of butterflies that include the skippers, flats, awls and darts. This family represents about a third of the total Australasian butterfly fauna, with some 77 species, many of which are endemic. Most species have limited distributions and specific habitat preferences, forming localised and sedentary colonies, mainly along the Australian eastern coast and mountains. The adults are mainly small to medium sized and dull brown in colour. The genus *Antipodia* contains three endemic species (Braby 2000).

The adult male chaostola skipper has a wingspan of about 32 mm and the female about 35 mm. The colour and patterning of the wings is shown in Figure 1.



Figure 1. Chaostola skipper *Antipodia chaostola*: a, ssp. *chares* (Victoria); b ssp. *chaostola* (NSW). Photo courtesy of Michael F. Braby.

The egg is about 1.4 mm wide, pale green to white, reddish-brown at the apex, and hemispherical to ellipsoid in shape. The larva is about 29 mm long with a yellow body and a faint grey middorsal line. The prothorax is red and the head brown-black with a prominent pale brown dorsolateral band and long white setae. The pupa is about 23 mm long, black, with the surface partly covered with a white waxy powder and without stiff posterior setae. The pupal cap is rounded and the surface is sculptured with two small raised areas. The cremaster has brown hooked spines (Atkins 1984; Braby 2000).



Figure 2. Young larva of chaostola skipper feeding in *Gahnia microstachya*.



Figure 3. Sloughed larval skin of chaostola showing characteristic head capsule with striped colouring and long white hairs.

2.3 Life history

The usual life cycle of chaostola skipper lasts two years (Atkins 1984). This feature of the life cycle is shared with other members of the genus but no other Australian skippers (Wainer and Yen 2009). In Victoria, pupae and young larvae have been observed in consecutive years indicating chaostola skipper flies each year (Atkins 1984). The adult flying period is October and November, although specimens have also been observed in September and December. Males are active in warm sunny still conditions. They fly in sunlit areas over the foodplant. Females appear to be less active than males and usually fly closer to the ground. As the immature stages appear to be widely and thinly dispersed it is thought that adults may fly some distance to locate the opposite sex (Wainer and Yen 2009). Both sexes have been observed to feed from flowers of *Leptospermum* spp. (tea-tree) and *Pimelea* spp. (riceflower) (Braby 2000).

It is probable females fly many kilometres in search of suitable foodplants in appropriate habitat (Wainer and Yen 2009). Adult females appear to favour young plants or regrowth following bushfires for oviposition (Atkins 1984).

The foodplants for larvae in Tasmania are *Gahnia radula* (thatch sawsedge) and *G. microstachya* (slender sawsedge). Larval shelters have occasionally been found on *G. grandis* (cutting grass) but only when the species is in proximity to *G. radula* (TSS 2012).

Eggs are usually laid in October and November and larvae develop slowly over the following 12 months. The larval stage lasts up to 20 months or more. During the second winter larvae do not feed but appear to remain quiescent from about March to August. Pupation occurs in August and adults emerge 4 to 7 weeks later (Braby 2000).

Young larvae are easily recognised by their pale, striped head with long hairs, bright red prothorax and habit of resting head downwards in shelters made from tightly bound *Gahnia* leaf tips. Each larva normally constructs three shelters as it grows (Wainer and Yen 2009). Mature larvae construct strong conical or tent-like shelters near the base of the plant. Pupation is head downwards within these shelters. Larvae are usually solitary with one on each plant, but may occur together with *Hesperilla donnysa* larvae. They are often heavily parasitised or diseased (Atkins 1984).

2.4 Distribution

The distribution of chaostola skipper (*Antipodia chaostola chaostola*) in NSW is restricted to the Blue Mountains between Lithgow, Newnes, Blackheath and Katoomba. The foodplant is usually *Gahnia filifolia* but sometimes *G. sieberiana* is used (Sands and New 2002).

Chaostola skipper (*Antipodia chaostola chares*) in Victoria has a restricted and disjunct distribution from the Grampians to east of Melbourne. The foodplant is mostly *G. radula* but also *G. microstachya* and *G. sieberiana* (Sands and New 2002).

Prior to listing on the *Threatened Species Protection Act 1995*, chaostola skipper was known to be extant at only a few sites in south-eastern Tasmania including Conningham, Mt Nelson and Hop Pole Bottom. Over the following 20 years the species was discovered at several other localities including Grassree Hill, Little Swanport and Coles Bay, and rediscovered at Kingston (Bell 2005). In 2016 chaostola skipper was found at Bridport on the northeast coast, about 100 km from the nearest known locality at Freycinet Peninsula (Map 1).

Earliest records of chaostola skipper in Tasmania are from Huonville, 1899 (later recorded from a single specimen in 1902 and a single specimen in 1942), Hobart 1915, Snug River (undated) and Bicheno 1945. In the 1950s the species was located at Kingston and Knocklofty but could not be found at Huonville, and the solitary record from Bicheno in 1945 could not be confirmed (Couchman and Couchman 1977). At the time Couchman and Couchman (1977) considered the species 'extremely local in its distribution' and lost at Kingston due to encroachment of housing.

Douglas (1984) commented that 'searching of Mount Knocklofty has not revealed the existence of a colony there in recent years' and that 'housing and fire may have eliminated it'. Despite urban settlement he did record chaostola skipper at Kingston in 1980, 1981 and 1982, though considered that 'it does not occur in any numbers'. In the face of ongoing urban development he considered 'the future of the Kingston colony exceedingly tenuous'. Douglas (1984) found the species on Sheppards Hill at Coningham and collected specimens in 1981 and 1982. He noted at the time that the colony 'is not threatened by housing development, but is in an area which frequently suffers bushfires'. McQuillan collected an adult specimen from Old Coach Road, west of Bicheno and specimens from Mt Nelson in 1992 (Neyland 1994; Neyland and Bell 2000). Braby (2000) noted that a breeding colony of chaostola skipper was 'discovered recently' on Freycinet Peninsula, 30 km south of Bicheno. The species was found in 2003 south of Coles Bay in Freycinet National Park while surveying for a proposed development nearby (Bell 2005), and in 2006 north of Coles Bay in Freycinet Conservation Area (DAYoung pers. comm.). Chaostola skipper was rediscovered at Kingston in Peter Murrell State Reserve in 2004 during assessment of a proposed FPP nearby and in 2005 in a proposed FPP for clearance and conversion on private land adjacent to Coningham Nature Recreation Area (Bell 2005).

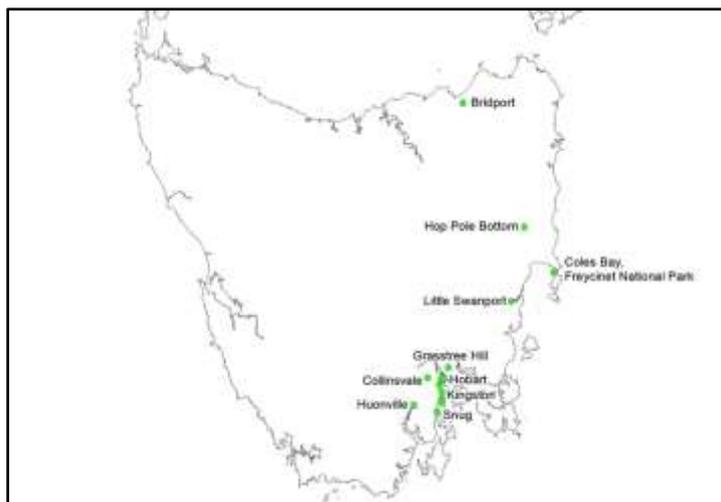


Figure 4. Records of chaostola skipper as at May 2017.

In 2012 the Threatened Species Section, DPIPWE undertook surveys for chaostola skipper across the Kingborough Municipality (TSS 2012). Prior to these surveys the known distribution of the species in the municipality included Coningham (close to Old Station Road), Peter Murrell State Reserve and two sites in the heart of Kingston, Hawthorn Drive and Celery Top Drive (at the time the Celery Top Drive site was thought to have been destroyed by land clearing). The surveys confirmed the presence of chaostola skipper at Hawthorn Drive and Peter Murrell State Reserve but failed to relocate the species at Coningham. However, the survey extended the species range within the Peter Murrell reserves, 800 m west and 1100 south-east of the original records, and to a new site at Coningham, 500 m from the original records (TSS 2012).

2.5 Habitat

At Coningham (on private land and within the Coningham Nature Recreation Area), chaostola skipper was found on *G. radula* in *Eucalyptus amygdalina* forest and woodland on sandstone (DAS) and *E. obliqua* dry forest (DOB) and *E. tenuiramis* forest and woodland on sediments (DTO).

At Little Swanport the habitat is *E. amygdalina* forest and woodland on sandstone (DAS) and *E. globulus*-*A. mearnsii* forest on sandstone (probably DGL). South of Coles Bay in Freycinet National Park the vegetation is *E. tenuiramis* forest and woodland on granite (DTG) and north of Coles Bay, Young D. A. (pers. comm.) described the location as *Allocasuarina*, over *Lepidosperma* and *Lomandra* with foodplants *G. radula* and *G. microstachya*, presumably on granite and probably DTG.

A detailed assessment of the extent of the foodplant *Gahnia radula* in the Kingborough Municipality by the Threatened Species Section, DPIPWE in 2012 found the species was coastal up to 150 m a.s.l. and within 2.7 km of the coast. The species was mostly on sandstones and siltstones, but also Permian sediments, Tertiary non-marine sediments and Tertiary silicstones, and across a range of vegetation community types including *E. amygdalina* forest and woodland on sandstone (DAS), *E. obliqua* dry forest (DOB), *E. tenuiramis* forest and woodland on sediments (DTO) and *E. amygdalina* coastal forest and woodland (DAC). *Gahnia radula* appeared to prefer sunny northern slopes and ridgelines, but occurred more sparsely on other aspects and in relatively moist conditions such as shallow drainage lines and margins of wet scrubs. In the Kingborough Municipality *G. radula* appeared to have been reduced to about 20% of its original extent and in the northern Kingston area to less than 5% (TSS 2012).

2.6 Population biology and abundance

Atkins (1984) considered that in Victoria adults of chaostola skipper are rarely observed, butterflies are patchily distributed and restricted to small preferred discrete sites, and that repeated exhaustive wanderings are often required to locate colonies (Atkins 1984).

Wainer and Yen (2009) state that in NSW natural fluctuations in adult numbers of chaostola skipper occur because of interactions of fire and parasitoids. Juveniles are naturally attacked heavily by parasitoids. After fires when foodplants have regenerated, adults recolonise from unburnt areas and are temporarily able to increase in abundance due to low densities of natural enemies, mostly parasitoids.

Thereafter, the abundance subsides to low numbers until the next fire (Wainer and Yen 2009). Sands and New (2002) note that chaostola skipper is renowned for its 'boom and bust' cycles and rarity between these periods of abundance. They also suggested increased abundance of chaostola skipper following fire.

2.7 Aim of the current study

The current potential range for chaostola skipper, as agreed by the FPA and DPIWWE for the purposes of planning within the forest practices system, covers an extensive area in Tasmania. The potential range extends along the east coast from Huonville, along the north coast as far as the Tamar River, and on the Furneaux Islands. The application of such a large potential range is the result of a precautionary approach in the absence of dedicated and systematic surveys for this species.

The aim of the current project was to conduct a systematic survey for chaostola skipper to better determine the actual range and the extent of potential habitat, and to gather additional information on the species' ecology to inform the development of appropriate management prescriptions for the forest practices system.

3 Methods

A crude habitat and distribution map was constructed from information associated with known records of chaostola skipper (Figure 4), TASVEG vegetation types associated with locality records (Figure 6), and the distribution of the key foodplants of the species, *Gahnia radula* (Figure 7) and *G. microstachya* (Figure 8). Information was compiled from several sources including the Natural Values Atlas (DPIPWE 2017), published and unpublished literature, and personal observations.

The habitat and distribution map was used to guide a survey for chaostola skipper within its current potential range. Roadside searches were conducted in suitable habitat from 3 to 4 July, 13 to 16 July, and 4 to 7 August 2017. In total, fifty-seven sites supporting one or both of the foodplants, *Gahnia radula* and *G. microstachya*, across the range of the foodplants in Tasmania, were searched for chaostola skipper (Figure 9).

Searching involved the examination of foodplants for larval shelters that are characteristic of chaostola skipper. One shelter at Huonville supporting a tiny larva in *Gahnia radula*, one shelter at Binalong Bay supporting a larva in *G. radula* (Figure 5), and one shelter at Hop Pole Bottom in *G. microstachya* supporting a large larva (Figure 16) was unfurled sufficiently to confirm the species as chaostola skipper. No other shelters were disturbed during the survey. All other determinations of chaostola skipper were based on the structure of the larval shelter and were considered to be made with a high degree of confidence.



Figure 5. Examination of characteristic larval shelter in *G. radula* at Binalong Bay to confirm the species as chaostola skipper *Antipodia chaostola leucophaea*. Distinctive features of the larva include orientation with head downwards, yellowish body, red segment directly behind head and long white setae on the head capsule.



Figure 6. Distribution of TASVEG forest communities associated with chaostola skipper records i.e. *E. amygdalina* or *E. tenuiramis* dominated forest communities on sediments or granite (Source: TASVEG 3, DPIPWE 2017).

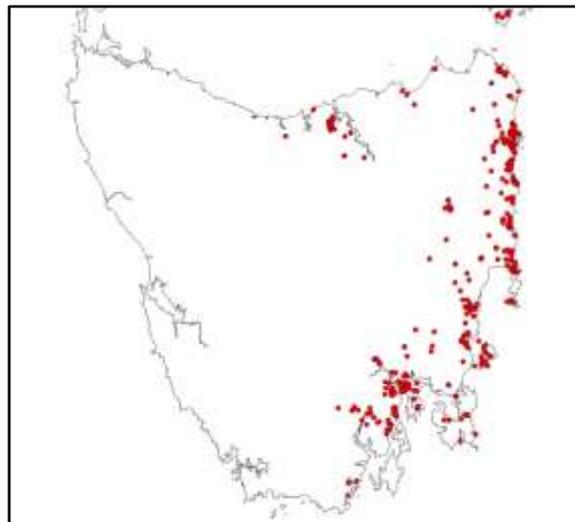


Figure 7. Records of *Gahnia radula* in Tasmania (Source: Natural Values Atlas, DPIPWE 2017). Distribution of *Gahnia radula* in Tasmania is coastal, rarely extending inland, on infertile substrates such as soils derived from mudstones, siltstones, granites and Aeolian sands. It is rare on dolerite and only when it is abundant on nearby poorer soils. At sites that are frequently burnt *G. radula* can dominate the understorey (Neyland and Bell 2000).

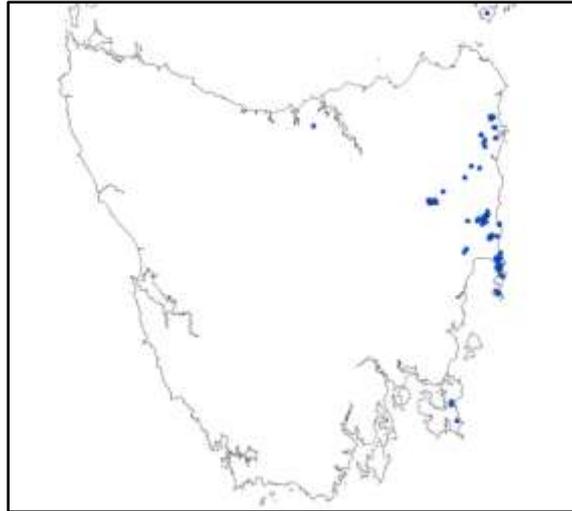


Figure 8. Records of *Gahnia microstachya* in Tasmania (Source: Natural Values Atlas, DPIPWE 2017). The distribution of *Gahnia microstachya* in Tasmania is dryish situations in open woodland, frequently among granite boulders or on granite derived sands, coastal and near coastal areas to c. 450 m a.s.l., on east coast (Curtis and Morris 1994).

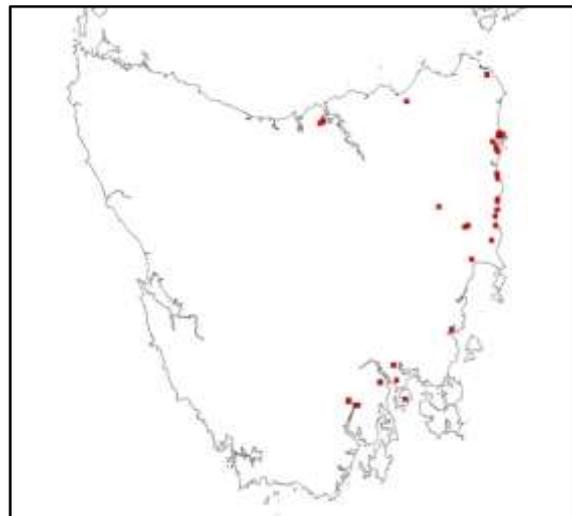


Figure 9. Locations of search sites for chaostola skipper, July and August 2017.

4 Results

Chaostola skipper was found at seven of the 57 sites (i.e. 13%) that were searched in this study. These included five new locations (Mount William, Bay of Fires, Apsley River, Lenah Valley and Ranelagh), and two rediscovered locations (Hop Pole Bottom and Huonville) (Figure 10).

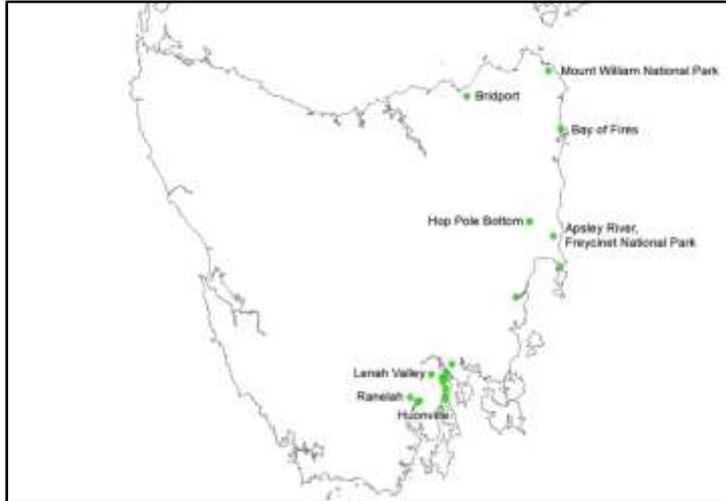


Figure 10. New locations and rediscovered locations of chaostola skipper July and August 2017 (Includes Bridport location discovered in 2016).

4.1 Descriptions of new sites

4.1.1 Huonville

Chaostola skipper (larval shelters) was found in a tiny clump of *Gahnia radula* in a road reserve on Knights Road, Huonville (Figure 11). TASVEG mapping for the site is FAG (Agricultural Land) and the geological mapping is Jurassic dolerite. The site is less than 300 m from Triassic Sandstone and Permian mudstone, occurring mainly in cleared agricultural and residential land. This new record of chaostola skipper is only 2 km from an historical record of the species (estimated accuracy of historic record = 5 km). Chaostola skipper was originally recorded from Huonville in 1899, later recorded from a single adult specimen in 1902 and a single adult specimen in 1942. Searches in the 1950s failed to find the species and it was thought to be extinct at Huonville due to land clearing for agricultural and residential development. The location of the new record is a remnant roadside clump of *G. radula* adjacent to improved pasture. Based on NVA records of *G. radula* and the presence of suitable vegetation communities near the new record it is likely chaostola skipper is distributed more widely in the local area. Potential habitat is present in Sherwood Conservation Area to the east, and on private land to the north of the new record.



Figure 11. Location of new record of chaostola skipper on Knights Road, **Huonville** (Yellow triangle = new record of chaostola skipper; White star = historic record of adult chaostola skipper with accuracy estimated at 5 km; Red circles = NVA records of *Gahnia radula*; Yellow boundary = Sherwood Hill Conservation Area; Scale = 1:12,500).

4.1.2 Ranelagh

Chaostola skipper (single larval shelter) was found in *Gahnia radula* within the roadside reserve on Browns Road, 2.7 km west of Ranelagh (Figure 12). TASVEG mapping for the site is DOB (*Eucalyptus obliqua* dry forest) and the geological mapping is Permian mudstone. Field notes indicate the vegetation at the site is DTO (*Eucalyptus tenuiramis* forest on sediments) and an extensive area surrounding the location, including State forest to the north, is mapped as Permian mudstone. Field notes also indicate that much of the forest adjacent to the road within the State forest block is DTO. Based on this information it is likely that chaostola skipper occurs more widely in the local area on both State forest and private land.



Figure 12. Location of new record of chaostola skipper on Browns Road west of **Ranelagh** (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea*; Red circle = NVA record of *Gahnia radula*; Yellow boundary = State forest; Scale = 1:12,500).

4.1.3 Lenah Valley

Chaostola skipper (larval shelters) was found in *Gahnia radula* adjacent to a Hobart City Council road near the southern end of Pottery Road (Figure 13). TASVEG mapping for the site is DTO (*Eucalyptus tenuiramis* forest and woodland on sediments) and the geological mapping is Permian mudstone. Field notes indicate the vegetation at the site is DTO (*Eucalyptus tenuiramis* forest on sediments) and an

extensive area surrounding the location is mapped as Permian mudstone. It is likely chaostola skipper occurs more widely in the area.



Figure 13. Location of new record of chaostola skipper near Pottery Road, **Lenah Valley** (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea*; Red circles = NVA records of *Gahnia radula*; Scale = 1:12,500).

4.1.4 Hop Pole Bottom

Chaostola skipper (larval shelters) was found in *Gahnia microstachya* within the Swan River Forest Reserve east of Old Coach Road at Hop Pole Bottom (Figure 14). TASVEG mapping for the site is DAD (*E. amygdalina* forest and woodland on dolerite) and the geological mapping is Jurassic dolerite. Field notes indicate the vegetation at the site is DAD (*E. amygdalina* forest on dolerite). Note that the vegetation at the site is unusual for chaostola skipper comprising a shared dominance between *E. amygdalina* and *E. pulchella*, a heathy understorey with abundant *Xanthorrhoea australis* (grasstree) and occasional patches of *G. microstachya* on a dolerite substrate (Figure 15). It is likely that *G. microstachya* and therefore chaostola skipper has a restricted distribution around Hop Pole Bottom reflecting the scant records of the foodplant and the limited extent of this unusual vegetation type in the area.



Figure 14. Location of new record of chaostola skipper at **Hop Pole Bottom** (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea*; White star = historic record of adult chaostola skipper, accuracy estimated from 100 m to 5 km, year of observation 1992; Red triangle = NVA record of *Gahnia microstachya*; Yellow boundary = State forest and Swan River Forest Reserve; Scale = 1:12,500).



Figure 15. Chaostola skipper habitat at Hop Pole Bottom i.e. *Eucalyptus amygdalina* forest on dolerite (DAD). The canopy dominance is shared with *E. pulchella* and the understorey is heathy with abundant *Xanthorrhoea australis*. *Gahnia microstachya* occurs as occasional clumps.

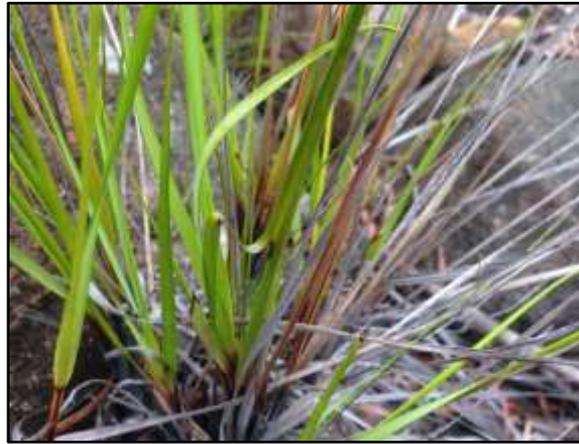


Figure 16. Chaostola skipper larval shelter in *Gahnia microstachya* at Hop Pole Bottom

4.1.5 Freycinet

Chaostola skipper (larval shelters) was found in *Gahnia microstachya* adjacent to Coles Bay Road, south of Apsley River in Freycinet National Park (Figure 17). TASVEG mapping for the site is DAD (*E. amygdalina* forest and woodland on dolerite) and the geological mapping is Jurassic dolerite. Field notes indicate the vegetation at the site is DAC (*E. amygdalina* coastal forest and woodland) and the substrate as granitic sands (Figure 18). There are several NVA records of *G. microstachya* and extensive TASVEG mapping of DAS and DAC locally suggesting that chaostola skipper could be more widely distributed in the area and south onto Freycinet Peninsula.



Figure 17. Location of new record of chaostola skipper near **Apsley River** in Freycinet National Park (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea* record; Red triangles = NVA records of *Gahnia microstachya*; White hatching = TASVEG mapping of *Eucalyptus amygdalina* forest and woodland on sandstone (DAS), *E. amygdalina* coastal forest and woodland (DAC) and *E. tenuiramis* forest and woodland on granite (DTO); Yellow boundary = Freycinet National Park and Moulting Lagoon Game Reserve; Scale = 1:12,500).



Figure 18. Chaostola skipper habitat south of Apsley River in Freycinet National Park i.e. *Eucalyptus amygdalina* coastal forest (DAC).



Figure 19. Chaostola skipper larval shelter in *Gahnia microstachya* south of Apsley River in Freycinet National Park.

4.1.6 Bay of Fires

Chaostola skipper (larval shelters) was found in *Gahnia radula* adjacent to The Gardens Road at Binalong Bay in Bay of Fires Conservation Area (Figure 20). TASVEG mapping for the site is DAC (*E. amygdalina* coastal forest and woodland) and the geological mapping is Quaternary sands and gravel. Field notes indicate the vegetation at the site is DAC (*E. amygdalina* coastal forest and woodland) and the substrate is granite (Figure 21). There are several NVA records of *G. radula* in the vicinity and extensive areas of vegetation mapped as DAC suggesting that the distribution of chaostola skipper could be broader in the area.



Figure 20. Location of new record of chaostola skipper adjacent to The Gardens Road at **Binalong Bay** in Bay of Fires Conservation Area (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea*; Red circles = NVA records of *Gahnia radula*; White hatching = TASVEG mapping of *Eucalyptus amygdalina* forest and woodland on sandstone (DAS), *E. amygdalina* coastal forest and woodland (DAC) and *E. tenuiramis* forest and woodland on granite (DTO); Yellow boundary = Bay of Fires Conservation Area, Humbug Point Recreation Area and Mount Pearson State Reserve; Scale = 1:12,500).



Figure 21. Chaostola skipper habitat at Binalong Bay in Bay of Fires Conservation Area i.e. *Eucalyptus amygdalina* coastal forest (DAC).



Figure 22. Chaostola skipper larval shelter in *Gahnia radula* at Binalong Bay in Bay of Fires Conservation Area.

4.1.7 Mount William

Chaostola skipper (larval shelters) was found in *Gahnia radula* adjacent to **Mount William** National Park (Figure 23). TASVEG mapping for the site is DAC (*E. amygdalina* coastal forest and woodland) and the geological mapping is Devonian granite. Field notes indicate the vegetation at the site is DAC (*E. amygdalina* coastal forest) and the substrate is granite. There are several NVA records of *G. radula* in the area as well as TASVEG mapping of DAC suggesting that the distribution of chaostola skipper could be broader in the Mount William area.

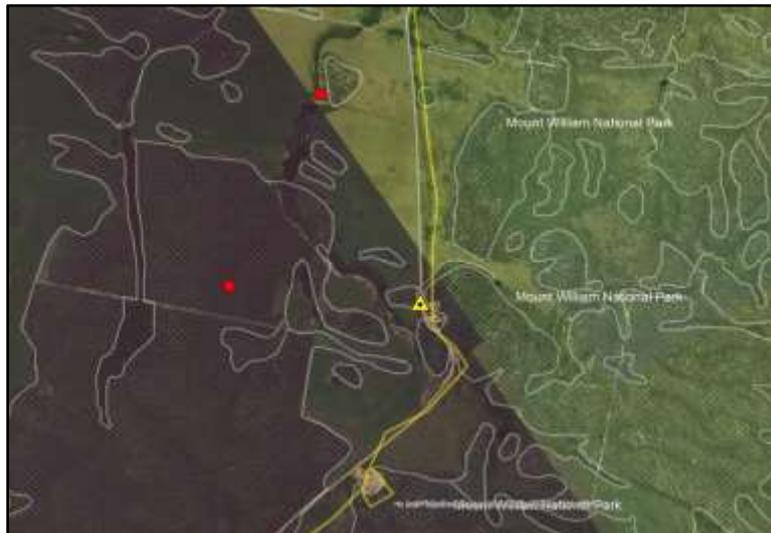


Figure 23. Location of new record of chaostola skipper on Musselroe Road adjacent to Mount William National Park (Yellow triangle = new record of chaostola skipper *Antipodia chaostola leucophaea*; Red circles = NVA records of *Gahnia radula*; White hatching = TASVEG mapping of *Eucalyptus amygdalina* forest and woodland on sandstone (DAS), *E. amygdalina* coast forest and woodland (DAC) and *E. tenuiramis* forest and woodland on granite (DTO); Yellow boundary = Mount William National Park; Scale = 1:12,500).



Figure 24. Chaostola skipper larval shelter in slashed *Gahnia radula* on Musselroe Road adjacent to Mount William National Park.

The location, habitat and foodplants of chaostola skipper at each known locality found in this study and in previous surveys are summarised in Table 1.

Table 1. Location, habitat and foodplants of chaostola skipper in Tasmania

Location	NRM region/LGA	Year observed (observer)	Year last observed	Habitat Foodplant Extent of foodplant
Tenure	Bioregion			
Huonville private land	South/Huonville Southern Ranges	1899, 1902 (unknown); 1942 (Couchman)	2017 (Bell)	Not recorded (shelters in remnant roadside clump of <i>Gahnia</i>) <i>G. radula</i>
Ranelagh private land	South/Huonville Southern Ranges	2017 (Bell)	2017 (Bell)	<i>E. tenuiramis</i> forest on mudstone (DTO) <i>G. radula</i>
Coningham Coningham Nature Recreation Area, private land	South/Kingston South East	1981, 1982 (Douglas); 1994 (Neyland); 2004 (Bell)	2012 (Richards, Schahinger)	Heathy/sedgey <i>E. amygdalina</i> forest on sandstone (DAS); <i>E. obliqua</i> dry forest on sandstone (DOB). <i>G. radula</i>
Snug River Probably private land	South/Kingston South East	Undated but early record (Unknown)	Undated but early record (Unknown)	Unknown Probably <i>G. radula</i> (outside range of <i>G. microstachya</i>)
Kingston Peter Murrell State Reserve and Conservation Area, Kingborough Council, private land	South/Kingston South East	1950s (Couchman); 1980, 1981, 1982 (Douglas); 2004, 2006, 2009 (Bell) 2012 (Richards, Schahinger) Celery Top Drive 2008 (North, Barker) Hawthorn Drive (Welling)	2017 (Bell)	Heathy/sedgey <i>E. amygdalina</i> forest on sandstone (DAS); <i>E. obliqua</i> dry forest on sandstone (DOB) <i>G. radula</i>
Mt Nelson, Hobart	South/Hobart	1992 (McQuillan)	1992	Not recorded

Location Tenure	NRM region/LGA Bioregion	Year observed (observer)	Year last observed	Habitat Foodplant Extent of foodplant
Probably private land	South East		(McQuillan)	Probably <i>G. radula</i> (outside range of <i>G. microstachya</i>)
Knocklofty, Hobart Hobart City Council, private land	South/Hobart South East	1950s (Couchman); 2006 (Bell)	2017 (Bell)	Heathy/sedgely <i>E. amygdalina</i> forest on sandstone (DAS) <i>G. radula</i>
Lenah Valley Hobart City Council	South/Hobart South East	2017 (Bell)	2017 (Bell)	Sedgely <i>E. tenuiramis</i> forest on mudstone (DTO) <i>G. radula</i>
Grasstree Hill private land	South/Clarence South East	2013 (Richards, Spencer)	2013 (Richards, Spencer)	Sedgely <i>E. tenuiramis</i> forest on mudstone (DTO) <i>G. radula</i>
Little Swanport Private Land Reserve	South/Glamorgan Spring Bay South East	2002 (Bell)	2002 (Bell)	Sedgely <i>E. globulus</i> forest on sandstone (DGL) <i>G. radula</i>
Coles Bay South Freycinet National Park	South/Glamorgan Spring Bay South East	c. 2000 (Crosby); 2003 (Bell); 2012 (Bell, Richards); 2016 (Wapstra); 2017 (Bell)	2017 (Bell)	Heathy/sedgely <i>E. tenuiramis</i> forest on granite (DTG) <i>G. radula</i> , <i>G. microstachya</i>
Apsley River Freycinet National Park	South/Glamorgan Spring Bay South East	2017 (Bell)	2017 (Bell)	Heathy/sedgely <i>E. amygdalina</i> forest on granite (DAC) (<i>Banksia marginata</i> , <i>Allocasuarina littoralis</i> <i>Hibbertia</i> sp. and <i>Lepidosperma concavum</i> common). Burnt recently. <i>G. microstachya</i>

Location	NRM region/LGA	Year observed (observer)	Year last observed	Habitat
Tenure	Bioregion			Foodplant Extent of foodplant
Bicheno Probably private land	South/Glamorgan Spring Bay	1945 (Couchman)	1945 (Couchman)	Unknown Unknown
Hop Pole Bottom Swan River Forest Reserve	North/Northern Midlands Northern Midlands	1992 (McQuillan)	2017 (Bell)	Heathy/sedgey <i>E. amygdalina</i> / <i>E. pulchella</i> forest on dolerite (DAD) (<i>Leptospermum grandiflorum</i> , <i>Lepidosperma laterale</i> , <i>L. inops</i> and <i>Acacia genistifolia</i> common) <i>G. microstachya</i>
Binalong Bay Bay of Fires Conservation Area	North/ Break O Day Flinders	2017 (Bell)	2017 (Bell)	Heathy/sedgey <i>E. amygdalina</i> forest on granite (DAC) <i>G. radula</i>
Mount William Mount William National Park	North/Dorset Flinders	2017 (Bell)	2017 (Bell)	Heathy/sedgey <i>E. amygdalina</i> forest on granite (DAC) (<i>Banksia marginata</i> and <i>Kunzea ambigua</i> common). Roadside possibly slashed to keep low stature vegetation. <i>G. radula</i>
Bridport private land	North/Dorset Flinders	2016 (Bell)	2016 (Bell)	Heathy/sedgey <i>E. amygdalina</i> forest on sands (DAC). <i>G. radula</i>

5 Discussion

The present survey has substantially increased the number of known breeding colonies of chaostola skipper in Tasmania. Previously six breeding colonies were thought to be extant including Coningham, Kingston, Knocklofty, Grasstree Hill, Little Swanport, Coles Bay and Bridport. The present survey increased the number of breeding colonies by seven including Huonville, Ranelagh, Lenah Valley, Apsley River, Binalong Bay and Mount William. Recognising the time and property access constraints of the present survey it was surprising so many new locations were found. Surveys were limited to roadside occurrences of *Gahnia radula* and *G. microstachya*, and search time was limited to a maximum of 15 minutes at each site. Further, travelling between sites and searching back roads for occurrences of *G. radula* and/or *G. microstachya* was time consuming. In view of these constraints it would seem reasonable to suggest that more breeding colonies of chaostola skipper are likely to be found.

In combination with the discovery of a breeding colony at Bridport in 2016, the present survey has substantially extended the known distribution of chaostola skipper in Tasmania. Historic locality records were re-confirmed as far south as Huonville, and as far inland as Hop Pole Bottom on the east coast. The Binalong Bay, Mount William and Bridport sightings substantially extend the known distribution north to Mount William and west to Bridport. The potential range for chaostola skipper used within the forest practices system is supported by the current survey and it now more closely aligns the known range for the species. There are NVA records of *Gahnia radula* from Flinders Island, Cape Barren Island and Clarke Island, and a record of *G. microstachya* from Clarke Island. Based on the results of the current survey it is likely chaostola skipper also occurs in the Furneaux Group and opportunistic searches for the species on the Furneaux islands is recommended.

The present survey revealed that chaostola skipper occurs in a broader range of vegetation types than previously thought. Most new locations supported habitat typical of its foodplants, *Gahnia radula* and *G. microstachya*. The only exception was Hop Pole Bottom where chaostola skipper habitat is heathy/sedgey *E. amygdalina* – *E. pulchella* forest on dolerite supporting an understorey of abundant *Xanthorrhoea australis* with very occasional small clumps of *Gahnia microstachya*. Note that other new records of chaostola skipper were in *Eucalyptus amygdalina* coastal forest and woodland, on sands and gravels, or on granitic sands.

Overall, the results of the present survey suggest chaostola skipper is potentially more common across its range and potentially more persistent at known sites than previously thought. That the species has not been found at some historic localities over the past century might reflect the apparent ‘boom and bust’ cycle suggested by some authors (e.g. Wainer and Yen 2009; Sands and New 2002).

Observations on breeding colonies of chaostola skipper in Victoria and NSW suggest increased abundance of adult butterflies following fire, with varying times to re-establishment and/or recolonisation (i.e. between 5 and 9 years following fire), and reductions in abundance after long periods in the absence of fire, possibly to very low levels. This pattern of abundance is likely to reflect the life history and ecology of chaostola skipper’s foodplants (Wainer and Yen 2009). The response of Tasmanian chaostola skipper to fire is the subject of a current project by the Forest Practices Authority being undertaken at Peter Murrell State Reserve, a location that supports the core of a breeding colony at Kingston. The project is monitoring the abundance of chaostola skipper larval shelters within the reserve and within individual fire management units, before fire and annually following fire.

Wainer and Yen (2009) considered that ‘a 9 to 12 year fuel reduction burn cycle, and staggering the burning of patches of the habitat in a mosaic pattern, are probably suitable strategies to provide a constant availability of appropriate habitat’ for the Victorian chaostola skipper. They also consider that fire is the greatest threat to the viability of colonies by killing larvae and pupae. Therefore, it is important to maintain a range of fire ages including unburnt areas to ensure a reservoir of developmental stages to recolonise burnt areas. The survey by the Threatened Species Section, DPIW in 2012 within the Kingborough Municipality supports the notion of chaostola skipper as a fire succession species with the capacity to recolonise sites from nearby unburnt sites (larval shelters were observed within a burnt area within 2 years of fire). However, they also note that fires over large areas such as the fire at Coningham in 2008 may have been detrimental to the long-term viability of chaostola skipper in that area. They advocated a management approach of maintaining a mosaic of vegetation age-classes and reducing the potential for large-scale conflagrations through appropriate fuel-reduction burns (TSS 2012).

Notwithstanding the high likelihood of finding more colonies of chaostola skipper in Tasmania, the distribution of breeding colonies remains fragmented and most colonies are separated by large distances of unsuitable habitat. The distances between known locations and between areas of suitable habitat probably exceed the potential dispersal capacity of the species (TSS 2012). Ongoing housing development, adverse fire events, road maintenance and intensification of agricultural activities at known locations in the south will probably drive an ongoing downward trend in the abundance of chaostola skipper at these locations. Ongoing land clearance on private land also remains a threat to chaostola skipper while the clearance and conversion of non-threatened forest communities for agricultural purposes remains acceptable under Tasmanian forest policy (Tasmanian Government 2017).

Planning for chaostola skipper within the Tasmanian forest practices system relies on the identification of 'potential habitat' (vegetation communities supporting the food plants *Gahnia radula* and *G. microstachya*) within the 'potential range' (distribution of *G. radula* and *G. microstachya*), and/or within the 'core range' of the species (within 2 km of a known location). The presence of 'potential habitat' within a proposed FPP area requires forest planners to use of the Forest Practices Authorities' Threatened Fauna Adviser (ThFA) to deliver a management recommendation.

ThFA management recommendations for chaostola skipper are based on whether the proposed FPP area is within the 'core range' or 'potential range', and if within the 'potential range', whether 'potential habitat' is 'patchy' or 'extensive'. A proposed FPP within the 'core range' supporting 'potential habitat' or within the 'potential range' supporting extensive 'potential habitat' requires advice to be sought from the Forest Practices Authority. This allows the Forest Practices Authorities' ecologists to consider such FPPs on a case-by-case basis. In some circumstances advice can be provided without a specialist site assessment due to the type of forestry operation. However, in some cases a specialist survey may be required to determine the presence of the species within the FPP and the surrounding area. The results of the current survey support the requirement to seek advice from the Forest Practices Authority, however given the likelihood of finding further breeding colonies within the potential range, specialist surveys should also be required for proposed FPPs remote from known localities of chaostola skipper.

A proposed FPP within the 'potential range' of chaostola skipper supporting patchy 'potential habitat' receives a management recommendation to target potential habitat within Wildlife Habitat Clumps (WHCs), applied at the standard requirement by the *Forest Practices Code*, and to target mature habitat rather than younger habitat. The placement of WHCs as small patches of retained habitat within the harvest area is considered acceptable where the distribution of potential habitat is compatible with this, and while distributing WHCs across the harvested area is considered desirable, consolidation of patches is acceptable if potential habitat is concentrated in a particular area. The management recommendation indicates that habitat set aside for chaostola skipper is intended for long-term retention, and should be identified on a planning map and flagged in the field prior to the operation. The habitat set aside should be protected from disturbance from forestry activities and low intensity fuel reduction burning and top disposal burning should be minimised but is acceptable. In the light of the results of the current survey and more recent observations on the impact of fire on colonies, and the ecology of chaostola skipper and its foodplants, it is recommended that the current management recommendations be revised to accord with this new information.

6 Recommendations

- Extend the core range of chaostola skipper to reflect the current extent of known colonies. The proposed new core range is as follows:
'The core range of the chaostola skipper is a 3 km (radius) buffer centred on the known sites'
- Retain the current potential range for chaostola skipper used in forest practices planning as it now more closely reflects the known range for the species and clearly, will not extend beyond the distribution of its foodplants, *Gahnia radula* and *G. microstachya*. The current potential range is as follows:
'The potential range of the chaostola skipper is the distribution of Gahnia radula and G. microstachya'
- Revise the description of potential habitat for chaostola skipper used in forest practices planning to include additional vegetation types where the species has now been found, particularly *Eucalyptus amygdalina* coastal forest and woodland (DAC), and any location supporting the foodplants, *Gahnia radula* and *G. microstachya*. The proposed new potential habitat description is as follows:
'Potential habitat for the chaostola skipper is dry forest and woodland supporting Gahnia radula and/or G. microstachya (Usually Eucalyptus amygdalina or E. tenuiramis dominated forest/woodland on sandstone, mudstone, Aeolian sands, or granite substrates).'
- Request specialist surveys for chaostola skipper for proposed FPPs that involve clearance and conversion of potential habitat, with the aim to protect habitat supporting the foodplants, *Gahnia radula* and *G. microstachya* within and around known colonies.
- Manage chaostola skipper in FPPs for plantation and native forestry by managing the cover of the foodplants, *Gahnia radula* and *G. microstachya* at the FPP level and where practical considering the cover and distribution of potential habitat in the broader landscape. Combine TFA Recommendation 7 (Within potential range; potential habitat present; native forest silviculture; habitat patchy), Recommendation 8 (Within potential range; potential habitat present; native forest silviculture; habitat extensive) and Recommendation 9 (Within potential range; potential habitat present; plantation establishment and management) into a single recommendation with the pathway *'Within potential range; potential habitat present'*, require the development of a management prescription for *Gahnia radula* and/or *G. microstachya* within the FPP area that protects 30% of the cover of these species from fire, harvesting or other disturbances during the proposed operation and require that *'The Forest Practices Authority must be contacted for advice'*. The FPA will determine whether a specialist survey needs to be undertaken to determine the presence/absence of chaostola skipper and to assess the adequacy of the proposed management of the foodplant.
- Ensure that forest planners, land managers and ecological consultants can identify chaostola skipper potential habitat (i.e. *Gahnia radula* and *G. microstachya*) by continuing to provide specialist advice and practical training opportunities through the forest practices system.

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8 Appendix

8.1 Project Brief: Systematic survey of potential habitat within the potential range of chaostola skipper *Antipodia chaostola leucophaea*

Background

The current potential range boundary for chaostola skipper, as agreed by the FPA and DPIPWE for the purposes of planning within the forest practices system, covers an extensive area in Tasmania. Chaostola skipper's potential range extends along the east coast and west as far as the Tamar River. The application of such a large potential range is the result of a precautionary approach in the absence of dedicated and systematic surveys for this species.

Chaostola skipper is listed as endangered under the Tasmanian *Threatened Species Protection Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Known foodplants for the species include thatch sawsedge, *Gahnia radula* and slender sawsedge, *G. microstachya*. The potential range of chaostola skipper reflects the known range of the key foodplant, *G. radula*. Only opportunistic surveys and surveys required as part of development proposals and planning for FPPs, have been undertaken on the species. Although Chaostola skipper's potential range extends to the Tamar River, the species has not been found north of Freycinet Peninsula on the east coast.

For survey purposes the presence of chaostola skipper can be identified by the characteristic conical shaped larval-pupal shelters that are found only on the foodplants, *G. radula* and *G. microstachya*. Identifying the adult during the spring flying season is problematic without having the specimen in the hand.

8.1.1.1 Research objectives

1. Determine the actual range and extent of potential habitat of chaostola skipper in order to review and revise the range boundary and potential habitat description for this species.

8.1.1.2 Methods

This project will review the known records and locations of chaostola skipper throughout its known range. This information will be used to develop a model of potential habitat and a systematic survey approach to confirm the presence/absence of this species within its current agreed potential range. Data will be collected from all chaostola skipper-present sites to inform the development of a refined description of potential habitat.

Dedicated and systematic surveys for chaostola skipper will target the current potential range between Freycinet Peninsula and the Tamar River. All previous records of the species have been associated with *E. amygdalina* forest communities on a sandstone or mudstone substrate, or *E. tenuiramis* forest communities on a granite substrate.

8.1.1.3 Personnel and governance:

- Governance: Dr Phil Bell will be the project leader with assistance from FPA ecologists where available. Phil has over 20 years' experience in the conservation ecology and management of butterflies in Tasmania.

8.1.1.4 Budget:

This project is planned as a one off study to be conducted in 2016. FPA are providing FPA ecologist in-kind time for this study and funding will be sought to cover consultant (Phil Bell) time to manage the project, undertake field surveys and report on the findings. Three days are required for review of NVA database records, development of a crude habitat model and design of a systematic field survey method (\$1500), eight days are required for field survey (\$4000) and two days for data analysis and preparation of a report (\$1000). Eight days are required for travel (\$1600) and vehicle (\$800). Total cost for the project is \$8,900.

8.1.1.5 Progress:

This project will commence in November 2016 to coincide with chaostola skipper's flying season.

8.1.1.1.6 Outputs:

- FPA will publish the results of this research in *Forest Practices News*.
- The results may also be of interest to a wider audience and publication in a scientific journal may be sought.
- Review and revision of the potential range and potential habitat description.

Document control log table

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Document summary information

Document name	Assessing the effectiveness of <i>Forest Practices Code</i> provisions for the threatened chaostola skipper <i>Antipodia chaostola leucophaea</i>
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Stages required for release outside FPA

Category of advice C		
Stages	Required/not required	Completed (date)
Specialist	required	November 2017
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CFPO	required	January 2018
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Board	Not required	