

National Recovery Plan for the Swift Parrot (*Lathamus discolor*)



January 2019

The Species Profile and Threats Database pages linked to this recovery plan is obtainable from:
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

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1 Summary

Swift Parrot (*Lathamus discolor*)

Family: Psittacidae

Current status of taxon:

Critically Endangered (*Environment Protection and Biodiversity Conservation Act 1999*)

Distribution and habitat:

The Swift Parrot breeds mostly on the east and south-east coast of Tasmania during summer and migrates to mainland Australia for winter, where it forages across a broad range of forest types. The area occupied during the breeding season varies between years, depending on food availability, but is typically less than 500 km².

Habitat critical for survival:

Habitat critical to the survival of the Swift Parrot includes:

- Any nesting sites or foraging areas where the species is known or likely to occur (as shown in Figure 1).
- Any newly discovered nesting sites or important foraging areas.

Recovery plan Vision, Objective and Strategies:

Long-term Vision

The Swift Parrot population has increased in size to such an extent that the species no longer qualifies for listing as threatened under any of the Environment Protection and Biodiversity Conservation Act 1999 listing criteria.

Recovery Plan Objective

To achieve and sustain a positive population trend for the Swift Parrot over the life of this Recovery Plan. This will be achieved by implementing the actions set out in this Recovery Plan that minimise threats while protecting and enhancing the species' habitat throughout its range.

Strategies to achieve objective

1. Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions
2. Manage and protect known Swift Parrot breeding and foraging habitat at the landscape scale
3. Reduce impacts from Sugar Gliders at Swift Parrot breeding sites
4. Improve understanding of foraging and breeding habitat use at a landscape scale in order to better target protection and restoration measures
5. Monitor and manage other sources of mortality
6. Engage community and stakeholders in Swift Parrot conservation
7. Coordinate, review and report on recovery process

Criteria for success:

This recovery plan will be deemed successful if, within 10 years, the following have been achieved:

- The Swift Parrot population trajectory is positive.
- Understanding of the species' ecology has increased, in particular knowledge of movement patterns, habitat use and post-breeding dispersal.
- There is participation by key stakeholders and the public in recovery efforts and monitoring.

2 Introduction

This document constitutes the National Recovery Plan for the Swift Parrot (*Lathamus discolor*). The plan considers the conservation requirements of the species across its range and identifies the actions needed to be undertaken to improve the species' long-term viability. This recovery plan supercedes the 2011 National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011).

The Swift Parrot is listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The listing status of the Swift Parrot was re-assessed in 2016 due to new information showing predation of females and nestlings by the introduced (to Tasmania) Sugar Glider (*Petaurus breviceps*). The re-assessment concluded that the risk posed by this previously unidentified threat was significant enough to justify moving the species from the Endangered category to the Critically Endangered category of the EPBC Act list of Threatened Species. The re-assessment also concluded that the recovery plan should be updated to include measures to reduce the impact of Sugar Gliders.

The 2011 Recovery Plan was reviewed by the Swift Parrot Recovery Team in 2016-2017. The review concluded that the previous plan resulted in:

- Increased understanding of the habitat features associated with breeding;
- Progress in developing Tasmanian forestry management protocols in the breeding areas, and integrating these into Forest Practice Authority (FPA) management recommendations. However, the review highlighted that issues remained with the implementation of the FPA regulations. The Review also identified that there had been limited work across other jurisdictions on Swift Parrot habitat management; and
- Some work was being done on monitoring and managing the threat from collisions, competition and beak and feather disease. However, the review found that work on these threats was not prioritised as they were considered to have low overall impact on the species survival compared to habitat loss and the impacts of Sugar Glider predation.

Overall the review found that trend information for Swift Parrots remained uncertain, as there was no estimates of population size or equivalent indices that could be used to estimate a population trend. However, based on modelling of known reproductive success parameters and predation by Sugar Gliders, it was demonstrated that the population was likely declining. The Review also concluded that at the time of writing the 2011 Recovery Plan the Sugar

Glider threat was not recognised and that, as a result, the plan was lacking any recovery actions to address that threat. The Review concluded that a new recovery plan should be developed for the Swift Parrot to account for predation by Sugar Gliders and address the ongoing loss of breeding habitat in Tasmania.

The accompanying Species Profile and Threats Database (SPRAT) provides additional background information on the biology, population status and threats to the Swift Parrot. SPRAT pages are available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

2.1 Conservation status

The Swift Parrot is listed as threatened under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and in all parts of its range.

Table 1: National and state conservation status of the Swift Parrot

Legislation	Conservation Status
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	Critically Endangered
<i>Biodiversity Conservation Act 2016</i> (New South Wales)	Endangered
<i>Nature Conservation Act 1992</i> (Queensland)	Endangered
<i>National Parks and Wildlife Act 1972</i> (South Australia)	Endangered
<i>Flora and Fauna Guarantee Act 1988</i> (Victoria)	Threatened
<i>Threatened Species Protection Act 1995</i> (Tasmania)	Endangered
<i>Nature Conservation Act 2014</i> (Australian Capital Territory)	Vulnerable

2.2 Swift Parrot Recovery Team

Recovery teams help implement recovery plans. They include representatives from organisations with a direct interest in the recovery of the species, including from government, conservation groups and species experts. Membership of the Swift Parrot Recovery Team currently includes individuals with relevant expertise from the Australian Government, the range state governments (Tasmanian, South Australia, Victorian, New South Wales and the ACT), BirdLife Australia, as well as species experts and research scientists.

3 Background

3.1 Species description

The Swift Parrot (White 1790) is a small fast-flying, nectarivorous parrot which occurs in eucalypt forests in south eastern Australia. Bright green in colour, the Swift Parrot has patches of red on the throat, chin, face and forehead which are bordered by yellow. It also has red on the shoulder and under the wings and blue on the crown, cheeks and wings. A distinctive call of pip-pip-pip (usually given while flying), a streamlined body, long pointy tail and flashes of bright red under the wing enable the species to be readily identified.

3.2 Distribution

The Swift Parrot breeds in Tasmania during the summer and migrates north to mainland Australia for winter (Figure 1). The breeding range of the Swift Parrot is largely restricted to the east and south-east coast of Tasmania, with location of breeding each year being determined largely by the distribution and intensity of blue gum (*E. globulus*) and black gum (*E. ovata*) flowering (Webb et al. 2014). The flowering patterns of these species varies dramatically in location and extent over annual cycles (Webb et al. 2017). Swift Parrots also occasionally breed in the north-west of the state, between Launceston and Smithton, however the number of birds involved is low as potential breeding habitat remaining in the north-west is scarce and highly fragmented. Swift Parrots have also been found breeding in isolated patches of blue gum on the west coast of Tasmania near Zeehan, and on King Island and Flinders Island (Webb unpublished data).

Swift Parrots disperse widely on the mainland, foraging on flowers and lerps in Eucalyptus species, mainly in Victoria and New South Wales. In Victoria, Swift Parrots are predominantly found in the dry forests and woodlands of the box-ironbark region on the inland slopes of the Great Dividing Range. There are a few records each year from the Melbourne and Geelong districts and they are occasionally recorded south of the divide in the Gippsland region.

In New South Wales, Swift Parrots forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions in New South Wales tend to support larger numbers of birds when inland habitats are subjected to drought, as occurred in 2002 and 2009 (Tzaros et al. 2009).

Small numbers of Swift Parrots are observed in the Australian Capital Territory and in south-eastern Queensland on a regular basis. The species is less frequently observed in the Southern Mount Lofty Ranges and the Bordertown-Naracoorte area in south-eastern South Australia (Saunders and Tzaros 2011).

3.3 Population

The Swift Parrot occurs as a single, migratory population (Stojanovic et al. 2018). The most recent population estimate was done for the Bird Action Plan 2010, which suggested there were approximately 2,000 mature individuals in the wild (Garnett et al. 2011). There are no more recent estimates of population size. While the current population size might be unknown, recent research has shown that the Swift Parrot population is likely undergoing dramatic declines due to predation by Sugar Gliders, an introduced species to Tasmania (Campbell et al. 2018). Stojanovic et al. (2014) found that Swift Parrot nests failed at a very high rate on the Tasmanian mainland, compared to no failure on offshore islands where Sugar Gliders were

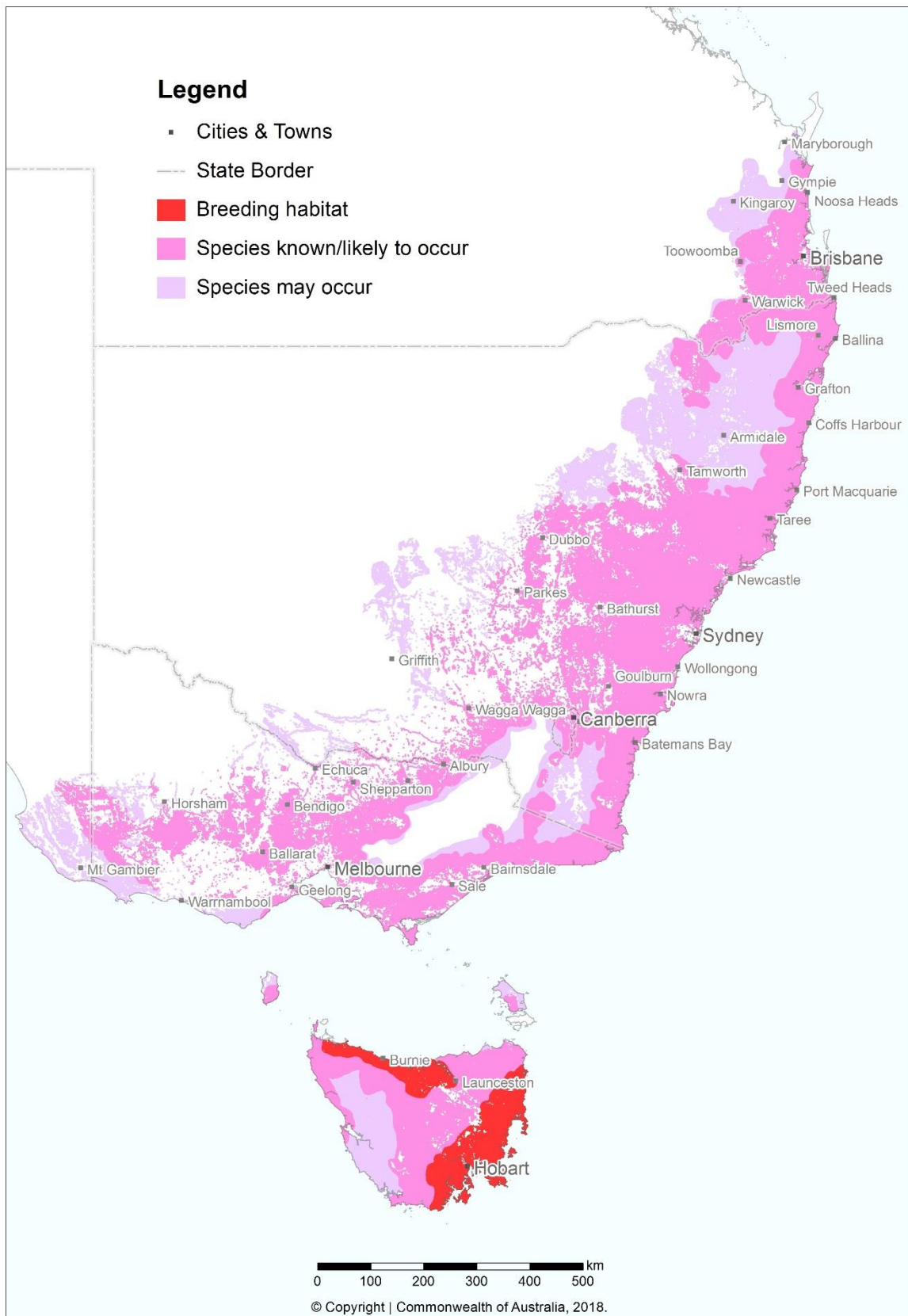


Figure 1 - Distribution of the Swift Parrot in Australia

shown to be absent. Most cases of glider predation resulted in the death of the adult female parrot, and always involved the death of either eggs or nestlings.

Heinsohn et al. (2015) constructed a population viability analysis (PVA) using the demographic data gained from the Sugar Glider predation study and population monitoring (Stojanovic et al., 2014; Webb et al., 2014). Five scenarios were considered in the PVA. The first scenario was based on field data from Bruny and Maria Islands, which are both Sugar Glider free. This scenario estimated growth rates in the absence of Sugar Glider predation and projected a substantial increase in numbers over time. Four other PVA models were tested which accounted for Sugar Glider predation but used differing generation times.

The mean decline over the four scenarios that included Sugar Glider predation was projected at 86.9 percent (range over the four models was 78.8-94.7 percent decline) over three generations. The preferred model by Heinsohn et al. (2015) projected that Swift Parrots would undergo an extreme decline of 94.7 percent within a three generation period. This model used a generation time of 5.4 years, which was obtained through expert elicitation (Garnett et al., 2011). While research has found that breeding success is much higher on Sugar Glider free islands (Stojanovic et al., 2014), this greater success was insufficient to buffer the population against collapse under the modelled scenarios (Heinsohn et al., 2015).

4 Biology and Ecology

4.1 Longevity

Generation length is estimated at approximately 5.4 years, but this estimate is considered to be of low reliability. This figure is derived from an age of first breeding of two years and a maximum longevity of 8.8 years (Garnett et al., 2011).

4.2 Habitat

Mainland habitat

Swift parrots spend the winter on mainland Australia and nest in Tasmania over summer. Figure 1 illustrates the known distribution of the species. During the non-breeding season the population frequents eucalypt woodlands and forests in South Australia, Victoria, New South Wales and Queensland. Key foraging species includes Yellow Gum (*Eucalyptus leucoxylon*); Red Ironbark (*E. tricarpa*); Mugga Ironbark (*E. sideroxylon*); Grey Box (*E. macrocarpa*); White Box (*E. albens*); Yellow Box (*E. melliodora*); Swamp Mahogany (*E. robusta*); Forest Red Gum (*E. tereticornis*); Blackbutt (*E. pilularis*); and Spotted Gum (*Corymbia maculata*). Within these habitats, Swift Parrots have been found to preferentially forage in large, mature trees (Kennedy 2000; Kennedy and Overs 2001; Kennedy and Tzaros 2005) that provide more reliable foraging resources than younger trees (Wilson and Bennett 1999; Law et al. 2000). The distribution of Swift Parrots across the landscape will vary depending on the flowering of key foraging species.

Tasmania

Breeding records for Swift Parrots are largely restricted to the south and east coast, with some sporadic breeding occurring in the north of the state. Birds arrive in Tasmania in early August and breeding occurs between September and January. The distribution of nesting Swift Parrots each breeding season is determined largely by the distribution and intensity of blue gum (*E. globulus*) and black gum (*E. ovata*) flowering (Webb et al. 2014). The flowering

patterns on these species varies dramatically in location and extent over annual cycles (Webb et al. 2017).

Swift Parrots nest in hollows of live and dead eucalypt trees. In eastern Tasmania, most recorded nest sites have been located within 30 km of the coast. Swift parrots nest in any eucalypt forest that supports suitable tree hollows, providing a suitable food source is within foraging range. Nest sites have been recorded in dry and wet eucalypt forest types. Swift parrots select trees and forest patches with a relatively higher number of potential hollows (Voogdt 2006, Webb et al. 2012). Nest trees are typically characterised by having a diameter at breast height of around 100cm, several visible hollows and showing signs of senescence (Webb et al. 2012; Stojanovic et al 2012). Eucalypt trees in Tasmania usually take at least 100 years to form hollows, and at least 140 years to form deeper hollows (Koch et al. 2008). However, based on the DBH of identified nest trees most are likely much older than this.

The prevalence of hollows in eucalypt forests and woodlands and close proximity to a foraging resource is considered more important than forest type and/or tree species in determining where nests occur. Where suitable hollows are available, nest sites can be found in all topographic positions and aspects (Webb et al. 2012).

Swift Parrots are known to reuse nesting sites and individual nest hollows over different years (Stojanovic et al. 2012) and this highlights the importance of these areas for the species' long-term viability. The presence of a foraging resource will determine whether an area is suitable on a year to year basis (Webb et al. 2014). Monitoring of blue gum flowering and the occurrence of Swift Parrots across the breeding range in the south and east show that some nesting sites are used on a cyclic basis when there is suitable flowering in surrounding areas (Webb et al. 2014; 2017).

4.3 Breeding biology

Both sexes are involved in the search for suitable nest hollows which begins soon after they arrive in Tasmania. Nesting commences in late September, however birds that are unpaired on arrival in Tasmania may not begin nesting until November, after they have found mates (Brown 1989). Gregarious by nature, pairs may nest in close proximity to each other and even in the same tree.

The female occupies the nest chamber just before egg laying and she undertakes all of the incubation and brooding until nestlings are sufficiently developed. The usual clutch size is four eggs but up to five may be laid. During incubation the male visits the nest site every three to five hours to feed the female. He perches near the nest and calls her out, either feeding her at the nest entrance or both will fly to a nearby perch.

Reproductive success is strongly influenced by the availability and intensity of blue and/or black gum flowering, and nest site selection with regard to the presence of Sugar Gliders. In years where birds breed primarily on Bruny and Maria Islands, breeding success is much higher as Sugar Gliders are not found on these islands (Stojanovic et al. 2014, 2015).

4.4 Habitat critical for survival

Habitat critical to the survival of the Swift Parrot includes:

- Any nesting sites or foraging areas where the species is known or likely to occur (as shown in figure 1).
- Any newly discovered breeding or important foraging areas.

Habitat critical to the survival of the Swift Parrot occurs across a wide range of land tenures, including on freehold land, travelling stock routes and reserves, publicly owned forests and state reserves, and National Parks. It is essential that the highest level of protection is provided to these areas and that enhancement and protection measures target these productive sites.

When considering developments in any part of the parrot's range, including in areas where the species 'may occur', surveys for occupancy at the appropriate times of the year remain an important tool in establishing the areas importance for Swift Parrots. In addition, it is also important to note that Swift Parrots opportunistically use areas depending on the occurrence of eucalypt flowering. So areas that may be important habitat over time might not have birds in any given year. This pattern of habitat use means that recent survey data and historical records need to be considered when assessing the relative importance of a region for Swift Parrots.

5 Threats

5.1 Historical causes of decline

Area of occupancy has declined significantly since European settlement, as can be inferred from the extent of habitat loss. For example, 83% of box-ironbark habitat (the principal wintering habitat of the Swift Parrot on the mainland) has been cleared in Victoria, and 70% has been cleared in New South Wales (Environment Conservation Council 2001; Robinson & Traill 1996; Siversten 1993). White Box-Yellow Gum-Blakely's Red Gum woodland, another important habitat in New South Wales, has been reduced to less than 4% of its pre-European extent on the south-western slopes and southern tablelands of New South Wales (Saunders 2003); and in Tasmania, approximately 70% of grassy Tasmanian blue gum forest (Saunders and Tzaros 2011), and over 90% of *E. ovata* forest (Department of Environment and Energy 2018) that provide important foraging habitat during the breeding season has been cleared.

5.2 Current threatening processes

The major threats to the survival of the Swift Parrot are the ongoing loss of breeding and foraging habitat in Tasmania through forestry operations and land clearing, and predation by Sugar Gliders of nestlings and sitting females. Managing these threats is the primary focus of this Recovery Plan. Other identified threats include competition for foraging and nesting resources, mortality from collisions with human-made objects and impacts from climate change. These threats are described in more detail below.

Habitat loss and alteration

Forestry

Forestry operations and conversion of native forest to tree plantations over the past 30 years has reduced the amount of available Swift Parrot nesting and foraging habitat (Prober & Thiele 1995; Saunders et al., 2007, Saunders & Tzaros 2011, Webb et al. 2017). Recent estimates of clearing in the identified Southern Forests Swift Parrot Important Breeding Area in Tasmania suggests that between 1997 and 2016 approximately 33% of all eucalypt forest was lost through conversion of native forest to plantation or disturbed through native forest harvesting, and 23% of the identified old growth forest was lost (Webb et al. 2018). As nesting hollows generally only occur in trees older than about 100 years of age, and that larger trees have proportionally more nectar and food resources, the ongoing logging of breeding habitat remains a threat to the species' persistence in the wild.

In Tasmania, the forests that the Swift Parrot breed in are subject to management under the Tasmanian Regional Forest Agreement 1997 (RFA). The RFA is considered to be consistent with the requirements for threatened species protection and recovery that otherwise might apply under the EPBC Act (1999) and operations undertaken as part of the RFA do not need to be assessed against the provisions in the Act. Under the Tasmanian Forest Practices Act 1986, the management of threatened species in areas subject to 'forest practices' defined in the Act is guided by the Forest Practices Code (the Code) and regulated by the Forest Practices Authority (FPA). The Code refers to a set of 'Agreed Procedures' (FPA 2014) for the management of threatened species in production forests, intended to provide a stream-lined risk assessment process for threatened species in the context of wood production (FPA 2014).

The agreed procedures refer to measures to protect Swift Parrot breeding habitat. These measures have evolved since 1996 and initially only applied to dry forest habitat (FPA 2010; Munks et al 2004) considered a priority for the species, based on existing information. In 2007 new information became available that suggested that wet forests were part of breeding habitat for Swift Parrots, particularly during periods when *E. globulus* flowering was poor in dry forests (Webb 2008; Law et al. 2000). The current measures for the management of Swift Parrot habitat cover wet and dry forest habitat throughout the breeding range of the species and are delivered through a decision support system, the Threatened Fauna Adviser (Forest Practices Authority, 2014). Since Swift Parrot breeding habitat is poorly reserved (in formal CAR reserve system) in Tasmania there is considerable reliance on the measures delivered through the Tasmanian forest practices system. Ongoing development of spatial information on nesting and foraging habitat availability and management approaches in off-reserve areas (Koch and Munks, 2018 in press) is urgently required to refine and ensure the effectiveness of these measures.

Logging of foraging habitat on the Australian mainland also remains a threat. The extent of forest loss over Swift Parrot foraging habitat on the mainland has not been quantified and the impacts from commercial logging operations on the mainland remain uncertain.

Firewood collection – illegal and legal

Firewood collection is a threat to nesting and foraging habitat in Tasmania and to foraging habitat on mainland Australia. Trees targeted by firewood collectors are often large, mature forage trees or trees with suitable nesting hollows. Generally registered firewood suppliers operate in accordance with industry codes of practice or are formally regulated, which typically includes provisions to not collect from areas that might have an impact on threatened species. However, there is a large, but unquantified unregulated and illegal harvest of firewood, and these collectors are known to be impacting on Swift Parrot habitat.

Fire

Increases in fire frequency pose a significant threat to avian communities. Where fire intervals are too regular, flowering events and maturation of nectar-rich plant species may be reduced, resulting in a reduction of foraging resources for nectarivorous birds (Woinarski and Recher 1997). This is of particular concern in coastal New South Wales and in central Victoria where there is increasing residential and industrial development in close proximity to Swift Parrot habitat. Such developments are required to comply with new fire safety regulations involving clearing trees within fire protection zones and undertaking hazard reduction burns. With an increase in the human population residing adjacent to Swift Parrot habitat and increased accessibility to bushland areas, an increase in the incidence of accidental and deliberate fire may also be an issue.

The relationship between fire and the formation and destruction of hollows is complex. Fires may kill canopy trees but these (and their hollows) may persist as dead snags. Fires may also lead to hollow formation (or a change in dimensions of existing hollows) in surviving trees or destroy hollow-bearing trees. Frequent fire may alter natural wildfire tree recruitment processes and hence dictate future availability of hollows (Woinarski and Recher 1997). Fires may also cause the collapse of hollow bearing trees, thus reducing hollow availability into the future. One long-term study looked at survival of nest trees over time and found that unburned trees mostly survived but that nearly half of the trees burnt with cavities collapsed within six months of burning (Stojanovic et al., 2015).

Residential and industrial development

Urban, rural residential and industrial developments pose a significant threat to habitat throughout the range of the species, with important breeding areas in Tasmania and key foraging areas in Victoria, New South Wales and Queensland being of particular concern. Where potential breeding habitat is retained adjacent to developments there is an increased likelihood that potential nest trees could be removed for 'human safety reasons', including as part of establishing and maintaining fire breaks.

In central Victoria, urban and rural residential developments are increasingly encroaching into Box-Ironbark habitats, such as those around Bendigo. In New South Wales, urban and industrial expansion, particularly on the central and north coast pose an ongoing threat to winter foraging regions. In Queensland, urban development is of particular concern to the Swift Parrot at the northern extent of their winter range. In particular, the Gold Coast, Toowoomba and the Greater Brisbane region are at risk from tree removal associated with residential and industrial development.

Mortality risks to Swift Parrots from window-strike has also been documented previously and represents an ongoing threat to the species in urbanised areas.

Agricultural tree senescence and dieback

Much of the habitat used by Swift Parrots in agricultural landscapes are forest remnants or isolated, scattered paddock trees. This habitat continues to be lost through senescence; dieback; over grazing, with limited or no recruitment; and through ongoing removal of paddock trees to enhance farm productivity. This is of particular concern in eastern Tasmania, central Victoria and throughout New South Wales.

Predation by Sugar Gliders

Until recently the main threat to Swift Parrots was thought to be habitat loss and alteration within breeding areas. However, predation on the nest by Sugar Gliders on the mainland of Tasmania is now considered to be as significant a threat to the species as habitat loss, as Sugar Gliders take not only the young or eggs in the nest but also often kill the sitting female (Stojanovic et al. 2014; Heinsohn et al., 2015). Stojanovic et al. also found that on the Tasmanian mainland, survival of Swift Parrot nests was a function of mature forest cover in the surrounding landscape and suggested that the likelihood of sugar glider predation decreased with increasing forest cover. While a species native to the Australian mainland, Sugar Gliders were likely introduced to mainland Tasmania around 1835 (Campbell et al. 2018).

Collision mortality

Collisions with wire netting, mesh fences, windows and cars cause mortality to Swift Parrots in urban areas throughout the species' range (Pfennigwerth 2008). Continuing urban encroachment into breeding and foraging habitat is likely to exacerbate this problem. Swift parrots are sometimes found injured or dead from collisions during the breeding season, with few birds released back into the wild. The threat is exacerbated in years when foraging resources are concentrated in or near to urban areas. The construction of wind energy turbines in south-eastern Australia may also have implications for the conservation of the Swift Parrot where they are poorly sited (Barrios and Rodriguez 2004).

Competition

Swift parrots can experience increased competition for resources from large, aggressive honeyeaters within altered habitats (Ford et al., 1993; Grey et al., 1998), and from introduced birds and bees (Brown 1989; Paton 1993; Hingston et al., 2004; Heinsohn et al., 2015). Swift parrots compete with honeybees (*Apis mellifera*) and starlings for tree cavities, where nestling parrots can be killed and the cavities usurped (Heinsohn et al., 2015). This competition is worst in forest that is disturbed or fragmented (Stojanovic, D. Unpublished Data).

Climate change

Loss of nesting and foraging habitat from climate change and changes in seasonality and the geographic pattern of flowering is likely to pose a significant threat to the Swift Parrot (Porfirio et al. 2016). Climate change management requires both domestic and international action to stop further accumulation of anthropogenic greenhouse gases. Although management of this global issue is beyond the scope of this plan, long-term monitoring of the species in conjunction with climate monitoring stations may be needed to understand the sensitivities of the Swift Parrot to climate change. Such a monitoring program may provide valuable insights and a basis for future adaptive conservation management strategies. The cumulative effects of other threats together with climate change need to be considered for effective and adaptive long-term management of the Swift Parrot.

Cumulative impacts

Each of the identified threats to the Swift Parrot has the potential to compromise the long-term survival of the species, and where more than one threat is present the cumulative effect is likely to be substantially greater than the sum of the individual threats. When assessing threats to the Swift Parrot, combinations of threats need to be considered to provide a realistic assessment of impacts on the species.

6 Populations under particular pressure

Genetic analysis confirms that Swift Parrots form a single, genetically homogenous, breeding population (Stojanovic et al. 2018). Therefore, the actions described in this recovery plan are designed to provide ongoing protection for all Swift Parrots throughout their range.

7 Recovery plan vision, objective and strategies

Long-term Vision

The Swift Parrot population has increased in size to such an extent that the species no longer qualifies for listing as threatened under any of the Environment Protection and Biodiversity Conservation Act 1999 listing criteria.

Recovery Plan Objective

To achieve and sustain a positive population trend for the Swift Parrot over the life of this Recovery Plan. This will be achieved by implementing the actions set out in this Recovery Plan that minimise threats while protecting and enhancing the species' habitat throughout its range.

Strategies to achieve objective

1. Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions
2. Manage and protect known Swift Parrot breeding and foraging habitat at the landscape scale
3. Reduce impacts from Sugar Gliders at Swift Parrot breeding sites
4. Improve understanding of foraging and breeding habitat use at a landscape scale in order to better target protection and restoration measures
5. Monitor and manage other sources of mortality
6. Engage community and stakeholders in Swift Parrot conservation
7. Coordinate, review and report on recovery process

8 Actions to achieve specific objectives

Actions identified for the recovery of the Swift Parrot are described below.

It should be noted that some of the objectives are long-term and may not be achieved prior to the scheduled five-year review of the recovery plan. Priorities assigned to actions should be interpreted as follows:

Priority 1: Action is necessary in order to mitigate the key threats to the Swift Parrot and also provide valuable information to help identify long-term population trends.

Priority 2: Action would provide a more informed basis for the long-term management and recovery of the Swift Parrot.

Priority 3: Action is desirable, but not critical to the recovery of the Swift Parrot or assessment of trends in that recovery.

Strategy 1: Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions.

Action		Priority	Performance Criteria	Responsible Agencies and potential partners
1.1	Develop and apply techniques to estimate changes in population trajectory.	1	<ul style="list-style-type: none"> Changes in abundance of Swift Parrots estimated over time. Current Population Viability Analysis updated to include new information. 	Research BirdLife

Strategy 2: Manage and protect known Swift Parrot breeding and foraging habitat at the landscape scale

ACTION		Priority	Performance Criteria	Responsible Agencies and potential partners
2.1	Ongoing state and Commonwealth commitment to support strategic planning for Swift Parrot breeding habitat.	1	<ul style="list-style-type: none"> Monitoring and ongoing review of the implementation and effectiveness of the current management recommendations. Recommendations from ongoing review considered and implemented. Completion and implementation of an agreed strategic management plan for forestry activities in Tasmania that is consistent with the objective of achieving a sustained increase in the Swift Parrot population over the next 10 years. Completion of the Public Authority Management Agreement (PAMA, under the TSPAct, 1995) between DPIPWE and Sustainable Timber Tasmania for the Permanent Timber Production Zone land in the Southern Forests. 	DoEE DPIPWE STT FPA
2.2	Review and revise Swift Parrot management recommendations, planning tools and procedures as new information becomes available.	1	<ul style="list-style-type: none"> New information on breeding and foraging locations is incorporated into the existing regulations, codes of practice, management recommendations, and planning tools and procedures to better manage the Swift Parrot population across its range. 	DPIPWE STT FPA Research

2.3	Protect areas of 'habitat critical to survival' not managed under an RFA agreement (as described in Section 4.4) from large scale developments and land clearing (e.g., from residential developments, mining activity, wind and solar farms, and clearing for agriculture) through local, state and Commonwealth Government legislation.	1	<ul style="list-style-type: none"> • Large scale developments avoided on areas of 'habitat critical to survival' for the Swift Parrot. • Clearing of mature foraging and nesting trees in areas of 'habitat critical to the survival' of the Swift Parrot has been limited. • Any developments in areas of 'habitat critical to survival' have incorporated suitable threat mitigation measures. • If avoidance or mitigation were not possible, any developments that proceeded in areas of 'habitat critical to survival' provided suitable offsets using the approved offset calculators and/or provided direct support for recovery plan actions. 	DoEE DPIPWE OEH DEHP DELWP
2.4	Enhance existing breeding habitat	1	<ul style="list-style-type: none"> • Manage regenerating and regrowth blue gum or black gum forest to provide foraging habitat into the future. • Encourage large-scale plantings of blue gum and black gum by land holders and land managers in priority areas through a strategic landscape approach. 	DPIPWE STT Research BirdLife NGOs
2.5	Regulate firewood collecting	1	<ul style="list-style-type: none"> • Quantify the extent of illegal firewood harvesting in breeding habitat. • Enforcement action targeted at reducing illegal firewood harvesters. • Certification system introduced for legal firewood harvesters to demonstrate wood is harvested in accordance with codes of practice. 	DPIPWE
2.6	Where useful, develop agreements with local councils and government agencies that aim to maintain and enhance Swift Parrot breeding habitat.	2	<ul style="list-style-type: none"> • Management agreements developed with local councils and government agencies which maintain and enhance Swift Parrot breeding habitat. • Reporting mechanisms in place to capture the outcomes of land use decisions and planning involving Swift Parrot breeding habitat. 	DPIPWE OEH DEHP DELWP
2.7	Manage key winter foraging sites	2	<ul style="list-style-type: none"> • Management plans for key winter foraging sites (identified in Action 2.5) developed and implemented. 	OEH DEHP DELWP

			<ul style="list-style-type: none"> Consideration given to enhance formal protection for sites where appropriate (i.e, through new conservation reserves, national parks etc). 	
2.8	Identify and protect remnants of state and Commonwealth owned land in areas of 'habitat critical for survival' for Swift Parrots (as defined in Section 4.4).	3	<ul style="list-style-type: none"> Unprotected state and Commonwealth owned remnants in areas of 'habitat critical to survival' for Swift Parrots identified. Management plans developed to maximise conservation values of the identified sites. 	DoEE DPIPWE OEH DEHP DELWP BirdLife NGOs
2.9	Incorporate Swift Parrot conservation priorities into covenanting and other private land conservation programs.	3	<ul style="list-style-type: none"> Key breeding and foraging sites on private land identified and habitat quality assessed. Identified sites protected through covenanting and other private land conservation programs. 	DPIPWE OEH DEHP DELWP BirdLife NGOs

Strategy 3: Reduce impacts from Sugar Gliders at breeding sites

ACTION		Priority	Performance Criteria	Responsible Agencies and potential partners
3.1	Determine Sugar Glider density across key Swift Parrot breeding areas	1	<ul style="list-style-type: none"> Sugar Glider density across key Swift Parrot breeding areas known and mapped. 	Research
3.2	Test mechanisms to restrict Sugar Gliders from Swift Parrot nest hollows	1	<ul style="list-style-type: none"> Sugar Glider exclusion trials undertaken in key Swift Parrot breeding areas. Different exclusion methods assessed for effectiveness. 	Research
3.3	Trial methods to reduce Sugar Glider density from key breeding areas	1	<ul style="list-style-type: none"> Trials undertaken testing the impacts of predator playbacks on Sugar Glider density and Swift Parrot mortality and success. Trials undertaken testing the impacts of directly reducing Sugar Glider density (through trapping and euthanising) on Swift Parrot breeding mortality and success. 	Research
3.4	Better understand extinction/colonisation dynamics of Sugar Gliders	1	<ul style="list-style-type: none"> Improved understanding of the re-colonisation dynamics of Sugar Gliders resulting from local, management induced, population reductions. Improved understanding of the breeding and foraging ecology of Sugar Gliders in south-east Tasmania 	Research

3.5	Further investigate the possible link between forest condition, Sugar Glider density and predation rates	1	<ul style="list-style-type: none"> Improved understanding of the link between forest cover, patch size, Sugar Glider density and Swift Parrot predation rates and breeding success. 	Research
3.6	Develop communication strategy specific to Sugar Glider management	1	<ul style="list-style-type: none"> Targeted communications strategy developed that communicates why Sugar Glider numbers need to be controlled. Outputs of strategy may include social media, pamphlets and community presentations. 	DPIPWE Research BirdLife
3.7	Reduction of Sugar Glider predation rates on Swift Parrots over the breeding season.	1	<ul style="list-style-type: none"> Strategy developed to manage Sugar Glider population across key breeding areas. Strategy may include increased use of nest protection methods and/or programs to directly reduce Sugar Glider numbers, with a particular focus on reductions at key locations over the breeding season. Strategy implemented. 	DPIPWE Research
3.8	Early detection, and control, of Sugar Glider introduction to islands	1	<ul style="list-style-type: none"> Process developed and implemented to ensure early detection of Sugar Gliders on islands where Swift Parrots breed but which are currently Sugar Glider free. Management plan to control Sugar Gliders on key islands developed and approved. Management plan to include funded rapid response protocols. 	DPIPWE Research BirdLife
3.9	Regulatory reform of Sugar Glider protected wildlife status	1	<ul style="list-style-type: none"> Sugar gliders removed from Schedule 2 of the Tasmanian Wildlife (General) Regulations 2010. 	DPIPWE

Strategy 4: Improve understanding of foraging and breeding habitat use at a landscape scale in order to better target protection and restoration measures

Action		Priority	Performance Criteria	Responsible Agencies and potential partners
4.1	Continue population monitoring program in the breeding range.	1	<ul style="list-style-type: none"> Monitoring program continued throughout the life of this plan, 	Research

			with a focus on identifying key nesting and foraging areas.	
4.2	Undertake fine-scale mapping of breeding habitat to inform management.	1	<ul style="list-style-type: none"> • Fine-scale mapping of breeding areas undertaken for each breeding season for the life of this plan. • Nest tree locations identified, mapped and entered into database to assist with fine-scale management. 	Research
4.3	Develop standardised survey program to better understand habitat occupancy during the non-breeding season.	2	<ul style="list-style-type: none"> • Standardised survey program developed and trialled on mainland Australia during non-breeding season. • Winter survey program implemented on an annual basis over the life of this recovery plan. 	Research BirdLife OEH
4.4	Better understand site use, landscape use and habitat bottlenecks.	2	<ul style="list-style-type: none"> • Key winter foraging sites identified and documented. • Key breeding sites identified and documented. • Broad-scale movement patterns across the landscape better understood. • Changes over time in regions and habitats used analysed against such factors as eucalypt flowering patterns and climate variability. 	Research BirdLife OEH DELWP
4.5	Continue research on breeding success, survival and mortality through nest monitoring and targeted studies.	2	<ul style="list-style-type: none"> • Existing knowledge of breeding success, survival and mortality expanded. • Research to include focus on establishing effectiveness of recovery plan actions. 	Research
4.6	Use climate modelling techniques to investigate the potential influence of climate change on eucalypt flowering to identify potential refuge for the Swift Parrot over the next 100 years.	2	<ul style="list-style-type: none"> • Modelling to identify key areas of existing habitat that will become key refuge for the Swift Parrot over the next 100 years • Consideration given to enhance formal protection for sites where appropriate (i.e, through new conservation reserves, national parks etc). 	Research BirdLife

Strategy 5: Monitor and manage other sources of mortality.

ACTION		Priority	Performance Criteria	Responsible Agencies and potential partners
5.1	Continue to raise public awareness of the risks of collisions and how these can be minimised.	2	<ul style="list-style-type: none"> Existing collision impact guidelines updated as required and made accessible. 	All
5.2	Monitor for outbreaks of disease (e.g. of Psittacine Beak and Feather Disease), that may impact on the viability of the wild population.	2	<ul style="list-style-type: none"> Incidence of disease recorded during handling and monitoring of Swift Parrots. Management strategy developed if incidence of disease is noted to be increasing. 	DoEE DPIPWE OEH DEHP DELWP BirdLife Research
5.3	Encourage appropriate building design and tree plantings in urban areas to discourage foraging Swift Parrots, and hence reduce collision mortality.	3	<ul style="list-style-type: none"> Guidelines developed and disseminated to land managers to encourage appropriate building design and tree plantings in urban areas. 	DPIPWE BirdLife

Strategy 6: Engage community and stakeholders in Swift Parrot conservation

ACTION		Priority	Performance Criteria	Responsible Agencies and potential partners
6.1	Continue to raise awareness and educate the general public about Swift Parrot conservation.	1	<ul style="list-style-type: none"> Articles about Swift Parrot conservation are published in newsletters, local bulletins, and on the web. Informative displays are developed to educate the community. 	BirdLife Research
6.2	Actively encourage the general public to participate in 'citizen science' activities where appropriate.	2	<ul style="list-style-type: none"> Maintain a network of volunteers to help assist with regional surveys. Where appropriate, provide opportunities for the citizen scientists to participate in academic research projects related to recovery actions 	BirdLife Research
6.3	Engage Indigenous landholders where appropriate to undertake Recovery Plan related activities.	2	<ul style="list-style-type: none"> Undertake targeted consultation with Indigenous landholders to identify ways to increase engagement in recovery plan actions. 	All

			<ul style="list-style-type: none"> Where appropriate, engage Indigenous groups in implementation activities. 	
6.4	Ensure educational material on threats and management of Swift Parrot habitat available to land managers	2	<ul style="list-style-type: none"> Educational awareness material developed and/or updated. Material disseminated to state and local governments, consultants and resource managers. 	All

Strategy 7: Coordinate, review and report on recovery process

ACTION		Priority	Performance Criteria	Responsible Agencies and potential partners
7.1	Maintain a Recovery Team that effectively organises, implements, reviews and reports on the recovery outcomes.	1	<ul style="list-style-type: none"> National Swift Parrot Recovery Team continues to operate under agreed Terms of Reference. 	All

9 Duration and cost

Costing of this Recovery Plan will be undertaken during public consultation process.

10 Effects on other native species and biodiversity

The Swift Parrot has become a 'flagship' species for conservation issues across eastern Australian, in particular in the Tasmanian southern forests. Enhanced protection of these forests will also help many other listed threatened bird species and hollow-dependant animals in general. In Tasmania, this includes the Masked Owl (*Tyto novaehollandiae castanops*), Wedge-tailed Eagle (*Aquila audax fleayi*), Forty Spotted Pardalote (*Pardalotus quadragintus*); and on the mainland includes species such as the Regent Honeyeater (*Anthochaera phrygia*), Red-tailed Black Cockatoo (*Calyptorhynchus banksii graptogyne*) and the Superb Parrot (*Polytelis swainsonii*). Many other mammals, invertebrates and plants will also receive benefits due to measures put in place to protect and rejuvenate Swift Parrot habitat.

Threatened Ecological Communities listed under the EPBC Act that are of importance to the Swift Parrot includes: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Cumberland Plain Woodland, Shale Sandstone Transition Forests, Shale Gravel Transition Forests, Gippsland Red Gum Grassy Woodland and Associated Native Grassland and Grassy Eucalypt Woodland of the Victorian Volcanic Plain. There are also a number of Ecological Communities listed at the state level that will benefit from increased efforts to protect and conserve Swift Parrot habitat.

11 Social and economic considerations

The major economic impact of this recovery plan will be on those who require approval to remove or modify Swift Parrot habitat and are prevented from doing so, or are required to modify their proposal by a consent authority. This may include increased costs due to the

assessment processes, requirement to provide offset funding, to secure or rehabilitate habitat, or for other threat mitigation work.

Restrictions on further clearing of Swift Parrot habitat will impact on some landowners, managers and developers. These restrictions may not significantly impact on agricultural industries since many of the more fertile areas have already been cleared and the remaining forest communities are generally located on less fertile soils and are, therefore, relatively less attractive for grazing or cropping.

Application of prescriptions protecting Swift Parrot habitat in areas managed for forestry throughout the range of the Swift Parrot will reduce the volume of timber available for harvesting. The management of forestry operations is carried out under the provisions of the Regional Forest Agreements, with the management prescriptions being developed and implemented by State Governments and the associated forestry managers.

A large network of community volunteers across eastern Australia actively participate in BirdLife Australia coordinated annual surveys for Swift Parrots. Involvement can provide social benefits with community members and engaged groups having a sense of achievement, inclusion, community spirit and pride whilst gaining enjoyment and appreciation of their surrounding natural environment. The community education components of the program also promote community ownership, provide community support and encourage active involvement in protecting local natural resources.

In addition, there is the potential for financial gains through ecotourism ventures and holiday accommodation operators in areas where Swift Parrots are reliably seen. Such areas are more likely to be in Tasmania, particularly in the south east, and popular through the summer breeding season. Additional social benefits include encouraging passive recreation, appreciation of natural aesthetic values and increased awareness and appreciation of Indigenous cultural values.

12 Affected interests

Organisations likely to be affected by the actions proposed in this plan include Australian and State Government agencies, particularly those with environmental, agricultural and land planning concerns; the forestry and agricultural sectors; researchers; and conservation groups. This list, however, should not be considered exhaustive, as there may be other interest groups that would like to be included in the future or need to be considered when specialised tasks are required in the recovery process.

13 Consultation

The National Recovery Plan for the Swift Parrot has been developed through extensive consultation with a broad range of stakeholders. The consultation process included a workshop in Melbourne that brought together key species experts and conservation managers from a range of different organisations, to categorise ongoing threats to the Swift Parrot and to identify knowledge gaps and potential management options. Workshop invitees included representatives from the Commonwealth Government and from the Tasmanian, New South Wales and Victorian Governments; BirdLife Australia; Sustainable Timber Tasmania, the Tasmanian Forest Practices Authority and researchers from university sector. The Recovery Team has also had several opportunities to comment on the draft plan.

14 Evaluating the performance of the plan

This plan should be reviewed no later than five years from when it was endorsed and made publically available. The review will determine the performance of the plan.

The review will be coordinated by the Department of the Environment and Energy in association relevant Australian and State Government agencies and key stakeholder groups such as non-governmental organisations, local community groups, scientific research organisations and individual experts.

Australian Government

Department of the Environment and Energy

State/territory governments

Victoria – Department of Environment, Land, Water and Planning and Parks Victoria

New South Wales – Office of Environment and Heritage; Forestry Corporation of NSW

Queensland – Department of Environment and Heritage Protection

South Australia – Department for Environment, Water and Natural Resources

Tasmania – DPIPWE

Australian Capital Territory – ACT Parks Conservation and Lands

Natural resource management bodies

Local government

Non-government organisations

BirdLife Australia

Conservation groups

Universities and other research organisations

Swift Parrot Recovery Team

15 References

Barrios L & Rodriguez A (2004). Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. *Journal of Applied Ecology* **41**, 72-81.

Brown PB (1989). The Swift Parrot *Lathamus discolor* White: A report on its ecology, distribution and status, including management considerations. Technical Report. (Department of Lands, Parks and Wildlife: Hobart).

Campbell CD, Sarre SD, Stojanovic D (2018). When is a native species invasive? Incursion of a novel predatory marsupial detected using molecular and historical data. *Diversity and Distributions*. 2018;24:831–840. <https://doi.org/10.1111/ddi.12717>

Department of Environment and Energy (2018). Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) DRAFT Conservation Advice (incorporating listing advice) for the Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (*Eucalyptus ovata* / *E. brookeriana*). Downloaded from: <https://www.environment.gov.au/biodiversity/threatened/nominations/comment/eucalyptus-ovata-tasmania> on the 18/06/2018.

Environment Conservation Council (2001). Box-Ironbark Forests and Woodlands Investigation. (Environment Conservation Council: Melbourne).

Ford H, Davis WE, Debus S, Ley A, Recher H & Williams B (1993). Foraging and Aggressive Behaviour of the Regent Honeyeater *Xanthomyza phrygia* in Northern New South Wales. *Emu* **93**, 277-281.

Forest Practices Authority (2010). Interim species habitat planning guideline for the conservation management of *Lathamus discolor* (Swift Parrot) in areas regulated under the Tasmanian Forest Practices System. Internal report to the Forest Practices Authority. Forest Practices Authority, Hobart.

Forest Practices Authority and DPIPWE (2014). Procedures for the management of threatened species under the forest practices system. Forest Practices Authority and Department of Primary Industries, Parks, Water and Environment, Hobart, Tasmania

Garnett ST, Szabo JK & Dutson G (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Melbourne.

Grey MJ, Clarke MF & Loyn RH (1998). Influence of the Noisy Miner *Manorina melanocephala* on avian diversity and abundance in remnant Grey Box woodland. *Pacific Conservation Biology* **4**, 55-69.

Heinsohn R, Webb MH, Lacy R, Terauds A, Alderman R & Stojanovic D (2015). A severe predator-induced decline predicted for endangered, migratory swift parrots (*Lathamus discolor*). *Biological Conservation*, **186**, 75-82.

Hingston AB, Gartrell BD & Pinchbeck G (2004). How specialized is the plant-pollinator association between *Eucalyptus globulus* ssp. *globulus* and the swift parrot *Lathamus discolor*? *Austral Ecology*, **29**, 624-630.

Kennedy S (2000). A winter survey of the Swift Parrot (*Lathamus discolor*) in northern New South Wales. (New South Wales NPWS).

Kennedy SJ & Overs AE (2001). Foraging ecology and habitat use of the swift parrot on the south-western slopes of New South Wales. *Corella* **25**, 68-74.

Kennedy S & Tzaros C (2005). Foraging ecology of the swift parrot *Lathamus discolor* in the Box-Ironbark forests and woodlands of Victoria. *Pacific Conservation Biology* **11**, 158-173.

Koch and Munks (2018 in press) Ongoing development of spatial information on nesting and foraging habitat availability and management approaches in off-reserve areas.

Law B, Mackowski C, Schoer L & Tweedie T (2000). Flowering phenology of myrtaceous trees and their relation to climatic, environmental and disturbance variables in northern New South Wales. *Austral Ecology* **25**, 160-178.

Munks, S., Richards, K., Meggs, J. and Brereton, R. 2004. The importance of adaptive management in 'off-reserve' conservation of forest fauna: implementing, monitoring and upgrading Swift Parrot *Lathamus discolor* conservation measures in Tasmania. - In: Lunney, D. (ed.) *The Conservation of Australia's Forest Fauna* (second edition). Royal Zoological Society of New South Wales, pp. 688-698.

Paton DC (1993). Honeybees in the Australian environment. *Bioscience*, 43, 95-103.

Pfennigwerth S (2008). Minimising the swift parrot collision threat. Guidelines and recommendations for parrot-safe building design. (WWF Australia, Sydney).

Porfirio LL, Harris RMB, Stojanovic D, Webb MH & Mackey B (2016). Projected direct and indirect effects of climate change on the Swift Parrot, an endangered migratory species, *Emu*, 116 273-283. <http://dx.doi.org/10.1071/MU15094>

Prober S & Thiele K (1995). Conservation of the Grassy White Box Woodlands: relative contributions of size and disturbance to floristic composition and diversity of remnants. *Australian Journal of Botany*, 349-366.

Robinson D & Traill BJ (1996). Conserving woodland birds in the wheat and sheep belts of southern Australia. RAOU Conservation Statement No. 10. Supplement to *Wingspan*. 6 (2).

Saunders D (2003). Swift Parrot habitat - Endangered Community. *Swifts Across the Strait*. February 2003.

Saunders DL, Brereton R, Tzaros C, Holdsworth M & Price R. (2007). Conservation of the swift parrot *Lathamus discolor* - management lessons for a threatened migratory species. *Pacific Conservation Biology*, 13, 111-119.

Saunders DL & Tzaros C (2011). National Recovery Plan for the Swift Parrot *Lathamus discolor*. Found at: <http://www.environment.gov.au/resource/national-recovery-plan-swift-parrot-lathamus-discolor> on 16/11/2015.

Sivertsen D (1993). Conservation of remnant vegetation in the box and ironbark land of New South Wales. *Victorian Naturalist*. 110:24-29.

Stojanovic D, Webb MH, Roshier D, Saunders D & Heinsohn R (2012). Ground-based survey methods both overestimate and underestimate the abundance of suitable tree-cavities for the endangered swift parrot. *Emu*, 112, 350-356.

Stojanovic D, Webb M, Alderman R, Porfirio L & Heinsohn R (2014). Discovery of a novel predator reveals extreme but highly variable mortality for an endangered bird. *Diversity and Distributions*, 20, 1200-1207.

Stojanovic D, Terauds A, Westgate MJ, Webb MH, Roshier DA, Heinsohn R. 2015. Exploiting the richest patch has a fitness payoff for the migratory swift parrot. *Journal of Animal Ecology* 84:1194-1201.

Stojanovic D, Olah G, Webb M, Peakall R & Heinsohn R (2018). Genetic evidence confirms severe extinction risk for critically endangered swift parrots: implications for conservation management. *Animal Conservation*. <https://doi.org/10.1111/acv.12394>

Tzaros C, Saunders D, Webb M & Ingwersen D (2009). Swift Parrots – dynamic migrants within a drought prone environment. *Wingspan* 19 (3), 14-15.

Voogdt Y (2006). Characteristics of Swift Parrot (*Lathamus discolor*) nesting habitat. Honours thesis. Department of Biology, School of Zoology and Anthropology, Georg-August-University of Göttingen, Germany.

Webb MH, Holdsworth MC & Webb J (2012). Nesting requirements of the endangered swift parrot (*Lathamus discolor*). *Emu*, 112, 181-188.

Webb MH, Wotherspoon S, Stojanovic D, Heinsohn R, Cunningham R, Bell P & Terauds A. (2014). Location matters: Using spatially explicit occupancy models to predict the distribution of the highly mobile, endangered swift parrot. *Biological Conservation*, 176, 99-108.

Webb MH, Terauds A, Tulloch A, Bell P, Stojanovic D & Heinsohn R (2017). The importance of incorporating functional habitats into conservation planning for highly mobile species in dynamic systems. *Conservation Biology* 31, 1018–28.

Webb MH, Stojanovic D & Heinsohn A (2018). Policy failure and conservation paralysis for the critically endangered swift parrot. *Pacific Conservation Biology* <https://doi.org/10.1071/PC18020>

Wilson J & Bennett AF (1999). Patchiness of a floral resource: flowering of Red Ironbark *Eucalyptus tricarpa* in a Box and Ironbark Forest. *Victorian Naturalist* **116**, 48-53.

Woinarski JC & Recher HF (1997). Impact and response: a review of the effects of fire on the Australian avifauna. *Pacific Conservation Biology* **3**, 183-205