



Conservation Advice for *Pycnoptilus floccosus* (Pilotbird)

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 2 March 2022.

This document combines the approved conservation advice and listing assessment for the species. It provides a foundation for conservation action and further planning.

Conservation status

Pycnoptilus floccosus (Pilotbird) is listed in the Vulnerable category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 2 March 2022.

Pycnoptilus floccosus was assessed by the Threatened Species Scientific Committee to be eligible for listing as Vulnerable under Criterion 1. The Committee's assessment is at Attachment A. The Committee's assessment of the species' eligibility against each of the listing criteria is:

- Criterion 1: A2bc: Vulnerable
- Criterion 2: Not eligible
- Criterion 3: Not eligible
- Criterion 4: Not eligible
- Criterion 5: Insufficient data

The main factor that made the species eligible for listing in the Vulnerable category was that the species likely underwent a population decline of 30 to 50% in the last three generations (11 years) (Loyn et al. 2021). This major reduction in population was caused by the 2019/2020 bushfires (Loyn et al. 2021). The total population of Pilotbirds is estimated at 88,000 (range 10,000–143,000) mature individuals in the wild with a declining trend (Loyn et al. 2021).

Two Pilotbird subspecies have been described and both subspecies have undergone similar declines. *Pycnoptilus floccosus floccosus* (Upland Pilotbird) is thought to have declined by 33% (range 19–37%) and *Pycnoptilus floccosus sandlandi* (Lowland Pilotbird) is thought to have declined by 30% (range 17–34%), depending on the fire-related mortality assumed under different scenarios (ST Garnett and G Ehmke unpublished data cited in Loyn et al. 2021). The species extent of occurrence (EEO) is estimated to be 212,200 km² (stable trend), however the area of occupancy (AOO) is estimated to have contracted to 26,600 km² (Loyn et al. 2021).

In a separate analysis, 47% of the species' overall distribution was burnt in the 2019/2020 bushfires (Legge et al. 2021). An expert elicitation estimated that Upland Pilotbirds experienced a decline of 30% (potentially as much as 45%, which was the lower 80% confidence bound) one

year after fire (Legge et al. 2021). Lowland Pilotbirds were estimated to experience declines of 26% (potentially as much as 42%) one year after fire (Legge et al. 2021).

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the [Species Profile and Threat Database](#).

Species information

Taxonomy

Conventionally accepted as *Pycnoptilus floccosus* Gould (1851).

There are two recognised subspecies of Pilotbird:

- *P. f. floccosus* (Upland Pilotbird) occur above 600 m in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria (Higgins & Peter 2002, Loyn et al. 2021).
- *P. f. sandlandi* (Lowland Pilotbird) occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to the Dandenong Ranges near Melbourne (Higgins & Peter 2002; Loyn et al. 2021).

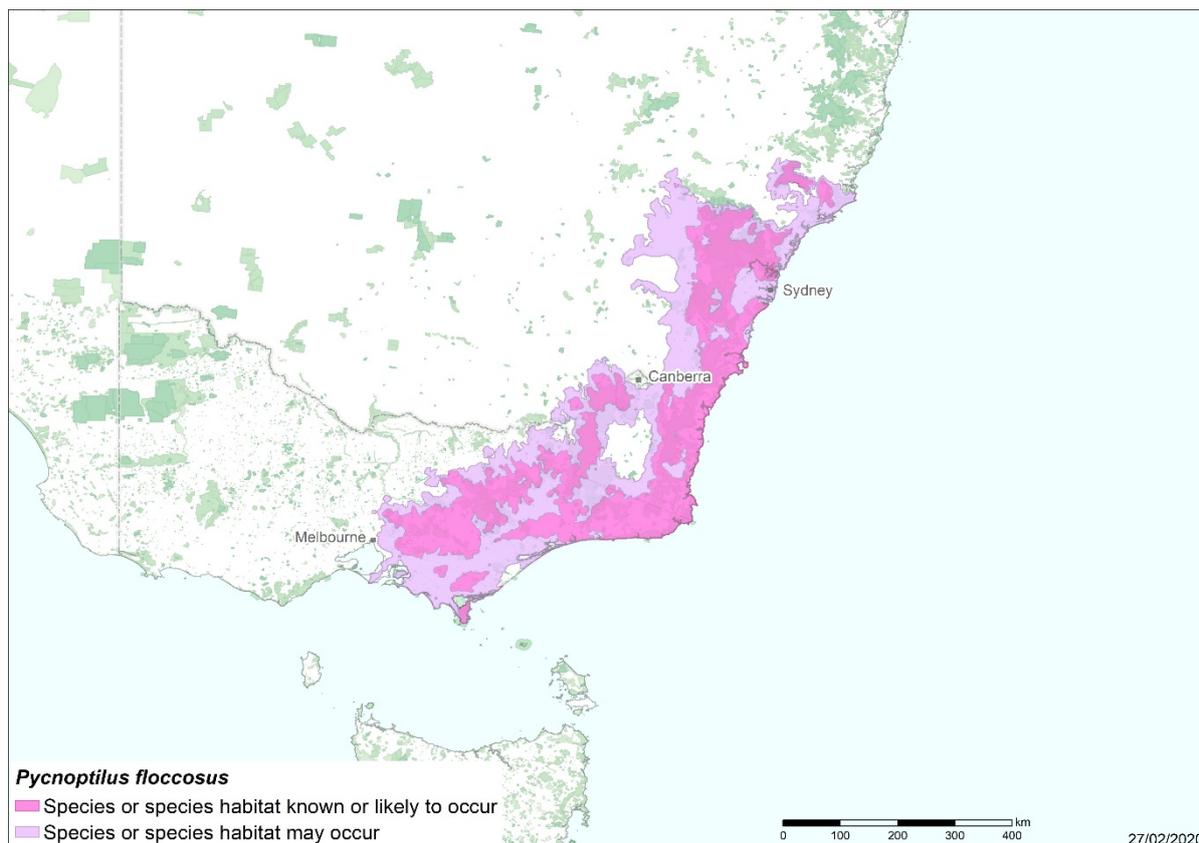
Description

Pilotbirds are small, plump, ground-dwelling birds, about 18 cm long with a wingspan and weight of around 23 cm and 27 g, respectively (Higgins & Peter 2002). Sexes are similar and do not display seasonal variation (Higgins & Peter 2002). Adults are large headed with cinnamon frons, amber eyes and slender, pointed, dusky bills. Their upperparts are a deep rufous-brown, while their tails are long, broad, and wedge-tipped. The species' throat, breast and underbelly are cinnamon, scalloped brown. Their lower underparts are dull white, and they have brown flanks and rufous tail coverts (Higgins & Peter 2002). Pilotbirds have characteristically large, strong feet. Juveniles are similar to adults but have darker foreheads, darker and richer russet-brown underparts, and a prominent pale gape (Higgins & Peter 2002).

Distribution

Pilotbirds are endemic to south-east Australia. Upland Pilotbirds occur above 600 m in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria (Higgins & Peter 2002; Loyn et al. 2021). Lowland Pilotbirds occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to Dandenong near Melbourne (Higgins & Peter 2002; Loyn et al. 2021).

Map 1 Modelled distribution of Pilotbird



Source: Base map Geoscience Australia; species distribution data [Species of National Environmental Significance](#) database.

Cultural and community significance

Pilotbirds are known to occur on the lands of at least the following Indigenous Peoples: Ngarigo, Ngunnawal, Walgal, Awakabal, Bidawal, Nindi-Ngudjam Ngarigu Monero, Bunurong, Darkinjung, Dharawal, Dharug, Gunaikurnai, Jaithmathang, Jerrinja, Taungurun, Wodi Wodi, Worimi, Wurundjeri and Yuin (Loyn et al. 2021). The cultural and community significance of the species is not known. Further research into the subject area may benefit the conservation of the species by providing insights about traditional land management.

Relevant biology and ecology

Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth (Higgins & Peter 2002). Largely sedentary, they are typically seen hopping briskly over the forest floor and foraging on damp ground or among leaf-litter. Flight is described as fairly weak, though, if disturbed, birds can sometimes ascend into shrubs (but no more than 1–2 m from the ground) (Higgins & Peter 2002). They are typically seen in pairs or occasionally in family parties, occupying small territories all year round.

Birds forage mostly in pairs for insects, and occasionally eat seeds and fruits (Higgins & Peter 2002). They use their bills and feet to turn and scratch leaf litter for food. Males are often seen feeding females (Higgins & Peter 2002). Pilotbirds have been associated with Superb Lyrebirds (*Menura novaehollandiae*), foraging in their wake as they scratch the forest floor (Higgins & Peter 2002).

Breeding takes place between August and January. Adults build a domed nest on or near the ground in which they usually lay two eggs (Zwart 1973). Eggs vary in colour from grey-green to purple-brown and are incubated by the female for 20–22 days. Upon hatching, young are fed insects by both parents and can continue to be fed by their parents for up to two months after fledging (Higgins & Peter 2002). Young Pilotbirds will forage together in groups with adults until the young males leave to stake their own territories. The generation length is 3.7 years (Bird 2020).

Habitat critical to the survival

Habitat critical to the survival of a species or ecological community refers to areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long-term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Habitat critical to the survival of the Pilotbird includes:

- wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth (Higgins & Peter 2002), and
- dry sclerophyll forests and woodlands occupying dry slopes and ridges (Higgins & Peter 2002).

Any breeding or foraging habitat in areas where the species is known or likely to occur (as defined by the distribution map provided in Map 1) and any newly discovered breeding or foraging locations should be considered habitat critical to the survival. Areas that are not currently occupied by the species because they have been burnt (either during the 2019/20, or in future fires), but which should become suitable again in the future, should also be considered habitat critical to survival.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Key considerations in environmental impact assessments

Habitat critical to the survival of Pilotbirds occurs in a wide range of land tenure arrangements, including on private land, nature reserves, state forests and National Parks (including the Blue Mountains world Heritage Area). It is essential that the highest level of protection is provided to these areas and that enhancement and protection measures target these sites.

When considering habitat loss, alteration or degradation to habitat in any part of the Pilotbird's range, including in areas where the species 'may occur', surveys for occupancy and identifying suitable habitat remain an important tool in refining understanding of the area's relative importance for Pilotbird. This pattern of habitat use means that both recent survey data and historical records need to be considered when assessing the relative importance of a local area or region for Pilotbirds.

Habitat critical to the survival of the species should not be destroyed or modified. Actions that have indirect impacts on habitat critical to the survival should be minimised and adequately mitigated (e.g. noise and light pollution). Actions that compromise adult and juvenile survival should also be avoided, for example, the transmission and introduction of diseases, and actions that might increase predation threat from both native and introduced predators. Actions should not be assessed in isolation and consideration must be given to existing and future activities that may impact the subspecies to ensure conservation outcomes on a landscape scale are achieved.

Actions that remove habitat critical to the survival would interfere with the recovery of the Pilotbird and reduce the area of occupancy of the species. It is important to retain both breeding and foraging habitats described above. If removal of habitat critical to the survival cannot be avoided or mitigated, then as a last resort an offset should be provided. Suitable offsets may include:

- Inclusion of unprotected areas of habitat critical to the survival in permanent nature reserves and provision of funding for the management of these areas.
- Increase extent and quality of feeding and breeding habitat.
- Restoration of native forest and woodlands adjacent to habitat critical to the survival to reduce edge effects.
- Management of threats (see *Threats*) in and adjacent to habitat critical to the survival.
- Other compensatory measures that will help address knowledge gaps to improve and maximise efficiency of the recovery of the species.

Other actions identified in this document may also form suitable offsets.

Threats

There were no substantive threats to the Pilotbird until a combination of extended drought and exceptional heat provided impetus for fire that burnt large parts of the habitat with high severity in January 2020 (Loyn et al. 2021). Both increased temperatures and drought are likely to increase in frequency and intensity in the future, as will the risk of extreme fires. As well as climate-induced fire impacts, there is some evidence that a warming climate is already affecting Lowland Pilotbirds at lower altitudes near Melbourne (Loyn et al. 2021). Predation by feral Cats and Foxes is also a potential threat to the species, especially following fire.

Table 1 Threats impacting Pilotbird

Threat	Status and severity ^a	Evidence
Fire		
Altered fire regimes	<ul style="list-style-type: none"> • Status: current/future • Confidence: known • Consequence: major • Trend: increasing • Extent: across the entire range 	Increase in frequency, extent or severity of wildfire is the main threat faced by Pilotbirds across its range, as it causes direct loss of habitat and individuals (Loyn et al. 2021). For example, it has been estimated that Upland Pilotbirds experienced a decline of 30% (potentially as much as 45%, which was the lower 80% confidence bound) one year after fire (Legge et al. 2021). Lowland Pilotbirds were estimated to experience declines of 26% (potentially as much as 42%) one year after fire (Legge et al. 2021). However, surveys and

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Threat	Status and severity ^a	Evidence
		<p>monitoring programs are required to obtain a quantitative measure of the impact of 2019/2020 fires on the species.</p> <p>Climate change increases the potential for extreme wildfires (Di Virgilio et al. 2019). Fire risk will continue to escalate in the future without sustained and substantial efforts to tackle climate change (Climate Council 2019).</p>
Climate change		
Increased frequency or length of droughts	<ul style="list-style-type: none"> • Status: current/future • Confidence: known • Consequence: moderate • Trend: increasing • Extent: across the entire range 	<p>Since the mid-1990s, southeast Australia has experienced a 15% decline in late autumn and early winter rainfall, and a 2% decline in average rainfall in April and May (Climate Council 2018). This has resulted in more time in drought, yet more intense, short duration heavy rainfall events (BOM & CSIRO 2020).</p> <p>The retreat of Pilotbirds up an altitudinal gradient may be an ecological response to the drying effect of drought at lower altitudes (Loyn & Menkhorst 2011). Pilotbirds were quite common and habituated to people in wet forest in the Dandenong Ranges in the 1970s but declined subsequently and are now rare (E McNabb pers. comm. cited in Loyn & Menkhorst 2011). Similar declines have been observed in Bunyip State Park and near Healesville, though the species remains common in wet forest at higher elevation e.g., near Toolangi.</p> <p>Additionally, drought makes vegetation more flammable, and therefore more likely to support extreme fire behaviour (Climate Council 2019). It also makes vegetation more susceptible to spot fires ahead of the main fires when weather conditions deteriorate (high temperatures, low relative humidity, strong winds) (Climate Council 2019).</p>
Temperature extremes	<ul style="list-style-type: none"> • Status: current/future • Confidence: inferred • Consequence: unknown • Trend: increasing • Extent: across the entire range 	<p>Since 1950, the annual number of record hot days (above 35°C) across Australia has more than doubled (Climate Council 2014) and the mean temperature has increased by about 1.4°C from 1910 (IPCC 2021). Heatwaves are also lasting longer, reaching higher maximum temperatures, and occurring more frequently over many regions of Australia, including the southeast (Perkins-Kirkpatrick et al. 2016).</p> <p>Birds are vulnerable to extreme heatwaves that overwhelm their physiological limits (McKechnie et al 2012). Heatwaves also exacerbate drought, which in turn can also increase bushfire risk (Climate Council 2014).</p> <p>It is not fully known how these weather events, or the cumulative effect of these weather events, affect Pilotbird's survival and reproduction. The precautionary principle should be applied to ensure suitable quality and quantity of habitat needed by the species is conserved across its known and suspected range.</p>

Threat	Status and severity ^a	Evidence
Habitat loss and degradation		
Clearing of native vegetation and commercial logging	<ul style="list-style-type: none"> • Status: current/future • Confidence: unknown • Consequence: major • Trend: stable • Extent: across part of its range 	<p>Since European settlement over 43% of native forests have been cleared nationwide (Bradshaw 2012). Commercial logging potentially removes habitat for birds that use trees and understory vegetation for cover, nesting habitat, or food (Dinesen 2019). Logging of native forests also makes them much more flammable and elevates the severity of bushfires when they occur (Lindenmayer et al. 2021).</p> <p>Ongoing clearing of native vegetation and inappropriate forest management may reduce the availability of Pilotbird foraging and breeding habitat.</p>
Invasive species (including threats from grazing, trampling, predation)		
Predation by cats and foxes	<ul style="list-style-type: none"> • Status: current • Confidence: known • Consequence: minor • Trend: unknown • Extent: across the entire range 	<p>Predation by feral and domestic cats (Commonwealth of Australia 2015a, 2015b) is most likely a threat to Pilotbirds (inferred from evidence of predation on the Superb Lyrebird (<i>Menura novaehollandiae</i>) (Dickman 2009). The threat of cats is also amplified by bushfires as cats take advantage of recently burnt areas (McGregor et al. 2016), to hunt in open habitats, which they prefer (McGregor et al. 2015).</p> <p>Fox predation is also likely a threat as foxes also occur in Pilotbird habitat.</p>

Status—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 1 in terms of the extent that it is operating on the species. The risk matrix (Table 3) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately (Table 2). The risk matrix (Table 3) and ranking of threats has been developed in consultation with experts, community consultation and by using available literature.

Table 2 Risk prioritisation

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Moderate risk	Very high risk	Very high risk	Very high risk
Likely	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Possible	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Very high risk
Unknown	Low risk	Low risk	Moderate risk	High risk	Very high risk

Categories for likelihood are defined as follows:

Almost certain – expected to occur every year

Likely – expected to occur at least once every five years

Possible – might occur at some time

Unlikely – such events are known to have occurred on a worldwide basis but only a few times

Rare or Unknown – may occur only in exceptional circumstances; OR it is currently unknown how often the incident will occur

Categories for consequences are defined as follows:

Not significant – no long-term effect on individuals or populations

Minor – individuals are adversely affected but no effect at population level

Moderate – population recovery stalls or reduces

Major – population decreases

Catastrophic – population extinction

Table 3 Pilotbird risk matrix

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain					
Likely		<ul style="list-style-type: none"> • Predation by Cats and Foxes 		<ul style="list-style-type: none"> • Inappropriate fire regimes 	
Possible				<ul style="list-style-type: none"> • Increased frequency or length of droughts • Temperature extremes 	
Unlikely					
Unknown				<ul style="list-style-type: none"> • Clearing of native vegetation and commercial logging 	

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be ‘very high’ or ‘high’. For those threats with an unknown or low risk outcome it may be more appropriate to identify further research or maintain a watching brief.

Conservation and recovery actions

Primary conservation outcome

- Stable population over time, enabled by a fire and forest management regime that reduces the risk of extensive, intense fires and allows full population recovery and recolonisation of burnt areas between fires.

Conservation and management priorities

Inappropriate fire regimes

- After fires, protect unburnt areas within or adjacent to recently burnt ground that may provide ongoing refuge.

- Actively manage the landscape to minimise the risk of large wildfires, ensuring that this also meets the ecological requirements of the species.
- Ensure fire management (fire risk reduction, fire suppression and post-fire management activities) considers impacts on key breeding locations, foraging, roosting and nesting habitat for Pilotbird.
- Constrain actions such as salvage logging that would reduce the likelihood of recovery or recolonisation of burnt areas after fire.
- Ensure remaining habitat is protected from development.
- Develop post-fire management protocols to protect known populations e.g., targeted cat and fox control programs.

Clearing of native vegetation and commercial logging

- Ensure remaining habitat is protected from disturbance and fragmentation.
- Reduce impacts of commercial logging in important foraging and breeding habitat.

Stakeholder engagement/community engagement

- Raise awareness and improve public knowledge of Pilotbirds within the local community through site visits, signage, and posters/information brochures to be distributed to local naturalist and tourism groups, relevant authorities, and volunteer organisations.
- Engage with private landholders and land managers responsible for land where breeding birds occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.
- Encourage community involvement in research and citizen science (e.g., submit sighting of birds).

Survey and monitoring priorities

- Develop and implement a monitoring program for the species that supports and enhances existing programs, to determine distributional and population status and trends, especially in relation to changes in threats and their management.
- Monitor Pilotbird populations along an altitudinal gradient to detect potential impacts of climate change.
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities

- Determine the conditions needed for recovery of the population after fire.
- Identify areas that currently have strong populations and that could be important as refuges in the future.
- Assess rates of recolonisation of burnt habitat, particularly that distant or isolated from unburnt populations.
- Assess the need for assisted recolonisation of formerly occupied habitat.

- Investigate population connectivity and the likelihood of genetic isolation now and in the future, especially for the upland subspecies.
- Use climate modelling techniques to investigate the potential impact of climate change (i.e., increased frequency or length of droughts and temperature extremes) on the species and their habitat critical for survival.
- Investigate threats from inappropriate fire regimes and commercial logging.

Links to relevant implementation documents

- [Threat abatement plan for predation by feral cats](#) (Commonwealth of Australia 2015b).
- [Threat abatement plan for predation by European red fox](#) (Commonwealth of Australia 2008b)

Conservation Advice and Listing Assessment references

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THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Threatened Species Scientific Committee finalised this assessment on 12 October 2021.

Attachment A: Listing Assessment for *Pycnoptilus floccosus*

Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC.

Assessment of eligibility for listing

This assessment uses the criteria set out in the [EPBC Regulations](#). The thresholds used correspond with those in the [IUCN Red List criteria](#) except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria.

Table 4 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	88,000	10,000	143,000	<p>There are estimated to be 11,000 (range 1,000–18,000) Upland Pilotbirds (<i>P. f. floccosus</i>) and 77,000 (range 9,000–125,000) Lowland Pilotbirds (<i>P. f. sandlandi</i>) in the wild.</p> <p>The population estimates of the two Pilotbird subspecies are based on average densities recorded in 2 ha 20 min counts (<i>P. f. floccosus</i> 1.5±0.6 birds/ha, <i>P. f. sandlandi</i> 1.3±0.6 birds/ha; BirdLife Australia 2020); the areas likely to have been occupied from 1990–2019 based on Birddata (BirdLife Australia 2020) and eBird (Cornell Lab 2020); a habitat occupancy of 5–10%; maps of fire severity in 2019/2020 within the pre-fire range; and, initial assumptions about mortality at different severity classes (severity low: 20%; medium: 50%; high: 80%; very high: 100%).</p>
Trend	Declined			<p>The population of Upland Pilotbirds is thought to have declined by 30% (15–45%; 80% confidence bounds) one year after fire (Legge et al. 2021); or 33% as a result of the fires with estimates ranging from 19–37% depending on the fire-related mortality assumed under different scenarios (ST Garnett and G Ehmke unpublished data cited in Loyn et al. 2021).</p> <p>The population of Lowland Pilotbirds is thought to have</p>

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Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
				declined by 26% (12–42%; 80% confidence bounds) one year after fire (Legge et al. 2021); or 30% as a result of the fires with estimates ranging from 17–34% depending on the fire-related mortality assumed under different scenarios (ST Garnett and G Ehmke unpublished data cited in Loyn et al. 2021). Both estimates in Loyn et al. (2021) conservatively assume a relatively high level of mortality; the true mortality may be lower. Baker et al. (1997) estimated that 10% of individuals survived a fierce fire in the Brindabellas (Loyn et al. 2021).
Generation time (years)	3.7	2.8	4.6	Bird et al. (2020)
Extent of occurrence	212,200 km ²	205,000 km ²	217,000 km ²	The EOO is based on all records since 1990 (Loyn et al. 2021)
Trend	Stable			Loyn et al. (2021)
Area of Occupancy	26,600 km ²	3,700 km ²	34,500 km ²	Loyn et al. (2021)
Trend	Contracted			Fires in 2019/2020 burnt 46–53 % of the range of Upland and Lowland Pilotbirds respectively (Legge et al. 2021); or 52.5 % and 50.9 % of all 1x1 km squares from which Upland and Lowland Pilotbirds have been recorded, respectively, since 1990 (G Ehmke unpublished data cited in Loyn et al. 2021).
Number of subpopulations	2	2	2	One subpopulation for each subspecies (Loyn et al. 2021).
Trend	Stable			Loyn et al. (2021)
Basis of assessment of subpopulation number	While both subspecies are assumed to be panmictic, this has never been tested (Loyn et al. 2021)			
No. locations	>10			Loyn et al. (2021)
Trend	Not calculated			Loyn et al. (2021)
Basis of assessment of location number	Pilotbirds are estimated to occur >10 locations (Loyn et al. 2021), based on the most plausible serious threat – fire. The number of locations was determined using the 2019/2020 fire extent (IUCN 2019; Loyn et al. 2021). The 2019/2020 bushfire heavily impacted south eastern Australia, though unburnt habitat fragments remain within the fire-affected area. Birds are highly mobile and are able move away from fire and persist in habitat refuge sites, recolonising burnt areas once they become suitable again. The geographic position of unburnt locations will vary between fires, but there are always likely to be >10 locations (Loyn et al. 2021) occurring at least within known sites in areas above 600 m asl in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria; and in forests from the Blue Mountains west of Newcastle around the wetter forests of eastern Australia to the Dandenong's near Melbourne (Higgins and Peter 2002).			
Fragmentation	Not severely fragmented (Loyn et al. 2021).			

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Fluctuations	Not subject to extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals (Loyn et al. 2021)			

Criterion 1 Population size reduction

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

Criterion 1 evidence

Eligible under Criterion 1 A2bc for listing as Vulnerable

Upland Pilotbirds occur above 600 meters in the Brindabella Ranges in the Australian Capital Territory, and in the Snowy Mountains in New South Wales and north-east Victoria. Lowland Pilotbirds occur in forests from the Blue Mountains west of Newcastle, around the wetter forests of eastern Australia, to Dandenong near Melbourne (Higgins & Peter 2002). Between July 2019 and February 2020, bushfires burned over 104,000 km² across southern and eastern Australia (Legge et al. 2021). It is estimated that 33% (range 19–37%) and 30% (range 17–34%) of Upland and Lowland Pilotbird populations perished in the fires, respectively. These estimates depend on the fire-related mortality assumed under different scenarios (Loyn et al. 2021). There has also been an estimated 52.5% and 50.9% decline in Upland and Lowland Pilotbird habitat respectively due to the fires. This includes important Pilotbird nesting and feeding habitat (Loyn et al. 2021). The extent of occurrence (EOO) for the species is stable (212,200 km²), however, the area of occupancy (AOO) for the species has contracted to 26,600 km² (Loyn et al. 2021).

In a separate analysis based on expert elicitation, populations of the Upland and Lowland Pilotbirds were estimated to decline by 30% and 25% respectively, and possibly by as much as 45% and 42%, respectively (based on the lower 80% confidence bound) (Legge et al. 2021).

The retreat of Pilotbirds up an altitudinal gradient may be an ecological response to the drying effect of drought at lower altitudes (Loyn & Menkhorst 2011). Pilotbirds were quite common and tame in wet forest in the Dandenong Ranges in the 1970s but have declined since and are now rare (E McNabb pers. comm. cited in Loyn & Menkhorst 2011). Similar declines have been observed in Bunyip State Park and near Healesville, though the species remains common in wet forest at higher elevation e.g., near Toolangi.

The Committee considers that the species has undergone a substantial reduction in numbers over three generations (11 years), which is equivalent to at least >30% to 50% and the cause has not ceased. This is because the risk of frequent, large extent, high intensity wildfires are projected to increase. Therefore, the species has met the relevant elements of Criterion 1 to make it eligible for listing as **Vulnerable**.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy

	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (E00)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (A00)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Criterion 2 evidence

Not eligible

The extent of occurrence (E00) for the species is estimated to be 212,200 km² (Upland Pilotbird: 16,200 km² (range 15,000–17,000 km²); Lowland Pilotbird: 196,000 km² (range 190,000–200,000 km²)) (Loyn et al. 2021). The area of occupancy (A00) is estimated to be 26,600 km² (Upland Pilotbird: 2,800 km² (range 300–3,700 km²); Lowland Pilotbird 23,800 km² (range 3400–30,800 km²)) (Loyn et al. 2021). The E00 is based on all records since 1990. The estimated A00 is the proportion of a tight polygon encompassing all records since 1990 (alpha hull). The minimum is based on the 2x2 km squares encompassing those records. The maximum

is an alpha hull encompassing all records regardless of whether they burnt. Fires in 2019/2020 burnt 52.5 % and 50.9 % of all 1x1 km squares from which Upland and Lowland Pilotbirds have been recorded, respectively, since 1990 (G Ehmke unpublished data cited in Loyn et al. 2021). The EOO for the species is thought to be stable; however, the AOO for the species has contracted (Loyn et al. 2021). Both subspecies of Pilotbird are estimated to occur at more than 10 locations and are not severely fragmented. The species is not subject to extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals. No parameter was changed by an order of magnitude by the 2019/2020 fire.

Following assessment of the data, the Committee has determined that the species' geographic distribution is not precarious for its survival. Therefore, the species has not met this required element of this criterion.

Criterion 3 Population size and decline

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

Criterion 3 evidence

Not eligible

The species consists of two populations (Loyn et al. 2021). The total population size is now generally accepted to be 88,000 mature individuals (consisting of 11,000 Upland Pilotbirds (range 1,000–18,000, low reliability), and 77,000 Lowland Pilotbirds (range 9,000–125,000, low reliability) (Loyn et al. 2021). The total population for the Upland and Lowland subspecies has very likely declined due to the 2019/2020 fires, but not enough to reduce the total populations

to less than 10,000. The species is not subject to extreme fluctuations in the number of mature individuals (Loyn et al. 2021).

The number of mature individuals of the species is not considered low, as there is no continuing decline, therefore the species does not meet the required elements to be listed as threatened under this criterion.

Criterion 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1,000
D2.¹ Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km ² or number of locations ≤ 5

¹ The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the [common assessment method](#).

Criterion 4 evidence

Not eligible

The total population size is now generally accepted to be 88,000 mature individuals (consisting of 11,000 Upland Pilotbirds (range 1,000–18,000, low reliability), and 77,000 Lowland Pilotbirds (range 9,000–125,000, low reliability) (Loyn et al. 2021). This estimate is based on average densities recorded in 2 ha 20 min counts (*P. f. floccosus* 1.5±0.6 birds/ha, *P. f. sandlandi* 1.3±0.6 birds/ha; BirdLife Australia 2020); the areas likely to have been occupied from 1990–2019 based on Birdata (BirdLife Australia 2020) and eBird (Cornell Lab 2020); a habitat occupancy of 5–10 %; maps of fire severity in 2019/2020 within the pre-fire range; and, initial assumptions about mortality at different severity classes (severity low: 20 %; medium: 50 %; high: 80 %; very high: 100 %).

The total number of mature individuals is 88,000 which is not considered low. Therefore, the species has not met this required element of this criterion.

Criterion 5 Quantitative analysis

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

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis has not been undertaken. Therefore, there is insufficient information to determine the eligibility of the subspecies for listing in any category under this criterion.

Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 35 business days between 9 July and 27 August 2021.

Listing and Recovery Plan Recommendations

The Threatened Species Scientific Committee recommends:

- (i) that the list referred to in section 178 of the EPBC Act be amended by **including** *Pycnoptilus floccosus* in the list in the Vulnerable category.
- (ii) that there not be a recovery plan for this species.

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