Husbandry Manual
for the

Superb Parrot

Polytelis swainsonii

Aves: Psittacidae

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1 Introduction

The Superb Parrot *Polytelis swainsonii* as the first described species of the totally Australian genus *Polytelis* and must be considered typical of this group of long tailed, slender bodied parrots with pronounced sexual dimorphism. The other members of the genus are the Princess Parrot *P. alexandrae* and the Regent Parrot *P. anthopeplus*. Unlike the other members of this genus *P. swainsonii* is predominantly bright green in colour.

The wild population of *P. swainsonii* has a current conservation status of 'Vulnerable'. The single sub-population of this species is estimated to contain a total breeding population of probably less than 5000 breeding pairs and declining. Prior to these estimates up to 1992 previous surveys indicated that the wild population has been declining at more than 1% per year for the last 10 years.

The decline of the wild population of *P. swainsonii* has been attributed to the loss of habitat and contracting of its overall range in New South Wales and Victoria as a result of the clearance of box woodlands for agriculture, grazing, gathering of firewood and also from fuel reduction burning. In particular the riparian River Red Gum forest habitat has been adversely affected by logging for timber. There are also indications that the use of chemicals such as fertilisers and pesticides; rural tree dieback; competition by other species for tree hollows for nesting sites; road kills, poaching and trapping have also contributed to the decline of *P. swainsonii*.

Recovery plans have been put into place in both New South Wales and Victoria, with relevant government agencies being responsible for the implementation of appropriate land management practices. It has been suggested as part of the recovery plans for *P. swainsonii* that there may be potential for reintroductions to supplement local populations where nesting sites are available. This could assist in accelerating the extension of the species range and increase the probability of the long-term viability of local populations. Therefore it is appropriate that a captive breeding action plan should be devised.

Probably the first breeding success for *P. swainsonii* is that mentioned by Arthur A. Prestwich in his *Records of Parrots Bred in Captivity*, 1951, when Monsieur Duval of Theix, France was successful in 1881.

This species has been successfully bred in captivity since that early record in 1881. In Australia the first recorded reference to the breeding of this species is by Neville W. Cayley in his *Australian Parrots*, 1938, who states "Has bred in captivity in Australia on numerous occasions but I have been unable to ascertain who was the first breeder". Since 1938 *P. swainsonii* is recorded as being successfully bred in both aviculture and zoo holdings. The main captive breeding method has been with individual pairs in separate aviaries but colony breeding has also been successful.

The current 2004 holdings of *P. swainsonii* within the Australasian Species Management Program are 44 birds. There are no regional management programs established for this

species. (ACT Government 1999) (Barker et al. 2003) (Ford pers. com. 2004) (Forshaw 2002) (Garnett and Crowley 2000) (Higgins 1999) (Sindel and Gill 2003) (Streatfield 1995) (Webster and Ahern 1992) (Wilson 1990)

2 Taxonomy

2.1 Nomenclature

Class: Aves
Order: Psittaciformes
Family: Psittacidae
Genus: *Polytelis*
Species: *swainsonii*
(Garnett and Crowley 2000)

2.2 Subspecies

No subspecies recognised. (Garnett and Crowley 2000) (Higgins 1999) (Shephard 1989)

2.3 Recent Synonyms

Psittacus swainsonii Desmarest, 1826, Levrault's *Dict. Sci. Nat.* 39: 39 – New Holland = New South Wales.

The generic name reflects the bright plumage of these parrots (Greek, extravagant, costly). The species is named in honour of the distinguished English naturalist William Swainson (1789-1855), who first (1821) described it with the pre-occupied *Psittacus barrabandi*. (Forshaw 2002) (Higgins 1999)

2.4 Other Common Names

Barraband or Scarlet-breasted Parrot, Barraband's Parrot, Barraband's Parakeet, Barraband, Green Leek. (Forshaw 2002) (Higgins 1999)

3 Natural History

3.1 Morphometrics (Key Measurements and Features)

3.1.1 Mass And Basic Body Measurements

FIELD IDENTIFICATION

Body length: 400mm
Wingspan: 530-570mm
Weight: 130-160g

The following details are taken from various Australian museum specimens; (1) Adults (2) Juveniles and birds undergoing post-juvenile moult:

MASS (WEIGHTS) (g) AVERAGES, RANGE AND NUMBER OF SPECIMENS

	MALES	FEMALES
(1)	153.1 (134-164; 17)	154.3 (144-156; 8)
(2)	122.9 (85-148; 11)	142.7 (120-166; 6)

BASIC BODY MEASUREMENTS (mm) AVERAGES, RANGE AND NUMBER OF SPECIMENS

		MALES	FEMALES
WING	(1)	186.8 (178-193; 37)	183.4 (174-188; 16)
	(2)	178.9 (169-186; 14)	178.6 (170-183; 8)
TAIL	(1)	234.4 (218-258; 13)	216.8 (189-232; 11)
	(2)	189.8 (157-223; 6)	199.8 (191-214; 5)
BILL	(1)	16.3 (14.7-18.7; 36)	15.7 (14.8-16.6; 14)
	(2)	15.3 (13.9-16.7; 13)	15.7 (14.8-16.7); 9)
TARSUS	(1)	18.8 (17.5-20.5; 37)	19.0 (18.1-19.8; 16)
	(2)	18.9 (17.6-20.0; 14)	18.7 (17.8-19.6; 10)

(Higgins 1999)

3.1.2 Sexual Dimorphism

The Superb Parrot, *Polytelis swainsonii*, has pronounced sexual dimorphism and was the first described species of the totally Australian genus *Polytelis. P. swainsonii* must be considered typical of the three species of long tailed, slender bodied parrots that form the genus *Polytelis*.

Unlike the other two members of the genus, the Princess Parrot, *Polytelis alexandrae*, and the Regent Parrot, *Polytelis anthopeplus*, *P. swainsonii* is predominately bright green in colour. Two races of *P. anthopeplus* are recognized. The nominate race *P. a. anthopeplus* from the western range in Western Australia tends to be greener in colour than the recently renamed subspecies *P. a. monarchoides* from the eastern range, centred around the border areas of New South Wales, South Australia and Victoria, which is predominately yellow. *P. alexandrae* has soft pastel colours. Sexual dimorphism is

pronounced in both subspecies of *P. anthopeplus*, but less conspicuous in *P. alexandrae*. (Forshaw 2002) (Sindel and Gill 2003)

3.1.3 Distinguishing Features

Adult male

General plumage colouration, both above and below, rich green, slightly paler and more yellowish on underparts; hindcrown to nape washed with blue, forehead to forecrown, chin, throat and cheeks bright yellow, sometimes tinged with orange on centre of forehead; a wide crescent of scarlet-bright red across foreneck immediately below yellow throat; bend of wing, outer most secondaries and outer webs of primaries dull blue, last two forming indistinct thin blue leading edge to folding wing; tall above dark green washed with deep blue toward tip, below greyish-black with dull yellowish-white at tips of lateral feathers; bill pale coral-brownish red; iris, yellow-orange red, orbital ring, grey; legs and feet, gray. (refer Figure 1.)

Adult female

Duller than male; differs by: face, dull bluish green (not yellow), grading to greyish green on upper throat, and usually with varying dull-pink wash on lower throat; rest of head and neck, bright green with no blue wash on crown or nape; underbody duller, yellow-green; thighs, pink red; undertail the same as male, except for conspicuous rose-pink edges to outer feathers merging to cream at tip, under wing same as male, except coverts duller green; bill, duller brownish-red; iris yellow-crimson. (refer Figure 2.)

Figure 1. Adult male.

Figure 2. Adult female.

Juveniles

Very similar to adult female but duller; best distinguished by: head and neck, dull yellow-green, with no blue wash to face or pink wash on foreneck; tail has slightly broader and brighter tip, and tip to tail flight feathers (rectices) pointed (rounded in adult); bill much paler, creamy yellow; iris red-brown. (Forshaw 2002) (Higgins 1999) (Lendon 1979) (Proctor and Lynch 1993) (Sindel and Gill 2003)

3.2 Distribution and Habitat

(Breeding, Post-breeding Dispersal and Habitat Use)

Distribution

Inland southeastern Australia from central New South Wales south to northernmost Victoria.

In New South Wales, west of the Great Dividing Range, *P. swainsonii* is distributed from the lower northwestern slopes and eastern sector of the northwestern plains, between Narrabri and Lightning Ridge, south to the southern tablelands, in the Canberra district of the Australian Capital Territory, and to the Murray River, between Albury and Barham. Westernmost records include Quambone, Nyngan, Goolgowi and Hay, with occasional extralimital reports from Walgett, Bourke, Hermidale and to the northeast of Balranald. There are unconfirmed reports of sightings on the south coast between Bermagui and Tathra, but reports from elsewhere on the coast especially from near Sydney, are presumed to be of aviary escapees.

In northernmost Victoria, where formerly it was more widespread, the species is now confined mainly to the mid Murray River and its tributaries from the lower Goulburn River and the Barmah Forest east to Yarrawonga and the lower Ovens River, occasionally extending upstream to Killawarra State Forest, north of Wangaratta.

Breeding is restricted to the southern sector of the range, mostly below latitude 33°S, where it is concentrated along mid reaches of the Murrumbidgee River, between Wagga Wagga and Toganmain Station, along mid reaches of the Murray River and its tributaries, between Barham and Yarrawonga, and on the southwestern slopes of the Great Dividing Range from about Cowra south to the Cootamundra and Yass districts. North of latitude 33°S, the presence of *P. swainsonii* is due principally to a post breeding dispersal from the southwest. (refer Figure 3 and 4)

Figure 3. *P. swainsonii* former distribution (blue) and current distribution (green) in Australia.

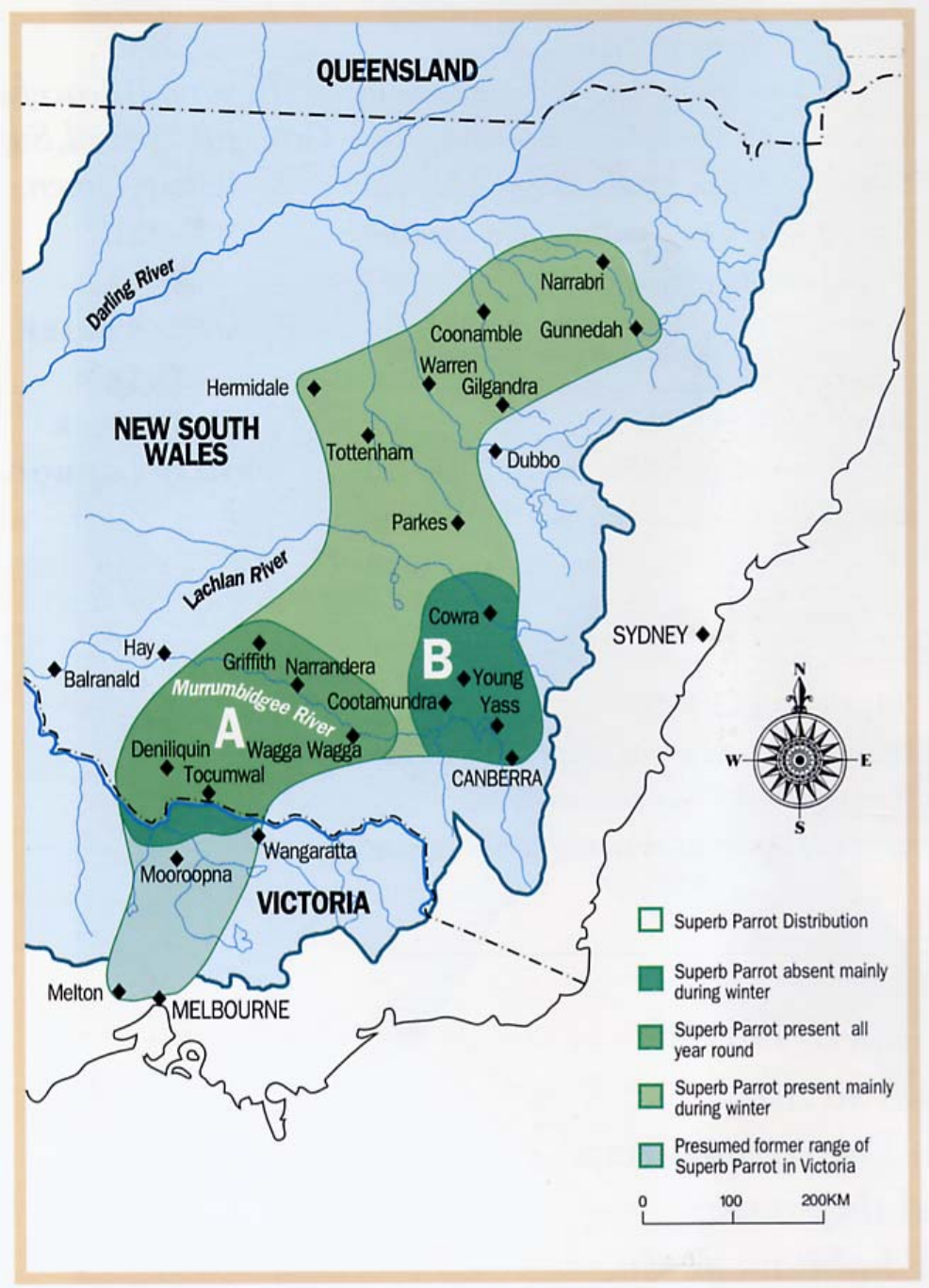


Figure 4. *P. swainsonii* Distribution. Breeding areas in the Murray-Riverina (A) and southwestern slopes (B).

Habitat

In parts of the breeding range (refer Figure 8) there is a close association between *P. swainsonii* and riverine forests of river red gums *Eucalyptus camaldulensis*, and with mixed box-eucalypt woodlands on the adjoining floodplains. This side-by-side

positioning of breeding and foraging habitats is important to *P. swainsonii*. In the Hay district, at the western extremity of the range along the Murrumbidgee River, riparian woodlands consist of black box *Eucalyptus bicolor* intermixed with river red gums, and are only a few trees wide, being replaced away from the river by extensive saltbush *Atriplex* plains. In this area, *P. swainsonii* are rarely found away from the river frontage. Towards the east there is a widening of riverine forests of river red gums, and away from the river the vegetation changes to open grasslands, where increasing rainfall brings about a gradual transition to well-watered woodlands. Along the eastern fringe of the range, river red gums often are replaced by river she-oaks *Casuarina cunninhamiana*. With the eastward expansion of woodlands, *P. swainsonii* become less restricted to riparian habitats, so that on the southwestern slopes of the Great Dividing Range there is virtually no dependence on river systems.

P. swainsonii utilise two distinct habitat types for nesting. The most extensive breeding habitat is the river red gum forests along the Murrumbidgee, Edward and Murray Rivers and their tributaries. (refer Figure 5 and 6) Also in these areas there is a strong association between nesting sites and the near occurrence of extensive tracts of foraging habitat in box-eucalypt woodland on the adjoining floodplain. Demonstrating this association is an observation of a nesting colony from along the Murrumbidgee River travelling approximately 11km north of the river to reach their feeding sites by moving through remnant patches of *Callitris-Eucalyptus* woodland scattered through paddocks or in corridors that followed fence lines or roads. At the feeding sites this same mixed woodland occurred as remnant patches with introduced grasses and herbs dominating the groundcover vegetation or as roadside verges with scattered shrubs and a groundcover of both native and introduced species. On the southwestern slopes (refer Figure 7) of the Great Dividing Range, in the second type of habitat utilised for nesting, differentiation between nesting and foraging components is not particularly evident, and here *P. swainsonii* nest and feed in mixed woodlands in which at least five *Eucalyptus* species besides river red gums are used for nesting. In the same area, feeding occurs also in cereal crops and in scattered remnants of woodland associations

Figure 5. Barmah-Millewa river red gum forest habitat.

Figure 6. Flooded river red gum forest habitat typical of the Murray-Riverina region.

Figure 7. Yellow Box woodland habitat of the southwestern slopes.

Outside the breeding season, *P. swainsonii* frequent a wide variety of wooded habitats. In mid January, soon after dispersal from nesting areas, *P. swainsonii* regularly feed in scattered stands of boree *Acacia pendula* between the Murrumbidgee and Murray Rivers, in southern New South Wales, while in the same region during winter wandering flocks may be seen in various habitats, including forests of white cypress pine *Callitris columellaris.* Near Griffith, also in southern New South Wales, *P. swainsonii* has been observed in mallee *Eucalyptus*, but may have only been moving through the area, while in the east, on the southwestern slopes, *P. swainsonii* has been occasionally observed

feeding in town parks and gardens. Mixed *Callitris-Eucalyptus* woodlands are frequented in west-central and north-central New South Wales. In northern New South Wales, *P. swainsonii* favour the flooded-zone *Eucalyptus* community, similar to that along the mid reaches of the Murrumbidgee River, but occasionally are found in association with bimble box *Eucalyptus populiflora* away from the river.

Breeding

P. swainsonii mainly go to nest between September and January. Courtship displays are variable but usually commence with the male making short flights to and from the perched female, who also at times will take a short flight then return to the original perch. The male bows with eyes flashing while at the same time dilating and contracting the pupils; sometimes raising the feathers on the forecrown of the head and slightly spreading both wings. While the female crouches submissively with wings drooped and uttering a soft begging call. Courtship feeding usually follows and sometimes copulation takes place.

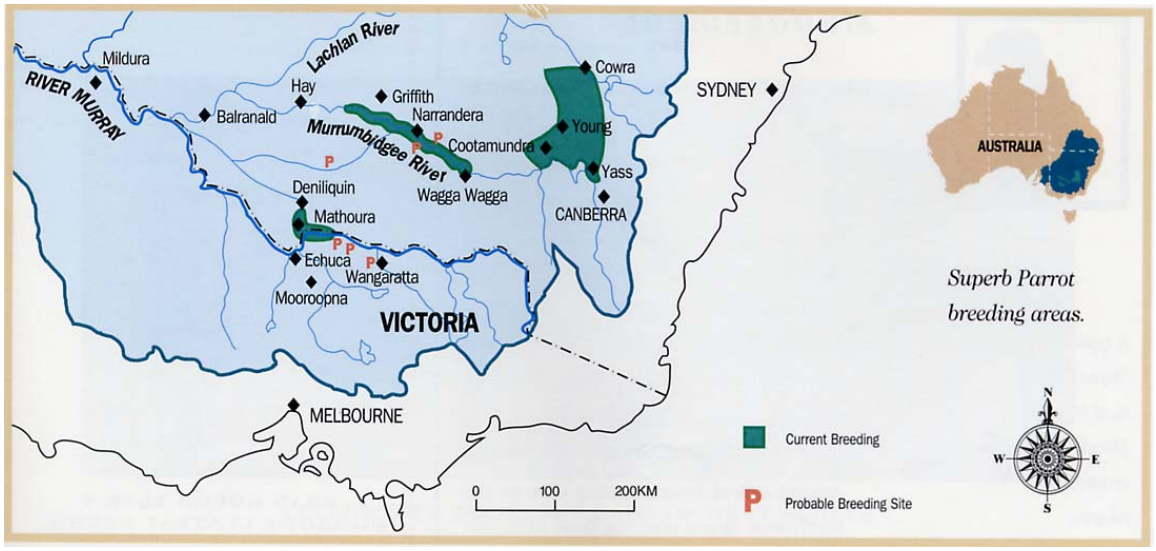
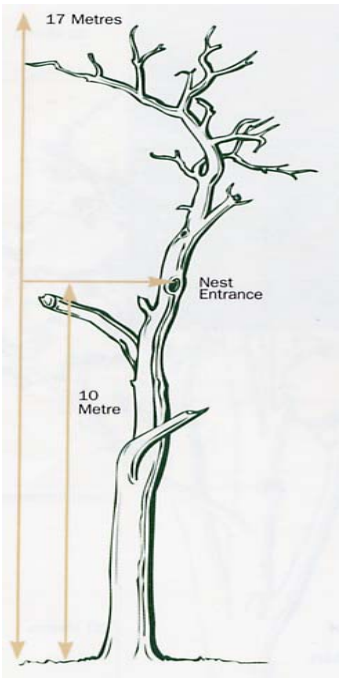
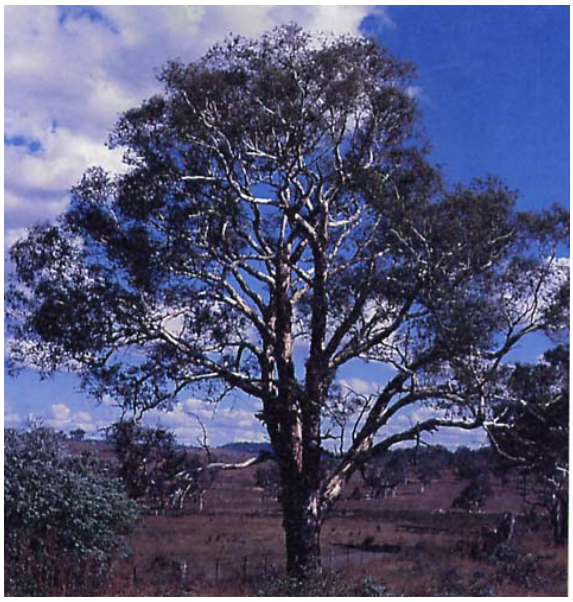


Figure 8. *P. swainsonii* breeding areas.

Within the Murray-Riverina (refer Figure 6) and the Barmah-Millew Forest (refer Figure 5) areas *P. swainsonii* relies on the riparian river red gum forest for nesting and prefers to nest in large trees, which contain numerous hollows. These types of trees take at least 150 years to form hollows. The availability of suitable trees for nest sites is critical to maintaining and increasing *P. swainsonii* numbers as nesting does not occur unless trees with suitable hollows are found. A typical nest tree is generally one of the largest trees in the forest and located within 9km of box woodland. The typical nest tree in the region has a diameter (at breast height) of 1.57m, a height of 33m and a maximum crown width of 11m. The typical nest hollow is 17m above the ground and around 26m from a watercourse. Black box, white cypress pine and boree are often associated with many breeding areas. (refer Figure 9)



(A)



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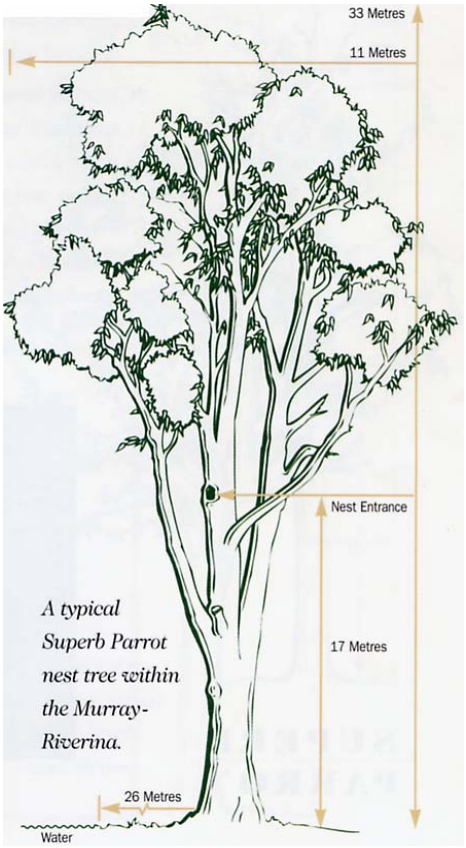

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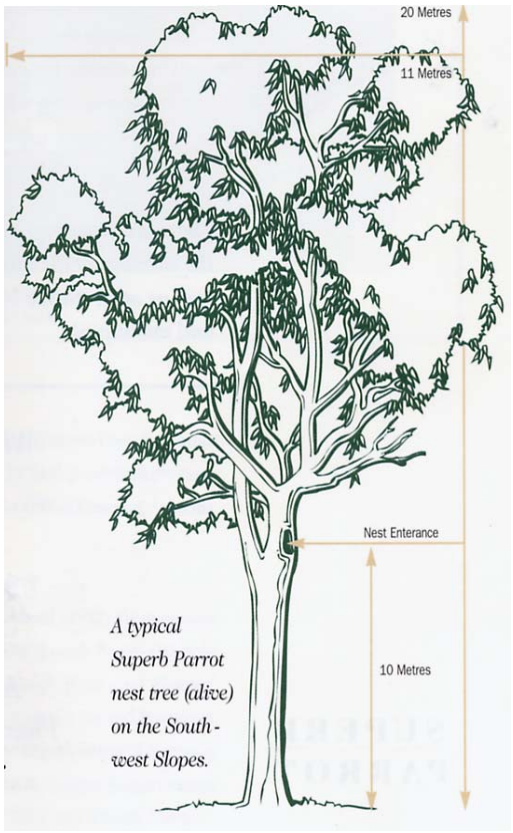

(D)

Figure 9. Typical *P. swainsonii* nest trees (A) dead and (B) alive on the southwestern slopes. Nest trees (C) and (D) as indicated.

On the southwestern slopes (refer Figure 7), *P. swainsonii* nest in open woodland and utilise both dead and live trees. Some of the more favoured nesting sites include river red gums *Eucalyptus camaldulensis*, Blakely's red gum *Eucalyptus blakelyi*, apple box *Eucalyptus bridgesiana*, grey box *Eucalyptus microcarpa*, white box *Eucalyptus albens* and red box *Eucalyptus polyanthemos*. The typical nest tree varies slightly depending on whether it is alive or dead, but is generally between 17 m and 20m high, have a diameter (at breast height) of less than 1m and a nest site around 10m high. The living trees have a crown width diameter of around 8m. *P. swainsonii* tend to nest in or a short distance from box woodlands and around 160-180m from a water source (dam or river). The Western Silver Wattle *Acacia decora*, is often associated with breeding sites. (refer Figure 9)

Colony breeding in groups of up to nine pairs has been recorded but solitary pair breeding is also common. Observations at individual nests suggest that many hollows are traditionally reused by *P. swainsonii* year after year, and occasionally different hollows in the same tree may be occupied in successive years. Also, there is some evidence of traditional nesting trees continuing to be used after those trees have died, but the occasional selection of dead trees for nesting is not supported by available evidence. It has not been confirmed whether nesting hollows are reused by the same pairs, nor is it known if some nests are occupied only intermittently.

Nesting hollows appear to vary in depth with eggs having been found at approximately 38cm from the entrance and at ground level 11m below the hollow entrance, with decayed wood dust at the bottom of the hollow. A normal clutch of four to six white, rounded, oval eggs are laid usually at two-day intervals. Incubation is undertaken only by the female, who is fed by the male two or three times daily, either inside the hollow, at the nest entrance or outside the nest, throughout the incubation of the eggs and the first week or so of brooding the young.

The chicks hatch after recorded incubation periods of 20 to 22 days. Throughout the incubation period and for the first week after hatching the breeding males flock and feed together, returning periodically to their nest hollow to feed the incubating female. As the young grow the female leaves the nest to forage with the male. Advanced chicks have been observed to come to the nest entrance to be fed by both parents. The young fledge about 35 to 40 days after hatching and join their parents to forage in family groups and at times link up with larger flocks. The survival rate of young *P. swainsonii* in the wild is unknown and needs further investigation.

Observations of the wild population in the Boorowa N.S.W. area (Thompson, P. 2004 pers. communication, 1 Nov) indicate that there appears to be a higher ratio of males to females that are bred each year. Similar ratios are also known in captive breeding (Thompson, P. 2004 pers. communication, 1 Nov). This imbalance may account for the flocks of males but more importantly could be a contributing factor to the decline of wild populations of *P. swainsonii*. Research needs to be conducted on the imbalance to determine its role within both wild and captive populations.

Post-breeding dispersal and habitat use.

Between January and April, *P. swainsonii* generally disperse away from the breeding area. Immediately after fledging, dispersal occurs from the Murray-Riverina nesting sites into the box woodland surrounding the riverine forest (with the exception of the Edward River area, where it has been observed that there is little initial net movement). On the southwestern slopes, a similar early movement occurs into box-gum woodlands to the west. Subsequently adults and young gradually distribute themselves over a far greater range, possibly following different food sources as these become available.

It is known that during mid January, part of the *P. swainsonii* population forages on the boree trees, which form scattered woodlands between the Murrumbidgee and Murray Rivers. Whilst the distribution of the entire population from mid January to early April is unclear, the breeding habitats are not frequented during this time. Between April to August, the populations appear to be scattered from the Riverina to north-central New South Wales and, during this time, a variety of habitats are exploited. In north-central New South Wales, river red gum forest and box-pine woodland are utilised whilst, in the Riverina, river red gum forest, box-pine woodland, box woodland, pine woodland and boree woodland are all used. On the southwestern slopes *P. swainsonii* has rarely been observed during winter (May-August), the few *P. swainsonii* that have been seen are presumed to be breeding pairs. The bulk of the population from the southwestern slopes appears to disperse through the eucalypt-pine woodlands of west-central and north-central New South Wales. The over wintering of *P. swainsonii* in northern New South Wales may be a recent phenomenon, as there are no museum specimens from that region and *P. swainsonii* was not observed in the region until 1931. Routes followed by *P. swainsonii* when moving away from or returning to breeding areas are not known, but it is likely that dispersal patterns are determined by food availability, and it is possible that different routes are followed on outward and inward journeys (refer Figure 4).

A few *P. swainsonii* may be observed in the nesting areas as early as late March, but it is May or late April that birds begin returning to the riverine forests of river red gums or to the breeding areas on the southwestern slopes of New South Wales. Local observations (Thompson, P. 2004 pers. communication, 1 Nov) for the Boorowa district of the southwestern slopes suggest that the return of *P. swainsonii* to the area for breeding can be timed to coincide with the equinox but is dependent on climate patterns. It is suspected that the early arrivals are established breeding pairs and likely that subadults and non-breeding adults make up the flocks that continue to wander throughout the wintering range until about August, when populations are again concentrated in the breeding areas. Generally the post and pre-breeding movements of *P. swainsonii* are poorly known and require further research. (Costermans 1991) (Forshaw 2002) (Garnett and Crowley 2000) (Higgins 1999) (Robinson 1994) (Sindel and Gill 2003) (Streatfield 1995) (Thompson 2004) (Webster and Ahern 1992)

3.3 Conservation Status

IUCN: Vulnerable C2b CITES: II

The single sub-population of this species is estimated to contain a total breeding population of probably less than 5000 breeding pairs and declining. These population estimates relate to surveys documented during the period 1992 to 1997. Current wild population numbers are unknown. Research should now be conducted to gauge whether there has been a further decline in numbers and if the conservation status of *P. swainsonii* needs to be reviewed.

Captive population: Current ARAZPA institutional holdings for 2004 are:
Male: 19 Female: 20 Unknown: 7
NSW Department of Environment and Conservation registered holdings for New South Wales (Neilly, B. 2004 pers. communication 21 Sep):
Total male, female and unknown 2003: 2667
Total male, female and unknown to September 2004: 1806
(Garnett 2000) (Higgins 1999) (Johnson 2004)

3.4 Diet in the Wild

P. swainsonii spend much time on the ground, where they feed on seeds of grasses and herbaceous plants. Their diet also includes fruits, berries, nuts, nectar blossoms, and insects and their larvae obtained in the treetops or among the outer branches of shrubs.

There have also been recorded observations of *P. swainsonii* feeding on fallen seed among and presumably from wild geranium *Erodium* sp., barley grass *Hordeum murinum*, burr medic *Medicago denticulata*, spear grass *Stipa* sp., and wallaby grass *Danthonia* sp. It has been noted that during winter and spring *P. swainsonii* spent more time feeding among green weeds, and were observed feeding on the green seedheads of milk thistle *Sonchus oleraceus*, wild mustard *Sisymbrium* sp., shepherd's purse *Capsella* sp., barley grass, and stinging nettles *Urtica urens*.

During surveys conducted during the 1985 and 1986 breeding seasons, 55% of foraging observations were of *P. swainsonii* feeding on the ground, with the remaining greater proportion of feeding being conducted at 18% feeding on flowers, 15% feeding on leaves, 8% small branches and 2% cereal crops. The favoured foods include berries of the dwarf cherry *Exocarpus strictus*, seeds of white top grass *Danthonia caespitosa*, barley grass *Hordeum leporinum*, not fully ripened wheat or oats, and flower buds and berries of grey mistletoe *Amyema quandang*, and box mistletoe *A. miquelli. P. swainsonii* was also observed foraging in the canopy of eucalypts, feeding on all stages of flowers and fruits from young buds through to ripened seed capsules, of river red gums *Eucalyptus camaldulensis*, black box *E. largiflorens* and yellow box *E. melliodora*, while on the southwestern slopes of New South Wales white box *E. albens* was utilised in the same manner. In central-west New South Wales *P. swainsonii* was observed in bimble box *E. populnea* feeding on psyllid lerps. (refer Figure 10)

Figure 10. Psyllids (lerp insects) live under these coverings or tests (lerps) and suck sap from *Eucalyptus* leaves.

Small groups of *P. swainsonii* will visit homesteads, farm buildings or stockyards to feed on spilled grain, and in crop-growing districts they are attracted to roadsides where grain spills from passing trucks. Often in the company of Yellow Rosellas *Platycerus elegans flaveolus*, they come to feed on blossoms in groves of introduced sugar gums *Eucalyptus cladocalyx*, which are widely planted as windbreaks in farmlands throughout the Murrumbidgee Irrigation Area; the entire flower is eaten and not merely chewed to extract nectar. Near Canberra, in the Australian Capital Territory, and along mid reaches of the Murrumbidgee River *P. swainsonii* has been observed extracting seeds from ripened and unripened wattle *Acacia*, pods.

During summer *P. swainsonii* feed actively in the mornings up to 09:00 and in the afternoons after 17:00. In winter *P. swainsonii* tends to be active for more of the day. For both seasons *P. swainsonii* spends the greater part of the morning and afternoon active period feeding quietly on the ground. Usually *P. swainsonii* feed in groups of up to 7-8 birds but have been observed occasionally in flocks of 100 birds feeding in the canopy of one forest red gum *Eucalyptus tereticornis*. There have been observations of *P. swainsonii* feeding with Crimson Rosellas *Platycerus elegans nigrescens*, and other species, in stubble paddocks or wheat crops. *P. swainsonii* drink in the morning and late afternoon at rivers, preferring spits of sand as watering places, drinking in relays of two to three birds by flying down to the sand to drink then returning to the trees. (Brooker and Kleinig 1990) (Forshaw 2002) (Hadlington and Johnston 1987) (Higgins 1999) (Streatfield 1995) (Webster and Ahern 1992)

Figure 11. Other common Australian native food trees and shrubs of *P. swainsonii*.

Blakely's red Gum *Eucalyptus blakelyi*	Cootamundra wattle *Acacia baileyana*
Grey Box *Eucalyptus microcarpa*	Gold dust wattle *Acacia acinacea*
Mugga ironbark *Eucalyptus sideroxylon*	Wyalong wattle *Acacia cardiophylla*
Eurabbie gum *Eucalyptus bicostata*	Deane's wattle *Acacia deanei*
Silver wattle *Acacia dealbata*	Western silver wattle *Acacia decora*
Western wreath wattle *Acacia saligna*	Green wattle *Acacia decurrens*
Emubush *Eremophila longifolia*	Silky oak *Grevillea robusta*

3.5 Longevity

3.5.1 In the Wild

Like many parrot species *P. swainsonii* is probably quite long lived. Anecdotal information suggests that the species may live for twenty five years or more. (Webster and Ahern 1992)

3.5.2 In Captivity

P. swainsonii has been known to live in excess of twenty years. A prolific breeding pair of *P. swainsonii* have been reported to have produced young for twenty years. (Forshaw 2002) (Sindel and Gill 2003) (Wilson 1990)

3.5.3 Techniques Used to Determine Age of Adults

Sexing

The young leave the nest with similar plumage to the female then at about eight months old the young males commence a slow moult, which identifies their sex as the mottled adult male feathering gradually appears. This moult is not completed until during the second year. Juvenile females do not appear to moult as quickly or as extensively as juvenile males. Generally the whole moulting process into adult plumage is usually completed by about sixteen months old.

There is some indication that young *P. swainsonii* can be sexed with certainty as advanced nestlings or fledglings by examining the facial mask in sunlight. Young males have a yellow suffusion of the facial area while young females have a blue suffusion of the facial area.

Juvenile males are more active in general behaviour than juvenile females. Juvenile males begin to use their voice to chortle and chuckle to themselves. Juvenile females seldom utter more than an ordinary call note. This activity may be another useful indication of sex.

Aging

Juveniles lack notching on primary feathers; outer primaries all slightly pointed, but none as pointed as primaries of adult male, but all slightly more pointed than primaries of adult female. (refer Figure 12.)

The general age of the current wild population is unknown. Further observations of *P. swainsonii* are required to determine if mature aged birds are being successfully replaced to maintain a viable wild population. (Forshaw 2002) (Higgins 1999) (Lendon 1979) (Proctor and Lynch 1993) (Sindel and Gill 2003)

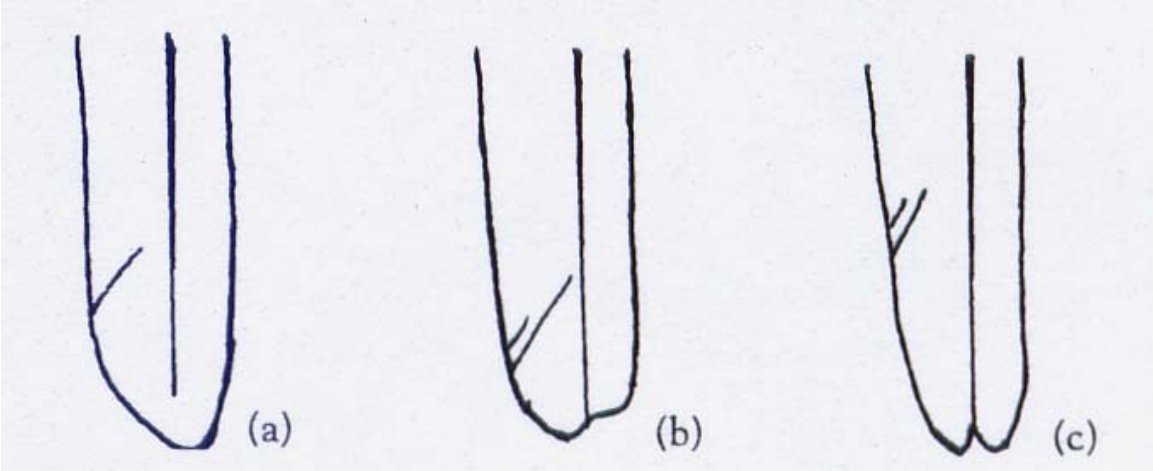

Figure 12. Primaries (a) Juvenile (b) Adult female (c) Adult male.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

Broadly speaking an exhibit/enclosure designed to house *P. swainsonii* for public display can vary depending on the purpose and number of birds. The purpose or main use of the enclosure should be established prior to any design being completed. Is the enclosure for breeding display purposes or simply for display purposes with no breeding to take place? If it is a breeding display is *P. swainsonii* to be exhibited as individual breeding pairs, several pairs to establish a breeding colony or as a one or more breeding pairs in a mixed display aviary with other compatible bird species with which no hybridization can take place? If it is a non-breeding display where for example only males of several compatible

bird species are to be displayed then the overall enclosure design may be slightly different towards being more of a decorative design rather than being a conventional aviary design i.e. rectangular.

The type of enclosure that has proved to be the safest and most successful for housing breeding pairs of *P. swainsonii* are medium to medium-large sheltered aviaries that are totally enclosed except for the front, with solid walls and partitions, concrete floors and opening into a service corridor or some other protected area. Each enclosure can be fully roofed or roofed only at each end to provide internal natural light. The number of birds planned to be housed in a specific enclosure should determine the enclosures size i.e. colony, mixed display.

Rather than having separate enclosures it would be more appropriate to design and construct several enclosures together as a breeding complex, which are easier to service and maintain. Having enclosures as a block may also be better for public viewing and the provision of interpretation. (refer Figure 13 and 14)

To allow for more natural light and air flow to enter individual enclosures (aviaries), a raised central perspex roof could be installed and reducing the internal partitions by a third or quarter of the length of each enclosure from the front would assist with these matters. Reducing the length of internal partitions would also assist with public viewing from different angles across the front of the complex. (refer Figure 14.)

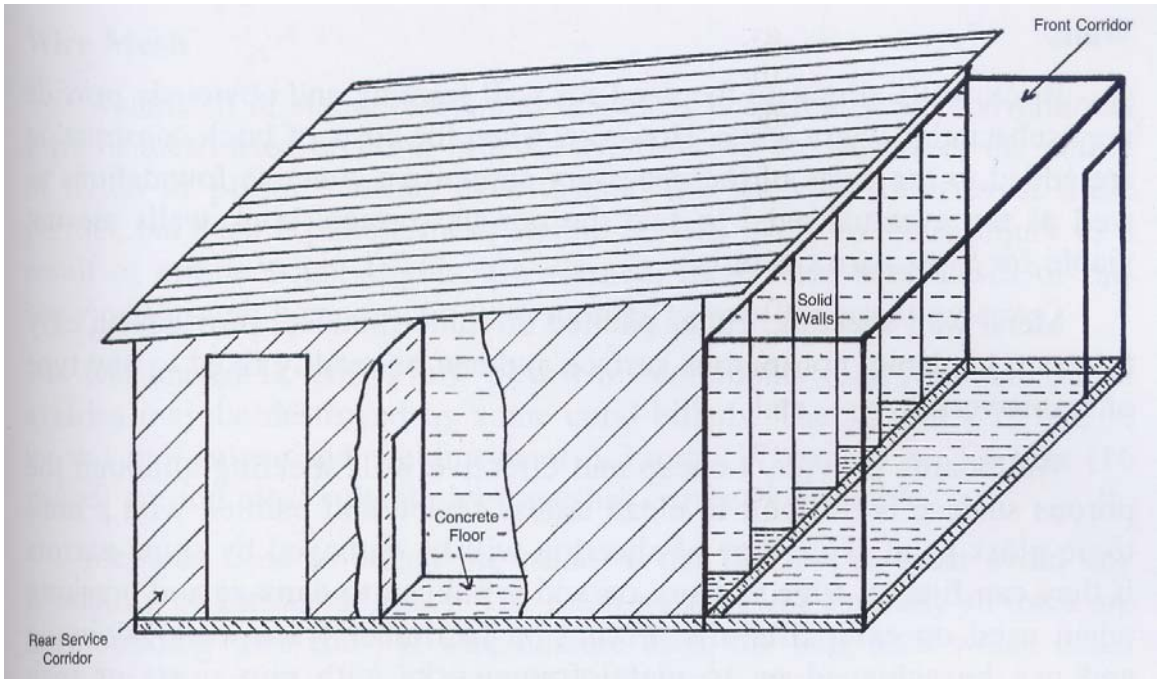

Figure 13. Example of a design for a fully roofed breeding complex with rear and front service corridors.

Figure 14. Example of a psittacine breeding complex with a raised public viewing area.

Figure 15. Alternatively a breeding complex could be designed to fit into the surrounding environment and provide more public viewing for individual enclosures. However, this particular design does give public access to a greater proportion of the enclosures.

Larger landscaped enclosures (refer Figure 16 and 17) can be effective for displaying *P. swainsonii* as a colony or for a mixed display. However, if breeding took place in larger enclosures there are concerns about young *P. swainsonii* taking off on erratic flight and picking up sufficient speed to cause fatal injuries by crashing into the wire of the open flight sections. This problem could be overcome by screening off the higher open flight sections of enclosures with cut branches or external shade-cloth so that young birds are unable to see directly out of the enclosure. The screening could be removed once the young birds become more adept at flying and know the boundaries of their enclosure. (Sindel, S. 2004 pers. communication, 17 Aug)

It would also be appropriate for the public viewing area to be maintained at a discrete distance from the outside of each enclosure. This would also assist in helping to reduce any disturbances caused by members of the public leaning on or hitting the sides of the enclosures, provoking a flight response and possible injury of the enclosed birds. Simple barriers around an exhibit that would blend in with the exhibit surrounds (refer Figure 14 and 17), which may include a landscaped garden area between the barrier and enclosure, may be sufficient to deter public access. The barrier would assist in reducing public risk by not allowing access directly to an enclosure i.e. bitten fingers, fingers or small hands caught in the enclosure wire.

Figure 16. Shows a well presented landscaped enclosure but public access may be too close. More inclement weather protection and a service walkway may be required.

Figure 17. A new more decorative enclosure that provides sufficient internal flight space for a large number of birds, with an adequate landscaped public barrier system.

The following features should be considered when designing an exhibit/enclosure to house *P. swainonii*:

Framework

Enclosure frames are better constructed from galvanised steel tubing either round or square. The joints of the steel tubing should be secured with either welding, pop rivets, tech screws or tee and elbow joints, and then apply a protective coating such as cold galvanising paint to prevent rust from forming on the joints.

Walls

Brick walls eliminate the need for wall framing and obviously provide substantial enclosure (aviary) walls. (refer Figure 15) However, when the costs of brick construction are added to the costs of the necessary supportive concrete foundations as well as the possible need to seal the porous surface, brick walls may not be a viable option.

Metal wall sheeting, either painted or colour bonded, provides an easy to clean, hygienic, non-porous surface and can be readily fixed to any type of framework.

Wallboards, plywood and chipboard may be cheaper options for walls but have porous surfaces and may be hard to clean unless sealed and coated with non-toxic gloss paint. These surfaces are vulnerable to being chewed by psittacine species.

Roofing

Metal roofing is a durable product, which, unlike other roofing materials, when installed correctly is almost totally immune from storm damage. In extreme climates insulation fitted under metal roofing will assist in moderating temperatures in enclosures. Heat is reflected by the bright surface of galvanised, zincalum and aluminium sheeting or by painting the metal roof surfaces white or silver to help reduce the internal effects of extreme summer temperatures.

Metal roofing fixed on top of flat fibre-type sheeting provides added insulation due to the air space between the roof corrugations and the flat sheeting. This will assist in reducing the temperature within enclosures (aviaries) during hot climatic conditions. The same insulation will provide higher internal temperatures during colder conditions. The flat surface of the sheeting will also provide an easy to paint ceiling under the metal roof. Spaces created in a roof need to be regularly checked and kept clear of any pest species.

Clear or opaque corrugated sheets of perspex or similar roofing material that is storm proof can be used in small sections of the roof to allow more light into an enclosure. Too much clear sheeting fixed around an enclosure may increase internal temperatures and can be detrimental to the health of birds. All other types of roofing materials may be unsuitable for enclosure construction due to such factors as vulnerability to storm damage, leaking, excessive weight such as tiles or cost.

Fully roofed enclosures provide protection from contact with wild birds, which have the potential to pass on diseases and parasites by direct contact or from their faeces, feathers and feather dust entering the enclosure i.e. Psittacine Beak and Feather Disease, worms. A full roof cover gives greater protection from inclement weather conditions, reducing the potential for having damp cold enclosures and allows the servicing of enclosures to be completed in all climatic conditions. The potential of attack from predators, especially raptors, is greatly reduced with fully roofed enclosures. Alternatively double layers of wire mesh where no roofing material is used, with space between the layers, can assist in providing the required protection from predators for an enclosures occupants.

Wire mesh

The 12mm x 25mm galvanised weldmesh of 1.3mm (17 gauge) or 1.6mm (16 gauge) are the most suitable wire meshes for *P. swainsonii* enclosures (aviaries). Methods used to attach the wire mesh to the framework must avoid any possibility of accidental injury occurring. The mesh must be cut carefully so there are no protruding wire ends. If wire ties are used the long ends, which could catch leg rings or bird legs must be cut off. Pop rivets with large heads or washers are a safe method of attaching weldmesh to a metal frame.

<u>All wire and any other metal filings and cuttings should be picked up after the enclosure construction is completed, even consider the use of large magnets to clean the floor surface, to ensure there are no pieces of metal remain that birds could fatally ingest.</u>

All new galvanised wire mesh must be thoroughly cleaned before allowing birds to make contact with it. This is to avoid heavy metal poisoning, which is caused by birds licking or chewing and then digesting deposits of lead or zinc oxides that are usually present on the new metal surfaces.

The prevention of lead poisoning really starts at the construction stage of an enclosure making sure that no lead based products are used in the construction. If known lead based products have to be used then these items should be hidden during construction to prevent any bird from accessing them. Zinc poisoning occurs mainly from galvanised enclosure (aviary) wire, however, any galvanised product used with psittacines has the potential to cause zinc poisoning i.e. holding cages, "D" shaped feeders. All galvanised products that are to be used in the housing or feeding of psittacines should be thoroughly cleaned of any zinc deposits before being used. Zinc Wash Acetic Acid has been indicated as being effective on galvanising. The excesses of zinc on new aviary wire should be scrapped off and disposed of effectively and safely. Then washing the wire with a 10% vinegar or similar acidic solution using a stiff wire brush and washing off vigorously with water has also been effective but is not guaranteed to be 100%. Weathering enclosure wire, which is exposing wire to normal climatic conditions for a few months, does not necessarily remove zinc deposits. Batches of new aviary wire can vary in their toxicity levels but imported wire appears to be the most toxic. Using a wire that is of a heavier gauge so that the birds find it harder to bite off deposits of zinc is an alternative but would still require cleaning and washing down. The new wire product "BHP Evencoat" is indicated as potentially being safer than standard enclosure (aviary) wire.

Partitons

When housing *P. swainsonii* it is advisable that the partitions be of solid materials, as recommended for walls. Solid partitions eliminate interference from neigbouring birds and provide a draught free, secluded environment conducive to successful breeding.

The only disadvantage of solid partitions is the reduction of air circulation within each enclosure in tropical climates or in regions that experience extreme temperatures. This situation can be resolved by either fixing ventilators at the rear of each enclosure, or as previously mentioned having a raised open central roof section and reducing the length of internal partitions by a third or quarter from the front of the enclosure as shown in Figure 14.

Walkways and service corridors

All bird complexes/enclosures should be provided with front access service walkways or fully roofed rear service corridors or both. Walkways or service corridors situated at the front of a complex/enclosure will assist in eliminating escapes, predator attacks and general disruptions as well as facilitating feeding and cleaning. (refer Figure 13 and 14)

Fully roofed service corridors at the rear of a bird complex/enclosure provide even easier feeding and cleaning facilities under all weather conditions. This type of service area

when designed with sufficient width allows the use of external feeding hoppers, watering devices and nesting facilities. Generally service corridors provide easy access, quick servicing and helps to minimise the disturbance to the complex/enclosure occupants, especially breeding pairs.

A disadvantage with having only a rear service corridor is the vulnerability of the front of the complex/enclosure to predator attack and other disturbances i.e. public access, which could be eliminated by also having a front service area and a well constructed public barrier system. To promote comfortable working conditions front access service corridors should be a minimum of 1.2m wide, while rear access service corridors can be wider at a minimum of 1.8m to allow easy servicing of external feeders, watering and nesting facilities.

However, when designing enclosures (aviaries) for public viewing the use of front access service walkways may not be appropriate. The extra wire panels required for walkways may hinder the public obtaining a clear view of the occupants of an enclosure.

Feeding and watering

Feeding and watering facilities in an enclosure must be positioned to avoid pollution or contamination from bird faeces and be protected from direct sunlight, rain and vermin. These requirements can be achieved by having feed and water containers positioned under shelters but not below perches. Feed containers should be suspended in such a way that facilitates easy servicing but more importantly to prevent access by vermin, especially rats and mice. Large banks of enclosures (aviaries) can be more efficiently watered with an automated watering system. (refer Figure 21)

Snake proofing

In Australia *P. swainsonii* are vulnerable to snake predation. Nests that contain eggs and young are particularly at risk of snake predation. Adult birds can fall prey to large snakes.

Snakes can gain access to an enclosure by squeezing through the tiniest crack of construction materials, via rat and mouse holes, through wire mesh that has 12mm or more sized holes within the wire and have the ability to scale vertical walls where the slightest protrusions can aid their ascent.

Snake protection for enclosures can be achieved by having smooth surfaced metal sheeting fixed around the lower sections of an enclosure to a height of 1.2m and removing any vegetation close to or hanging over an enclosure. Installing electric cattle fencing around the outer sections of an enclosure has proofed effective as a snake deterrent. The electric wire needs to be positioned at a sufficient height off the ground and close enough to the outer section of an enclosure so that a snake would make contact.

Contact with an electric wire would not necessarily kill a snake but ethical considerations may have to be taken into account towards the protection of wildlife in general. The

staff's safety, and the public's perception and safety would also need to be assessed against using electric wires and the likelihood of snake predation within a collection.

Interpretation

The design of an exhibit/enclosure should include the opportunity for interpretive signage to be displayed to assist in educating the public about the species on exhibit and its wild habitat.

It is important that the interpretive information displayed is accurate and concise. The signage should be presented in manner that compliments an enclosure, is consistent with the overall interpretation for a collection and made from durable materials. (refer Figure 18, 19 and 20) (Shephard 1989) (Sindel and Gill 2003)

Figure 18. Interpretation for *P. swainsonii* as a vulnerable species.

Figure 19. A standard interpretive format for an individual species.

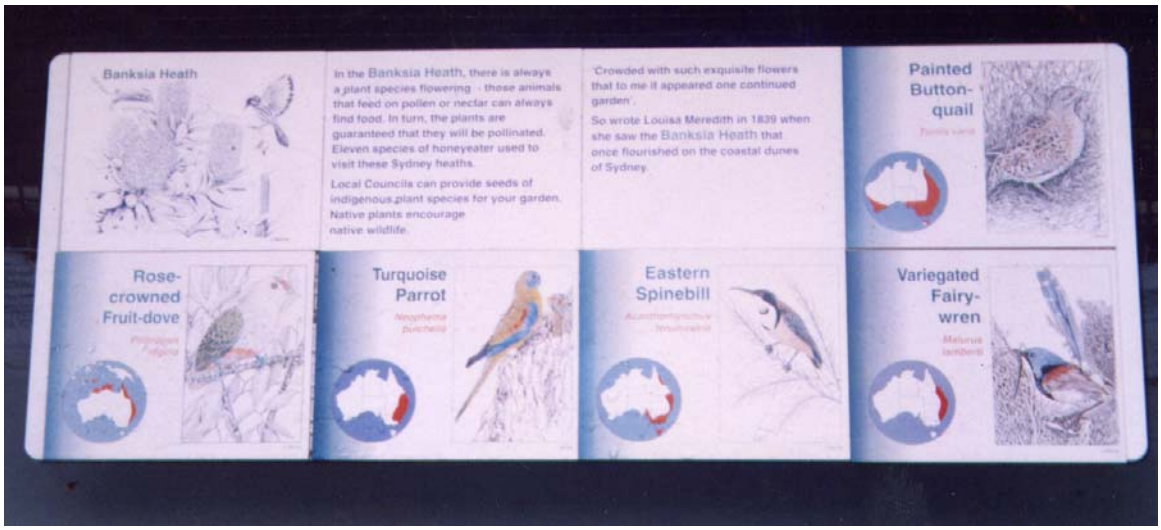

Figure 20. Example of displaying interpretive signage for a mixed species exhibit with information about a specific habitat.

4.2 Holding Area Design

When designing holding areas/cages thought must be given to the simplification of cleaning, feeding and watering. All of these features will save time. The most appropriate design is described in 8.5 Quarantine Requirements and refer to example in Figure 28, which is a mobile suspended aviary design. However, a cabinet style of holding cage may also be useful with only a wire front giving birds a more enclosed environment. The minimum dimensions for holding facilities to accommodate *P. swainsonii* is about 120cm long, 60cm high and 60cm wide. Larger dimensions could only be an advantage. In general the holding area should be large enough to make the birds feel comfortable and secure. (Sindel and Gill 2003)

4.3 Spatial Requirements

Individual breeding pairs

Individual pairs should be ideally housed in an enclosure 4m to 6m long, 1m to 1.2m wide and 2.1m high. Enclosures (aviaries) that are narrower than the suggested widths may be more difficult to service.

Colony breeding

Colony breeding has been successful with three pairs of *P. swainsonii* in an enclosure 5.5m long, 1.8m wide and 2.1m high. A colony of four male and five female *P. swainsonii* have been recorded breeding in an enclosure 7m long, 5m wide and 2.4m wide. These dimensions should be used as guiding examples. It is suggested that the space indicated for individual pairs could be a starting point and then increased by width and/or length for every extra pair of *P. swainsonii*, which are to be part of a colony i.e. ten pairs of *P. swainsonii* could be housed in an enclosure 6m wide, 12m long and 2.1m high, the individual pair width multiplied by ten provided the length.

Mixed display/exhibit

The dimensions indicated for colony breeding should guide an enclosure that is to house a mixed display of birds that includes at least one pair or several male *P. swainsonii* with other species of birds. However, the overall size of the enclosure will vary depending on the other species of birds to be exhibited with *P. swainsonii* and if the enclosure is to be planted to form part of the landscaped interior.

Space generally

The *Exhibited Animals Protection Regulation 1989* under the *Exhibited Animals Protection Act 1986* in Schedule 1 – Standards, Part 1 – General Standards, Space Generally states that; ‘Each animal must be provided with sufficient space in all directions to enable it: (a) to take exercise; and (b) to be protected from undue dominance and conflict; and (c) to be provided with its social, breeding and husbandry needs’. This

standard should be adhered to when developing an enclosure design for *P. swainsonii*. (NSW Government 1993) (Sindel and Gill 2003)

4.4 Position of Enclosures

In the southern hemisphere bird enclosures/aviaries should, where possible, always face north to maximise the direct sunlight received. In tropical climates where the sun is high in the sky for most of the year other factors i.e. shade, airflow; may take precedence over this rule. (Shephard 1989) (Sindel and Gill 2003)

4.5 Weather Protection

Protection from varying climatic conditions has been discussed in section 4.1 Exhibit/Enclosure Design. *P. swainsonii* is regarded as a hardy species and will tolerate hot summers as well as the cold and icy weather similar to that experienced in the southern ranges of New South Wales. However, enclosures should be designed and constructed to provide the maximum protection from extreme weather. Generally cold and damp conditions in an enclosure may lower a bird's resistance to the risk of infections and parasitic disease. (Macwhirter 1987) (Wilson 1991)

4.6 Temperature Requirements

Extreme temperatures can cause great discomfort to birds within a collection. If temperatures exceed 35°C and rise to well in excess of 40°C deaths may occur in adult birds and there would certainly be losses of nestlings unless cooling measures are implemented.

Sprinkler systems can be installed on the tops of enclosures using plastic irrigation pipes and fittings with filters installed to prevent any blockages. Misting sprays are the most effective as the cooling effect of this type of system is created by evaporation, which occurs more readily when water is in a mist form. The disadvantage of mist sprays, compared to standard sprinklers, is that they cover less area. Therefore a greater number of mist spray nozzles are required. It is recommended that sprays should be turned on before temperatures reach 35°C. An automatic system could be installed pre-set to specific temperatures. (Sindel and Gill 2003)

4.7 Substrate

The usual floors provided for psittacine breeding and display enclosures are natural earth; sand filled, pebble and concrete. Combinations of these types of floors are also utilised.

Natural earth floors (refer Figure 16) provide a pleasing appearance in large planted enclosures, but in smaller enclosures the earth can soon become polluted and unhygienic. Birds held on this type of floor may be worm infested if not regularly treated. Bacteria also thrive in damp earth floors, which can leave the occupants vulnerable to infections. Rodent infestations are common if exclusion barriers are not installed.

Sand filled floors have a pleasing appearance and are reasonably easy to clean by skimming/raking faeces, stale food and any other debris off the surface. The replacement of the top 10cm or all of the sand annually, or more regularly if required, is important to maintain floor levels and general appearance of an enclosure. If the sand is allowed to remain in enclosures for long periods it can silt up with dust, fine faece particles, food items and other fine debris. This would make a sand filled floor almost as polluted as an earth floor. Birds held on sand filled floors also require regular worming treatment. The drainage of sand filled floors is essential, either in the form of sub-surface agricultural type drainage pipes (refer Figure 21) or by elevating the floor level to at least 10cm above the surrounding ground level and providing suitable seepage weep holes.

Pebble floors also present a pleasing appearance and if provided with efficient sub-surface drainage systems (refer Figure 21) may be cleaned easily with high pressure hosing. If pebble floors do not have sub-surface drainage the surface can become difficult to clean and silting up will occur. Even adequately drained pebble floors can silt up after several years of usage, requiring removal and washing or renewal of the pebbles. The regular worming of birds held on pebble floors is essential.

Concrete floors are easy to clean and maintain and are by far the most functional type of enclosure floor. Cleaning of these floors can be simplified by sprinkling with a light layer of dry sand, which helps to prevent faeces and stale food items from adhering to the concrete surface. Any waste can then easily be removed using a broom and shovel. Industrial vacuum cleaners can simplify the cleaning of concrete floors but are disruptive for the birds. These floors can be cleaned using high pressure hoses provided suitable drainage has been installed. Concrete floors can help to prevent rodent access as well as help to control worm infestation, although regular worming treatment is still advisable. (Sindel and Gill 2003)

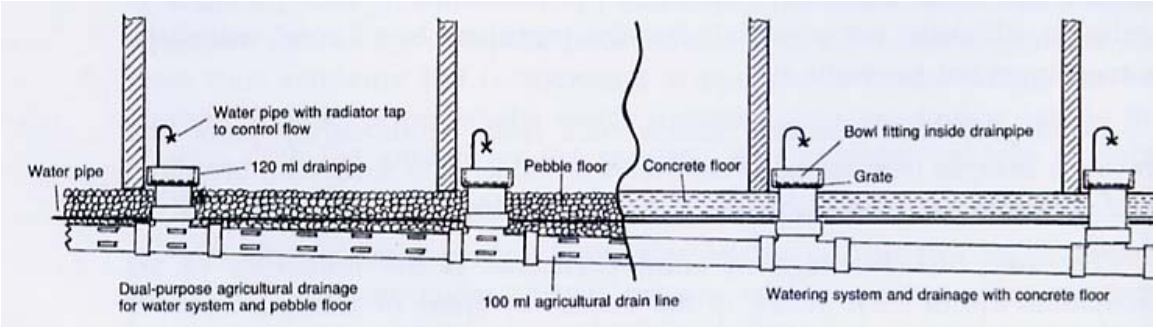

Figure 21. Pebble and concrete floors with sub-surface drainage and watering systems.

4.8 Nestboxes and/or Bedding Material

Refer section 10.10 Nesting, Hollow or Other Requirements.

4.9 Enclosure Furnishings

Perches

Natural branches, of various shapes and sizes, are preferable as they provide exercise for the bird's feet. Using branches for perching is more aesthetically pleasing and give an easy-to-grip surface. Fresh cut branches also provide an added activity for chewing and stripping the bark. Branches used for perches should be obtained from a reliable renewable source of Australian native trees and shrubs or from alternative non-native trees and shrubs that are not poisonous/toxic too bird's. Perches should not be allowed to become soiled and therefore need to be replaced on a regular basis to maintain the cleanliness of an enclosure. An indicator for replacement could be once all the bark as been removed from a branch but earlier removal may be preferable.

Perches are generally placed at the extremities of an enclosure to enable the maximum exercise to be obtained by the birds, but should also be positioned to avoid the fouling of walls/partitions and containers for food and water. One set of perches should always be placed under the sheltered section of an enclosure. All perches need to be securely fastened to the walls or wire flight sections of an enclosure. This can be achieved by either using screws and washers fixed into the ends of perches, especially for wired sections, or having permanently fixed perch holder brackets (refer Figure 22), which are particularly useful for enclosure walls and partitions. If perches are not securely fastened and stable, copulation may not take place and birds may become wary of using insecure perches.

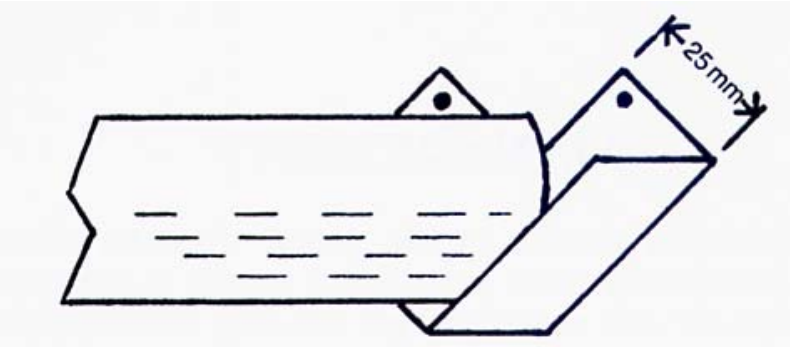

Figure 22. Perch holding bracket that can easily be made in various sizes from galvanised aluminium sheeting.

There tends to be a high use of stable perches which allows birds to walk rather than fly, so to encourage flying and balancing it is better to have a variety of ropes and flexible branches. Larger display enclosures (aviaries) could have vines and small trees to provide

increased perching variety and activity. Extra ropes securely hanging from the roof of an enclosure can give birds a swinging perch. Knots in the ropes would provide extra perching challenges.

Landscaping

Landscaping with items that would give a naturalistic setting and resemble the wild habitat of *P. swainsonii* can enhance the display/exhibit value of an enclosure. Such items would not only assist with the reduction of any possible stereotypic behaviour, and behavioural enrichment and physical well-being of the birds but also provide a more interesting educational exhibit. Landscaping items should not be sourced from areas that would be to the detriment of the natural habitat of wildlife. (refer Figure 16)

Wild populations of *P. swainsonii* have been observed spending 55% of their time foraging on the ground. To encourage foraging on the ground there can be a variation in an enclosures floor levels by creating mounds or using old fallen branches. A woodland floor effect could also be created with plantings of Australian native grasses and using a layer of bark and leaves. Further foraging opportunities can be created by regularly placing freshly cut leafy branches of *Eucalyptus*, or other known Australian native food plants, in suitably sized PVC tubing secured in the floor or to the framework of an enclosure.

In large enclosures the flight pattern of *P. swainsonii* may need to broken up to slow down flight speed to reduce possible self inflicted injuries. This is particularly important where breeding occurs and young *P. swainsonii* first emerge from nesting facilities. Strategically placed upright branches or plants in pots would assist with this matter. Permanent plantings of Australian native shrubs could be used to improve the landscape of an enclosure but *P. swainsonii* may chew these plants. An alternative would be to have a succession of potted plants that could be regularly changed if they become too chewed up. The chewed plants may be placed in a nursery area to be rejuvenated.

A permanent water feature that may resemble a stream, possibly with rocks, would also add to the naturalistic setting. This would reflect the close association that *P. swainsonii* has in its wild habitat with river systems. (Garnett and Crowley 2000) (NSW Government 1993) (Sindel and Gill 2003) (Shephard 1989) (Willemsen and Hawkins 2003)

5 General Husbandry

5.1 Hygiene and Cleaning

Enclosures must be cleaned out everyday. Faeces, seed husks, stale food items and other debris should be removed daily. Floors need to be swept, raked or hosed clean daily. The type of floor cleaning method will be dependent on the type of floor. For example concrete floors with a light sand covering would need to be swept and a fresh layer of dry sand spread out, whereas earth or sand floors would require raking clean. The majority of

harmful bacteria and microorganisms depend on moist dark areas for their survival. If these areas are eliminated, it will greatly reduce the chances of diseases becoming established. Therefore caution should be exercised, especially for occupied enclosures, before hose cleaning a floor area. Check that there is an established drainage system, there is certainty the floor area will dry completely in a relatively short period of time and/or the climate is conducive to drying.

Walls, partitions, wire mesh and perches should be inspected and cleaned/scrubbed daily, where they have been defaced by any faeces, food items and any other debris that may have been dropped or splashed on or against them. Similarly any landscape items i.e. water feature, rocks; in an enclosure should also be similarly kept clean.

All enclosures should be totally cleaned out and all surfaces disinfected at least before and after each breeding season, when the occupants of an enclosure are changed and always when there is a disease identified in a specific enclosure. The main purpose to maintaining hygienic conditions and cleaning out enclosures as often as necessary is to minimise vermin infestation and disease hazards, to reduce odours and prevent the possible ingestion of harmful objects. Parallel to a cleaning program should be a safe, effective and regular program for the control of insects, ectoparasites and vertebrate pests, which must be well established and maintained.
A procedure to follow if an infectious disease is identified in an individual enclosure and for the total cleaning of an enclosure would be to:

- Remove the occupants to another enclosure and/or isolate, quarantine, and/or treat as directed by a veterinarian.
- Remove all enclosure furnishings, food and water containers.
- Destroy, discard and/or clean and disinfect the removed items appropriately.
- Sanitise the enclosure by washing with hot water (75°C at the source) and soap or detergent; or washing with a detergent followed by application of a suitable disinfectant; or applying high-pressure steam.
- Veterinary advice on the matter should be obtained and followed.

Disinfection and Disinfectants

Disinfectants can be a valuable tool but should always be a secondary consideration to a thorough cleaning of all surfaces in an enclosure with water and detergent in the first instance. There is no one disinfectant that is suitable for all occasions. The situation where it is considered a disinfectant should be used needs to be fully evaluated to select the correct disinfectant to suit the required outcome i.e. chlorhexidine can be used to control viruses and Candidiasis.

In all cases a disinfectant must be used strictly in accordance with the manufacturers instructions and for its specified use i.e. disease control. A commonly thought principle that ‘use it at a stronger concentration so it will be more effective’ is both dangerous to birds and incorrect. Most disinfectants tend to be less effective at stronger concentrations.

Nearly all disinfectants are inactivated when an inorganic material is present i.e. feathers, faeces, waste food. Therefore all surfaces should be visibly clean before applying any disinfectant solution. Putting disinfectant on any organic materials means that the cost, time and effort has been wasted. Any disinfectant solution must be in contact with the area being disinfected for 15 to 30 minutes to be effective. Once this time has passed, the area must be thoroughly rinsed to remove any disinfectant residue that may harm birds. Care should be exercised if using disinfectants around nestlings and young birds as fumes from the disinfectants may affect them. Occupational health and safety procedures must be followed at all times. All disinfectants should be stored safely in a secure holding area, sealed in its original container and away from birds and food preparation areas.

A simple disinfection protocol for food and water containers is to soak the items for 30 minutes in a quaternary ammonium compound product or similar. Then place in a dishwasher on the hot water cycle, rinse thoroughly and dry. Store in a closed vermin proof area until used.

Hands should be cleaned in a disinfectant solution prior to and after; handling any birds, especially handrearing or sick birds, food preparation and cleaning out enclosures. Scrub hands in an idophor or chlorhexidine wash for at least five minutes, as most hand disinfectants need 5 – 10 minutes of contact to be effective.

Figure 23. Hibiclens, Avisafe and Halamid are considered to be useful disinfectants.

Any disinfectant or cleaning agent that contains the active ingredients of phenols, formaldehyde or glutaraldehyde are useful but can be dangerous to birds and humans. The following disinfectants are considered to be safe and effective to use around birds and humans when the manufacturers instructions are followed:

- Chlorhexidine as Aviclens, Hibiclens, Hibitane, Nolvosan.
- Quaternary ammonium compound as Sanodet.
- Chlorine as a bleach.
- Chloramine as Halamid, Halasept.
- Tertiary amines as Avi-Safe.
- Iodophor as Sanodine, Betadine, Iovone.
- Alcohols as methylated spirits, isopropyl alcohol.

(Cannon 1996) (Macwhirter 1987) (Sindel and Gill 2003)

5.2 Record Keeping

The daily close observations of *P. swainsonii* and aviary birds in general is important, especially in relation to bird health. Through close observation the signs and symptoms of ill health can be recognised early and appropriate action can be initiated. In relation to breeding observations will assist with compatibility of potential breeding pairs. The development of pair bonding, courtship and breeding behaviour can be observed. Aggression and fighting between birds in particular can be detected quickly through regular observations and the offending birds can be relocated before any physical damage occurs. Having realised the value of conducting close observation of birds, the next step is to adopt a more scientific and professional approach by systematically recording these observations.

The advantages of detailed record keeping are numerous. For example, the age and breeding capacity of each pair of birds is known. If details of parentage are kept, there can be more certainty in making new unrelated pairs with young birds. If line breeding were the chosen breeding method, then with accurate records birds can be paired to produce the type of progeny required.

Record keeping can be a simple as keeping a daily diary either of individual pairs of birds or of a whole collection. Notes or diary entries could then be either transferred to an indexed card system where individual birds or pairs have a card each, to record books or to a computer software program that has been specifically developed for maintaining complete aviary records. Commercial software programs such as “Bird Tracker” or “Aviary Manager – 3 for Windows” have been specifically developed for this purpose. Which ever record keeping method is adopted the following type of information to be collected and recorded can be used as a guide:

- Enclosure/aviary number
- Species occupying the enclosure/aviary
- History of the parents, i.e. age, origin, ring number and/or colour
- Details of current and previous breeding seasons:
  - Date and month breeding commenced
  - Clutch number
  - Number of eggs laid
  - Date eggs hatched
  - Date young fledged/number fledged
  - Date young were independent
- Outcome of young, i.e. Sex, ring number/colour, who they were paired to
- General reproductive stages, condition or behaviour
- Health problems
- Veterinary examinations and treatments
- Behavioural problems
- Diet
- Movements within and between institutions
- Body mass and measurements

(Jackson 2002) (Shephard 1989)

5.3 Methods of Identification

An important adjunct to systematic record keeping is the ability to be able to readily identify individual birds in a collection. Tattoos can be applied to wing webbing using tattoo pliers. However, because birds have thin skin, many tattoos will fade with time and birds need to be sedated for this procedure to be completed. The fitting of leg rings on aviary birds is a more common and easily completed practice that facilitates identification.

There are a large selection of both split and closed plastic and metal rings available. Split rings can pose a danger to birds by any sharp edges either injuring birds or getting caught on aviary wire or any protruding object. Parrots have been known to and are capable of removing split rings. The most appropriate identification method for birds the size of *P. swainsonii* is closed metal rings, which have the advantage of being engraved with information pertaining to an individual bird. The year a bird was breed and perhaps some identification of origin can be provided engraved on closed metal rings. The appropriately sized closed metal rings of 7mm internal diameter for *P. swainsonii* should be placed on the legs of chicks at about day eight after hatching. (Digney 1998) (Macwhirter 1987) (Shephard 1989)

5.4 Routine Data Collection

Extra data would need to be collected to assist with compiling and analysing a studbook for *P. swainsonii* and towards an Australasian Species Management Program (ASMP). In particular studbook data is important for managing captive populations in relation to measuring the general demographic and genetic parameters. This type of data can then be further utilised towards ASMP husbandry, population management and conservation programs. The ability to generate useful reports i.e. life tables; can only be as good as the full and accurate data collected as suggested in 5.2 Record Keeping. Further reference should be made to the publications ASMP Principles and Procedures; and Managing Zoo Populations: compiling and analysing studbook data. (Lees and Wilcken 2002) (Wilcken and Lees 1998)

6 Feeding Requirements

6.1 Captive Diet

P. swainsonii have a tendency towards obesity, which is influenced by diet and the degree of restriction of flight imposed by their housing. To reduce this excess weight problem it is advised that a non-oily, low fat seed diet should be provided, by using any or all of the many varieties of millet seeds. French white millet, after many years of experimentation has emerged as the most suitable and preferred millet of the group.

Dry seed should only be considered as supplementary to a daily ration of fresh greenfeed, sprouted seed and pulses, vegetables and fruit.

The regular inclusion of fattening or oily seeds such as sunflower seed, canary seed or oats, in this species diet can only lead to obesity and associated health problems. Such food items should only be fed on a limited basis just prior to the nesting season to promote breeding condition and fed in unlimited quantities to breeding pairs rearing young.

Fat birds are not healthy birds and they are usually poor breeders as obesity adversely affects fertility and predisposes to egg binding. Obesity also contributes to heart disease and fatty infiltration of the liver and cases of acute internal haemorrhage.

The following all year round diet is suggested for *P. swainsonii*:

Dry seeds:
Feed daily - (Non-oily, low fat) French white millet (main base seed – unlimited quantity available in hoppers), Japanese millet, panicum, and red millet.

Feed limited quantities prior to breeding season and unlimited to pairs with young - (Oily) Canary seed, sunflower seed, safflower, and hulled oats.

Sprouted seeds:
Feed daily - (Unlimited) All millets and milo.

Feed limited quantities - (Few dozen seeds per pair per day - increase quantity a few weeks prior to nesting season to stimulate breeding and unlimited to pairs feeding young) Canary seed, sunflower seed, safflower, hulled oats.

Vegetables:
Feed daily (chopped fine) - Silver beet, celery, endive, cabbage, carrot, beans, cauliflower, broccoli, kale, beetroot leaves, peas and leafy Chinese vegetables i.e. choy sum. Corncobs chopped into small cubes.

Sprouted pulses:
Red and green lentils, barlotti, mung and lima beans, black-eyed and chick peas can also be offered daily.

Greenfeed:
(Offered whole when in season, correctly identified and if the source is guaranteed not to have been sprayed with chemicals) Seeding heads of summer grass, winter grass, water millet, oats, milk thistle, chickweed, dandelion, pigweed and dock.

Seeding heads of sown grains: Millets, oats, canary seed.

Fruit:
Feed daily (diced)– Apple, pear, stone fruits, strawberries and any of the vine or bush berries i.e. grapes, blueberries.

Berries from hawthorn, pyracantha and cotoneaster plants can also be fed whole if not sprayed with any chemicals.

Cuttlefish bone, shell grit up to 2mm in diameter and fresh water should be available daily.

Sunlight:

Required by all parrots to convert provitamin D to D3 and necessary for the absorption calcium.

Flowering *Eucalyptus, Grevillea, Melaleuca* and *Callistemon*:

Branches from these plants should be supplied when in season to simulate the wild diet for flower/nectar foraging and to provide environmental enrichment.

Sprouted seed are to be soaked in water containing 'Aviclens' (1ml/litre) for 24 hours, then put into draining sieves and rinsed with 'Aviclens' for a further 24 hours. The seed should be rinsed again on the third day in plain water then fed out.

Sprouted pulses should be soaked in water containing 'Aviclens' (1ml/litre) for 24 hours, then rinsed thoroughly under plain water and fed out.

Calcium carbonate powder can be mixed through sprouted seed and pulses prior to feeding.

The abovementioned balanced diet will provide the vitamins and minerals required by *P swainsonii*. It will also provide variety to stimulate mental and physical activity with the various food shapes, sizes, textures and tastes. The daily quantity of food fed should be based around what can be completely consumed and if it is the breeding or non-breeding season. Observations and maintaining records will assist in providing the required quantities. All the foods listed should be alternated each day primarily to maintain variety but also for the cost and efficiency of feeding. (Forshaw 2002) (Gibson, J. 2004 pers. communication 9 Nov) (Hibbard 1999) (Macwhirter 1987) (Sindel and Gill 2003) (Taronga Zoo – Bird Dept. Staff, 2004 pers. communication 9 Nov) (Wilson 1990)

6.2 Supplements

Supplementary protein can be provided as a baked nutritional cake using the following ingredients:

2 Cups of oats	2 Cups of dried milk powder
2 Cups of wholemeal flour	1 Cup of soya flour
1 Cup of crushed mixed nuts	½ Cup of rice cereal
4 Tablespoons of peanut butter	4 Tablespoons of wheat germ
6 Tablespoons of honey	4 Teaspoons of calcium carbonate
6 Eggs	

Non-breeding birds should get a piece of the cake once a week while pairs with young should receive one to two pieces of cake per day. A piece of cake is approximately a 2.5cm square. (refer Appendix 1 for preparation method)

P. swainsonii food plants (refer section 3.4 Diet in the Wild) could be grown as a plantation or as part of the landscaped gardens near enclosures to supplement the captive diet. Possibly only plants that are available to the horticultural industry could be grown.

A few mealworms as a source of protein could also be offered weekly, if the birds will accept them. (Wilson 1990)

6.3 Presentation of Food

Food containers should be collected and washed/disinfected daily. For an efficient feeding routine it is recommended that there should be two sets of food and drinking water containers to enable one set to be washed ready for use the following day while one set is in use.

A variety of sprouted seeds, vegetables, pulses, greenfeed and fruit should be fed fresh daily, or when in season, in clean stainless steel containers. A permanent off the ground, feeding tray should be provided undercover and cleaned daily. In breeding colonies several feeding stations may need to be provided to prevent any bullying or squabbling.

Figure 24. Stainless steel food preparation area with a cutting bench and display of a variety of vegetables and fruits chopped and diced in various shapes and sizes.

Dry seed can be provided in hoppers, installed undercover, which have suitable removable trays below for catching seed husks and any wasted seed. Catching trays would need to be emptied and cleaned on a regular basis. Hoppers should be cleaned out and washed/disinfected at least once a week more regularly if time permits.

Water containers and landscape water features are required to be cleaned out and fresh water supplied daily. The water containers should be made from a smooth, non-porous and easy to clean surface, which would also assist in reducing the growth of algae.

Behavioural enrichment feeding should be provided to stimulate natural behaviour and to add variety to the presentation of food for *P. swainsonii*. Forage trays with a layer of seed and bark/leaves mixed together can provide ground-feeding opportunities similar to a woodland floor. Flowering branches of *Eucalyptus, Melaleuca, Grevillea*, or from any other food plants that are listed in Figure 11, will simulate tree top foraging and can be placed in suitably sized PVC tubing secured in the floor or to the framework of an enclosure. *Eucalyptus* branches that are infested with lerps (refer Figure 10) could be collected to provide natural protein especially during the breeding season. Fruit and vegetables can be skewered on the ends of perches to give some physical activities (refer Figure 25). Alternative behavioural enrichment feeding methods are provided in Appendix 2. (Macwhirter 1987) (Sindel and Gill 2003) (Willemsen and Hawkins 2003) (Wilson 1990)

Figure 25. An example of fruit and vegetable items skewered on perches for behavioural enrichment feeding.

7 Handling and Transport

7.1 Timing of Capture and Handling

The capture and handling of birds within an enclosure should be generally planned and conducted as the first operation in the morning. This enables the whole proceedings to be completed before public entry. To assist in reducing the stress on a bird to be captured and handled the most appropriate time to catch a bird is in the cool of the morning, preferably by 10-00am but no later than 11-00am. No capture should take place if the temperature is over 23-25°C, however, the capture and handling of a bird may be required if a bird is observed to be injured or is in some form of distress requiring veterinary treatment and needs to taken out of an enclosure immediately. (Taronga Zoo – Bird Dept. Staff, 2004 pers. communication 9 Nov)

7.2 Catching Bags

Once a quick examination of the captured bird has been completed, the bird should be placed in an appropriately size carrying bag and immobilised. The carrying bag should be made from a dark coloured soft durable material. Care should be taken not to restrict the bird's breathing by wrapping too tightly, and the bird's head should be covered to reduce visual stimulation. Carrying bags generally help to restrict movement and vision and provide a darkened, secure environment where most birds tend to settle into quite well. Once immobilised and in a dark environment *P. swainsonii* is less susceptible to stress. (Gibson, J. 2004 pers. communication 9 Nov) (Taronga Zoo – Bird Dept. Staff, 2004 pers. communication 9 Nov)

7.3 Capture and Restraint Techniques

The capture of *P. swainsonii* in an enclosure is effectively completed using a light durable soft cloth butterfly type catching net (pocket), which has a padded wire rim attached to a long handle. The size of the net should correspond to the size of the bird to be netted. Nets with extendable handles may be required for high enclosures. In larger enclosures, such as mixed or free flight exhibits, caged feeding stations can be utilised for capture operations. More planning is required for birds to be captured in caged feeding stations, as food reduction prior to the catching operation may be required to entice birds into the caged area.

The capture of a bird can be extremely stressful and traumatic to both the birds and staff involved. Therefore speed and precision during the operation is essential. The aim of the operation is first and foremost to minimise stress and the risk of injury to the bird, and to minimise the risk of injury to staff. Prolonged pursuits should be avoided, as this may be detrimental to the health of the bird to be captured.

Obstacles that may injure a bird in flight or hinder the capture operation in an enclosure should be taken down or removed i.e. perches. Catching *P. swainsonii* in flight is the most effective method, which does require practice and experience. More than one staff member may be required in larger enclosures. Catching a bird on the wiremesh of an enclosure should be completed with caution as extracting the bird off the wiremesh may result in injury to the bird.

There should be minimal handling of a captured bird as excessive handling can lead to shock. Correct handling will avoid putting further stress on the bird and any injury to staff. *P. swainsonii* will bite therefore it is important to restrain the head first by grasping the head from behind with the thumb and forefinger on either side of the head and close to the beak. Care must be taken not to apply too much pressure as this may cause bruising and possibly fractures. The claws and wings should also be restrained with the other hand by using a pigeon hold or the whole body can if necessary be lightly cradled under an arm. Regardless of the restraining technique do not apply too much pressure to the chest or abdomen as this could prevent the bird from breathing.
(Gibson, J. 2004 pers. communication 9 Nov) (Macwhirter 1987) (Shephard 1989) (Taronga Zoo – Bird Dept. Staff, 2004 pers. communication 9 Nov) (Vogelnest 1994)

7.4 Weighing and Examination

The simplest method for weighing birds is to immobilise the bird in a catching bag and then place the bag on a set of scales. The weight of the catching bag would need to be noted prior to weighing the bird or zeroing the weight of the catching bag on the scales. To make the weighing exercise more accurate, weigh the bird at the same time each day and before any medication is given. Weight loss is usually a sign of stress, inadequate diet, or deterioration in the health of a bird.

An examination should start by observing a bird without handling. A bird that is unwell will generally appear quiet and fluff its feathers. Note any deformity, unusual positioning of wings, lameness and laboured breathing or vomiting. Assess the bird's sense of balance and ability to see and respond to stimuli such as a noise or following the movement of your hand. If there are concerns about a bird's health from a visual examination then the bird should be caught for a physical examination. Critically ill birds may already be in shock and the stress of capture and a physical examination may be too much added stress that may cause a bird to die quickly. Veterinary assistance and advice should be sought if there are major concerns about a bird's health. The capture and restraint of a bird for physical examination should be conducted as outlined in 7.3 Capture and Restraint Techniques. A physical examination should be completed as outlined in 8.2 Detailed Physical Examination. (Cannon 1996) (Macwhirter 1987) (Vogelnest 1994)

7.5 Release

The release of *P. swainsonii* into an enclosure should be completed in the early morning. This gives the maximum active hours for the bird/s to settle and become familiar with the enclosure. *P. swainsonii* should be released from the carrying bag or transport box/container in the bird's own time and preferably on the floor of the enclosure or directly on to a perch. Birds may require assistance in finding the opening to a carrying bag. On some occasions a transport box/container may need to be left in an enclosure until a bird has found its own way out. A bird should not be forced or tipped out of a bag or box/container this will only add to the stress a bird may already be experiencing. Once a bird has been released into an enclosure there should be regular post-release monitoring to ensure the bird is safe and healthy. (Taronga Zoo – Bird Dept. Staff, 2004 pers. communication 9 Nov) (Walraven 1994)

7.6 Transport Requirements

If a bird is only being moved a short distance i.e. from one enclosure to another, a secure carrying bag can be used. Transport within a vehicle may be better in a carrying bag placed in a transport box to prevent any movement or possible escape or injury to a bird. This same transport method could be used to transport birds for periods of 30-40 minutes but no longer. When a bird/s is to be transported between sites or institutions for a period of time longer than 30-40 minutes then a specially constructed compartmentalised box/container should be used. The International Air Transport Association (IATA) 'Live Animals Regulations' and the CITES 'Guidelines for the transport and preparation for shipment of live wild animals and plants' should be consulted to assist with long distance transportation of birds. The following points should be considered when transporting birds:

a) Ambient temperatures – extremes of temperature must be avoided. Birds should not be transported in the heat of the day and hot vehicles should be avoided.
b) Ventilation – any transport container or vehicle in which birds are to transported must be well ventilated.
c) Noise – loud noises, voices and the sounds of potential predators i.e. dogs and cats; must be kept to a minimum as these will stress the birds.
d) Light – birds are best transported in subdued light or in the dark.
e) Transport instructions – instructions should be provided for the care of the birds i.e. water, food; secured to the outside of the box/container, especially to allow for unforeseen delays during transportation. When birds are to be transported unaccompanied by air, rail or road, the box/container should be labelled "LIVE BIRDS", correctly addressed and contact telephone numbers clearly stated
f) If wildlife authority permits are required by law for any reason, they must be obtained prior to transportation and copies of the permits attached to the box/container.

(Gibson, J. 2004 pers. communication 9 Nov) (Sindel and Gill 2003) (Vogelnest 1994)

7.6.1 Box/Container Design

The transport box/container must be appropriate for the size of *P. swainsonii*. The bird must be allowed to stand/perch and keep its neck extended. There should be some restriction to movement, particularly wing flapping is useful as this may cause injury to a bird. The inside of the box/container should be smooth and without and protrusions.

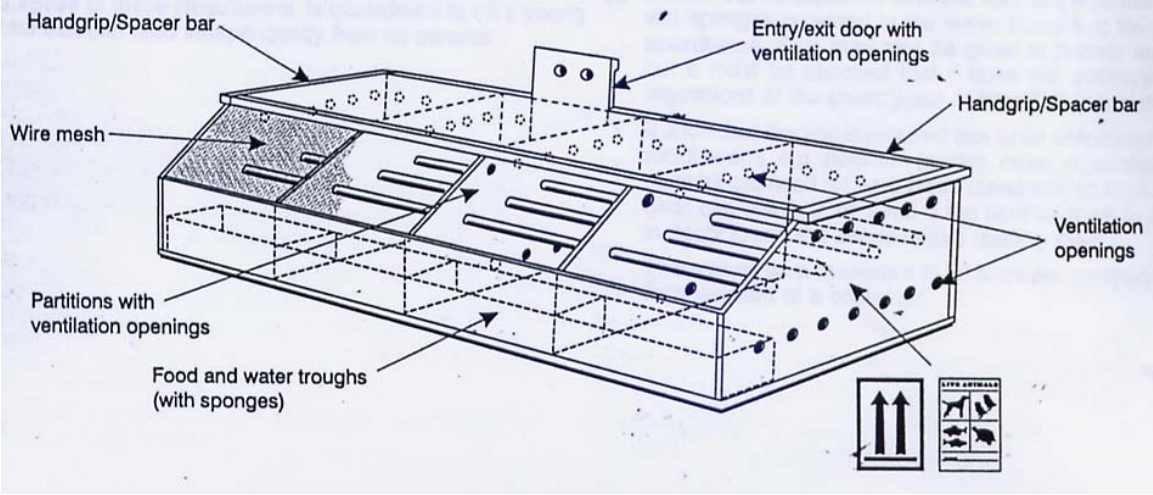

Figure 26. An example of an IATA compartmentalised container specified for the transportation of *Polytelis* species.

A formula for the minimum compartment size of a transport box is the overall length of a bird squared to calculate the base area with the height of the standing height of the bird, plus 25mm (refer Figure 27). (IATA 1998) (Sindel and Gill 2003) (Vogelnest 1994)

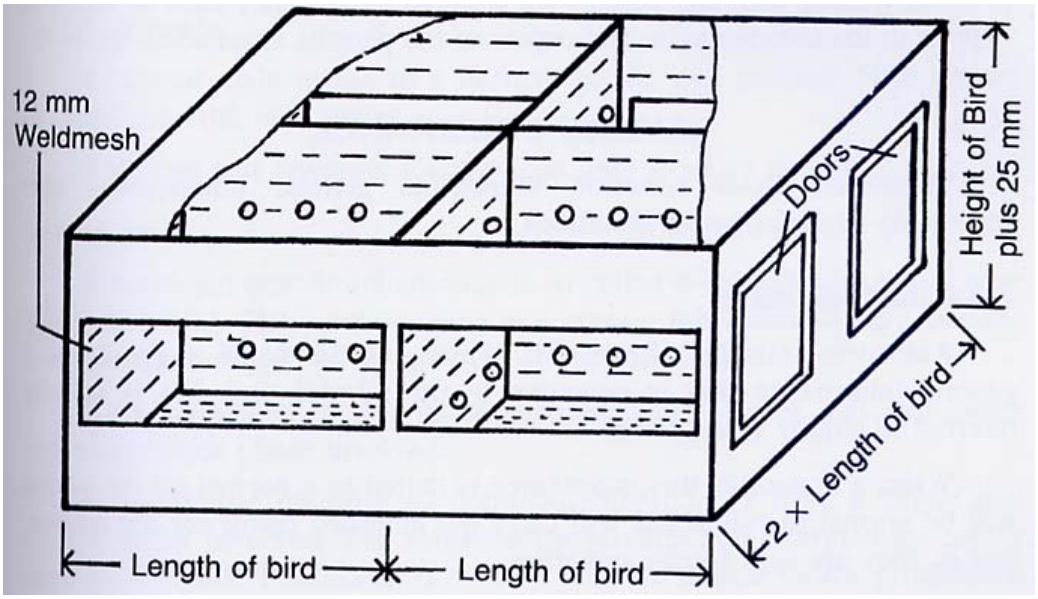

Figure 27. Design for a multiple compartment transportation box.

7.6.2 Furnishings

The floor of the box/container can be covered but should not provide a slippery surface. Newspaper, shredded paper or similar may be useful but should not be detrimental to the health of the birds being transported. Water containers should be provided securely fixed in the box/container, with rounded edges and flanges to prevent spillage, and be made of a non-toxic material. A single perch can be provided for very long trips, which should allow for a natural perching position. (CITES Secretariat 1979) (IATA 1998) (Sindel and Gill 2003) (Vogelnest 1994)

7.6.3 Water and Food

Water must be provided if a bird is to be transported for a long period of time, particularly in hot weather. Generally adequate water and food should be provided for the duration of a trip with a 100% safety margin. Seed can be scattered over the floor of a box/container and a slice of fruit may also be included as an extra source of moisture, however, state/country laws should be checked relating to fruit being transported across borders. (IATA 1998) (Sindel and Gill 2003) (Vogelnest 1994)

7.6.4 Birds per Box/Container

P. swainsonii is not normally an aggressive species, however, when placed under the pressure and stress of close confinement they may become violent. Therefore *P. swainsonii* should be transported as individuals in separate compartments. (Sindel and Gill 2003)

7.6.5 Timing of Transportation

The journey time for transportation should be kept to a minimum. All arrangements for the trip must be finalised before the bird/s leaves, to avoid delays. The recipient must be notified well in advance of the travel arrangements and expected arrival time. Generally overnight transportation is preferred as this is a cooler time of the day and the darkness will help to reduce stress. (Sindel and Gill 2003) (Vogelnest 1994)

7.6.6 Release from Box/Container

The destination arrival should be timed for the early morning to enable the bird/s to be released into an enclosure or holding facility and have time to settle and become familiar with their surroundings. (Sindel and Gill 2003) (Vogelnest 1994)

8 Health Requirements

8.1 Daily Health Checks

Each individual bird should be accounted for and visually checked for any health problems either as a first routine task every morning or during the daily cleaning and feeding routine. Any suspect bird should be immediately caught and held in isolation for veterinary inspection and treatment. If it is considered that the capture of a suspect bird would cause more distress to the bird, a veterinarian should be requested to come to the enclosure to take charge of the situation. There should be routine veterinary inspections of all birds, enclosures and related facilities to ensure that the health and well being of the birds is maintained. (Macwhirter 1987) (NSW Government 1993)

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

Modern anaesthetic agents have made avian anaesthesia and sedation much simpler and safer. However, in order to maximise the chances of a successful outcome the following pre-anaesthetic conditions should be followed:

a) Two to three hours pre-anaesthetic fasting is recommended for birds such as *P. swainsonii*.
b) Critcally ill birds must be stabilised before anaesthesia by providing fluids and warmth.
c) Anaesthetic time must be kept to a minimum. No bird should be kept anaesthetised for longer than 30 minutes.
d) If the procedure is anticipated to take longer than 10-15 minutes, warmth should be provided to keep the ambient temperature above 20°C.
e) Prior preparation and planning of the proposed procedure is essential.
f) Anaesthetic monitoring during the procedure must be conducted by a veterinarian or an experienced veterinary nurse.

There are two types of anaesthetics injectable or via inhalation. A number of injectable anaesthetics are available, but inhalation anaesthetics have distinct advantages. They are easier to administer, induction and recovery are usually smooth and rapid, anaesthetic monitoring is simpler, and the depth of anaesthesia can be changed easily. Injectable anaesthetics are however useful, but mainly for birds larger than *P. swainsonii*. Halothane and isoflurane are the two main inhalation anaesthetics that are generally administered to birds by face mask, catheter or endotracheal tubing. (Vogelnest 1994)

8.2.2 Physical Examination

The physical examination should be done thoroughly but quickly as excessive handling can lead to shock. Covering a bird's eyes usually has a calming effect. Experienced staff should only conduct a physical examination. A general physical examination should start at the head, eyes, ears, nostrils and cere checking for abnormalities. Open the beak examining the inside particularly for obstructions. Carefully run fingers over the entire bird starting at the crop down the keel to the abdomen and the vent. Check all the feathering and skin. Finally examine each wing, leg, foot and claw individually. A veterinarian should immediately treat any problems found during the examination. (Cannon 1996) (Macwhirter 1987)

8.3 Routine Treatments

P. swainsonii are mainly susceptible to roundworms (*Ascaridia*). The most common treatment is with Panacur 25 (Fenbendazole 25g/l) and is more effectively administered to individual *P. swainsonii* by crop needle. Nilverm or Avitrol (Levamisole) can also be used. The routine treatment will vary to the type of floor in an enclosure. If the birds are housed on concrete floors the birds should be treated at least twice a year, usually before and after breeding season. If the birds are housed on other types of floors the birds should have a routine treatment every three months. To monitor how effective the treatments are and if more treatments are required, regular faecal testing should be conducted.

P. swainsonii could possibly be trained to feed within internal enclosure cages, which could facilitate the collection of fresh faeces for faecal testing and provide the opportunity for the capture of birds if needed. This could greatly assist with regular treatments such as for worming or other regular veterinary procedures. *P. swainsonii* could be rewarded once released back into the cages with nectar supplements or similar. (Cannon 1996) (Sindel and Gill 2003)

8.4 Known Health Problems

The following are the known specific common health problems of *P. swainsonii*:

Roundworms

Cause:

- Ingestion of roundworm eggs excreted in the faeces of infected birds.
- Ingested egg hatches into a bird's intestine, producing a larvae or immature worm, which buries into the intestinal lining and matures into an adult worm.
- Adult worms lay eggs, which are expelled in a bird's faeces and the infestation cycle begins again.

Roundworms – continued

- The complete life cycle of roundworms from the ingestion of eggs to the passing of further eggs from adult worms is six weeks.
- If large numbers of adult worms are present, the intestine can become completely obstructed.

Signs:

- Weight loss (due to the parasites absorbing nutrients from the intestinal tract)
- Increased susceptibility to other diseases.
- Loss of energy, depression or not eating.
- Poor reproductive performance.
- Excrete loose faeces with or without blood (diarrhoea).
- Seed or whole worms in faeces.
- Sudden death.

Diagnosis:

- Observation of birds and worms may be visible in faeces.
- Faecal examination through faecal flotation tests.
- Post mortem examination.

Treatment:

- Two main drugs used are levamisole (Nilverm, Avitrol) and fenbendazole (Panacur 2.5).
- More effective as individual oral application administered using a crop/gavage needle to ensure correct dosage is received.
- Treatment has been successful orally administering levamisole at a rate of 20mg/kg body weight and fenbendazole at 50mg/kg body weight.

Prevention:

- Design a regular effective worming program that is monitored.
- Prevent the faeces of wild birds from entering enclosures.
- Control any intermediate hosts such as insects.
- Improve enclosure design by eliminating damp areas and having an easily managed floor area.
- Ensure enclosure hygiene standards are maintained.
- Quarantine and treat all new arrivals into a collection.

Psittacosis (Chlamydophilosis)

Cause:

- Contagious disease caused by the organism *Chlamydophila psittaci.*
- One or more strains of *Chlamydophila* may be present in a collection.
- Transmitted through contact with infected faeces; inhalation or ingestion of aerosols or dust containing contaminated materials such as feather debris or skin scale; orally from parent to nestling.
- Young birds, birds that have become stressed or birds coming in contact with a different strain of the disease are the most susceptible.
- The majority of birds are passively infected by their parents at a young age and then build up a natural immunity to the organism.
- Dried faeces can be infective for months.
- Mites, lice, flies and other insects can be vectors for spreading the disease.
- Wild birds can transmit the disease from their faeces.
- A zoonotic disease able to be transmitted to humans.

Signs:

- Eye discharge or swelling (conjunctivitis).
- Blinking or partially closed eyes.
- Sneezing, runny or plugged nostrils.
- Laboured respiration.
- A fluffed up appearance.
- General lethargy and weakness.
- Weight loss, poor appetite and green diarrhoea.
- Sudden death.

Diagnosis:

- Positive diagnosis is sometimes very difficult as *Chlamydophila* undermines the immune system and opens a bird's body to other pathogens that may be occurring at the same time.
- Testing of faeces, other discharges and blood but not considered accurate.
- Polymerase chain reaction to multiply the organisms DNA for identification is a more accurate test.
- Post mortem examination.

Treatment:

- Tetracycline group of drugs (chlortetracycline, doxycycline, oxytetracycline) are considered the most effective drugs.
- Doxycycline (Psittavet, Vibramycin, Virbavet) is the preferred drug.

Psittacosis (Chlamydophilosis) – continued

- Individual treatment is preferred by injection, orally using a tablet or paste or solution via crop/gavage needle.
- Successful treatments have been 25-50mg/ kg body weight every 24 hours orally for 45 days and 75-100mg/kg body weight every 7 days with 6-8 intramuscular injections.
- During treatment stress to birds should be minimised by ceasing breeding, no new introductions to a collection, remove any bullies, improve diets, ensure there is complete protection from climatic elements and clean and disinfect enclosures daily.

Prevention:

- Strict quarantining, testing and treatment of all new birds to a collection.
- Eliminate or avoid any actions that may cause the on set of stress in birds.
- Immediately isolate any bird suspected of having *Chlamydophilosis*.
- Maintain a clean and healthy environment within enclosures.
- Preventing the access of wild birds to enclosures.

Polytelis Paralysis Syndrome

Cause:

- Not fully known but the disease behaves the same as a viral infection.
- Considered to relate to lesions that cause the degeneration of the spinal cord (poliomyelomalacia).
- May appear as a small disease outbreak with several birds affected over a period of several weeks.
- Dietary deficiencies associated with vitamin E and selenium a possible cause.

Signs:

- Varying degrees of severity either loss of the fine control of the feet but can still use the legs; totally paralysed in the feet and legs or paralysed in the wings.
- May also show early as trembling, a wobbly gait, lack of coordination and abnormal head movements.
- Very severe cases can die suddenly apparently due to the inability to breath.

Diagnosis:

- Should be differentiated from other causes of paralysis that can present with the similar signs, these include heavy metal poisoning, egg binding and traumatic injury.
- No diagnostic method indicated.

Polytelis Paralysis Syndrome – continued

- Post mortem examinations have shown spinal cord damage and in some birds stroke-like damage to the brain.

Treatment:

- Some birds may recover without treatment.
- Anti-inflammatory medication, injectable selenium and injectable or oral vitamin E supplement have been successful if the infection it treated in the early stages.
- Physiotherapy involving exercises for the legs and toes has occasionally aided recovery.
- Treatment is unlikely to be successful during the late stages of infection.

Prevention:

- No known preventative methods indicated.

Other health problems that affect the *Polytelis* genus generally but are not known to be a specific health problem with *P. swainsonii* are Hairworm (*Capillaria*), Psittacine Beak and Feather Disease, Scaly Face Mite, Aspergillosis, Candidiasis, Avian Gastric Yeast (Megabacteria) and Egg Binding. (Cannon 1996) (Macwhirter 1987) (Shephard 1989) (Sindel and Gill 2003)

8.5 Quarantine Requirements

All collections should have a properly designated quarantine area. All birds brought into a collection must be quarantined in this area isolated from other birds for a minimum of 30 days. This quarantine area should be enclosed, well protected and draught free. The birds should be placed in separate easy-to-clean holding cages with false wire bottoms. (refer Figure 28)

Figure 28. Example of quarantine cages and facility.

During the quarantine period the birds may be treated with doxycycline, for Psittacosis, under veterinary supervision. Worming treatments and faecal testing should be conducted. The new birds should be thoroughly examined by a veterinarian and any other recommended treatments completed during the quarantine period.

The quarantine period is the ideal time to conduct observations of a new birds behavioural patterns and feeding habits. Many new birds have been known to die of starvation, as they are unfamiliar with a new diet. Therefore the quarantine period is also a critical time for gradual dietary changes to occur. The most important feature of quarantine is to prevent the introduction of new infectious agents into a collection. No bird should be removed from the quarantine area to the general collection until a veterinarian is completely satisfied with its health and acclimatisation. (Cannon 1996) (Sindel and Gill 2003)

9 Behaviour

9.1 Activity

Observations of wild *P. swainsonii* indicate that during summer the birds feed actively in the mornings up to 09:00 and in the afternoons after 17:00. In winter *P. swainsonii* tends to be active for more of the day. For both seasons *P. swainsonii* spends the greater part of the morning and afternoon active period feeding quietly on the ground or in the treetops feeding on blossoms. They spend the remainder of the day sitting quietly among the uppermost branches of eucalypts, sometimes revealing their presence by emitting a soft twittering. Occasionally they make sudden darting flights at treetop height along a river for a few hundred metres, alighting in another tree, where they again sit quietly, perhaps for several hours. *P. swainsonii* drink in the morning and late afternoon at rivers, preferring spits of sand jutting out as watering places, drinking in relays of two to three birds by flying down to the sand to drink then immediately flying back to the trees for cover. (Forshaw 2002) (Higgins 1999)

9.2 Social Behaviour

Throughout the year wild *P. swainsonii* congregates in flocks, where it is observed there is little apparent separation into pairs even during the breeding season. There is seasonal variation in the composition of these flocks. Outside the breeding season, they contain adults and immatures of both sexes, and may build up considerably in numbers. A flock of approximately 200 birds is the largest encountered during a decade of field studies. Flocks tend to become noticeably smaller in spring, when nesting activities commence, and this may be due to the departure of young birds from the previous year to establish their own flocks. Females disappear in about September, presumably to go to nest, leaving only males in flocks. These small flocks may increase into larger flocks comprising of up to 30 or more males. It has not been ascertained whether these flocks contain only non-breeding birds, the result of a natural predominance of males, or whether they also contain males of sitting females. At the conclusion of the breeding season, the flocks of males are replaced by small parties containing two or three pairs and up to eight or ten immatures.

P. swainsonii are naturally sociable birds. In captivity they can safely be housed with other species of non-aggressive parrots, pigeons and doves, softbills, most finches, pheasants and quail. (Forshaw 2002) (Higgins 1999) (Sindel and Gill 2003)

9.3 Reproductive Behaviour

Refer section 10.3 Reproductive Condition.

9.4 Bathing

P. swainsonii can be regular bathers so a minimum size water container of approximately 18cm in diameter and 5cm deep should be provided for each pair. Larger containers are likely to be fouled and can be dangerous for newly fledged young. Water containers should be checked and replenished daily, twice daily during hot weather. (Sindel and Gill 2003)

9.5 Behavioural Problems

No stereotypic or unwanted behaviour has been recorded for *P. swainsonii*.

9.6 Signs of Stress

In captivity *P. swainsonii* is not regarded as a bird that becomes stressed. Like all *Polytelis* species *P. swainsonii* has a pleasing, docile and inoffensive nature. It has been indicated that it takes remarkably little time for newly acquired adult birds to build a great deal of adoration for their keeper. (Sindel, S. 2004 pers. communication 17 Aug) (Wilson 1990)

9.7 Behavioural Enrichment

Behavioural enrichment and suggested methods for displaying *P. swainsonii* have been outlined in sections 4.1 Exhibit/Enclosure Design, 4.9 Enclosure Furnishings and 6.3 Presentation of Food.

9.8 Introductions and Removals

P. swainsonii is not generally regarded as an aggressive species. However, the introduction and removal of individuals or groups should be monitored and changes made, when necessary, to resolve any problems. Quarantine requirements should be adhered to at all times. (Sindel and Gill 2003)

9.9 Intraspecific Compatibility

Aggression between pairs, families and groups of *P. swainsonii* is uncommon. Compatibility of pairs is usually desirable but not always essential. Selected pairs should be placed together in an enclosure (aviary) on their own, prior to the breeding season and are generally bonded within a month or two. Therefore it is good practice to always place newly formed pairs or groups together a few months before the normal commencement of the breeding season to check their overall compatibility.

Observations of colony breeding in groups of up to nine pairs have been recorded for *P. swainsonii* in the wild but solitary pair breeding is also common. Colony breeding in captivity has been recorded for three pairs and four males and five females. A captive colony of 80-90 *P. swainsonii* has been reported (Thompson, P. 2004 pers. communication 1 Nov). (Sindel and Gill 2003)

9.10 Interspecific Compatibility

P. swainsonii is indicated as being a safe species to house and breed in a flock/mixed display with pigeons, doves, softbills, most finches, all non-aggressive parrot species, pheasants and quail. Keeping *P. swainsonii* with aggressive parrot species such as the Rosella group will almost certainly result in the persecution of *P. swainsonii*.

Colonies of several pairs of mixed *Polytelis* species when housed in a large enclosure, with plenty of nesting facilities available, will usually work well. However it should be noted that *P. swainsonii* has been recorded as hybridising with *P. anthopeplus* (Regent Parrot), *P. alexandrae* (Princess Parrot), *Apromictus erythropterus* (Red-winged Parrot), *Alisterus scapularis* (Australian King Parrot) and *Platycerus eximius eximius* (Eastern Rosella Parrot).

There is the potential for diseases to be passed between species within a flock/mixed display such as Psittacosis (Ornithosis), Psittacine Beak and Feather Disease, Hairworm (Capillaria) and Candidiasis. It is therefore important that quarantine procedures are followed and preventative treatments are maintained for each species. (Cannon 1996) (Sindel and Gill 2003) (Wilson 1990)

9.11 Suitability to Captivity

P. swainsonii is considered to be a highly desirable aviary bird. It is hardy and indicated as being well established in Australian aviaries. Furthermore, it has a pleasant disposition, soon becoming trusting of its keeper, is not noisy and generally breeds freely. There are reports of breeding pairs producing young in captivity for more than 20 years. Due to the long-term success of this species as an aviary bird, both in Australia and overseas, practical management techniques have been fairly well developed. It has been established in aviculture since 1867. (Forshaw 2002) (Sindel and Gill 2003)

10. BREEDING

10.1 Mating System

Compatibility of pairs is desirable but not always essential. Incompatible pairs of *P. swainsonii* often gradually accept each other and breed the next season. It is advisable to place newly formed pairs together a few months prior to the normal commencement of the breeding season.

During this lead up period new pairs should be monitored for any signs of aggression and changes made where deemed necessary. Such actions may avoid considerable problems at a later date. (Sindel and Gill 2003)

10.2 Ease of Breeding

P. swainsonii are established as domestic strains in Australian and as such are reliable parents. Colony breeding has been successful for this species including with several pairs of mixed *Polytelis* species when housed in a large enclosure (aviary) with plenty of nesting facilities.

P. swainsonii are also ideally suited to flock breeding due their tolerance of other birds and the lack of aggression of breeding pairs.

However the best breeding results for these species has been obtained by having one breeding pair of birds per an aviary. (Sindel and Gill 2003)

10.3 Reproductive Condition

Generally the breeding season is pre-empted by the increased activity of both male and female by flying backwards and forwards in the aviary, increased vocalisation, feeding, courtship displays and interest in a chosen nest site. (Sindel and Gill 2003)

10.3.1 Females

Females will solicit feeding by crouching submissively on the perch with the head raised sometimes calling to the male. (Sindel and Gill 2003) (Wilson 1990)

10.3.2 Males

Males will call fairly continuously either in flight or perching. The courtship display includes wing drooping, erection of crown feathers, sleeking feathers back while holding head high and standing upright, sometimes frantic running and flying around the female, flashing and dilating eyes and calling softly. (Sindel and Gill 2003) (Wilson 1990)

10.4 Techniques Used to Control Breeding

Most species of birds have evolved so that they can respond to environmental conditions and come into breeding condition at an optimal time for chick survival. Two types of stimuli are involved, *proximate stimuli*, such as day length, rainfall and temperature that can induce a bird to come into breeding condition; and *ultimate stimuli*, such as the availability of food, water, nesting sites and a suitable partner that can trigger mating and egg laying.

The manipulation of these triggers may be used to control breeding, if required. The *proximate stimuli* naturally control breeding with seasonality through the year but may be difficult to totally control. However, it is possible to manipulate the *ultimate stimuli* to control breeding. Varying the diet fed to change from non-breeding and to a breeding diet would act as a trigger leading into the breeding season (refer section 6 Feeding Requirements). Separating the males from females would provide the most effective breeding control. (Macwhirter 1987)

10.5 Occurrence of Hybrids

P. swainsonii has hybridised with *Polytelis alexandrae* (Princess Parrot), *Polytelis anthopeplus* (Regent Parrot), *Apromictus erythropterus* (Red-winged Parrot), *Alisterus scapularis* (Australian King Parrot) and *Platycerus eximius eximius* (Eastern Rosella). (Sindel and Gill 2003) (Wilson 1990)

10.6 Timing of Breeding

The breeding season has been recorded mainly during the period from early September to mid November. However depending on climatic conditions and locality breeding can take place from August to December. (Shephard 1989) (Sindel and Gill 2003) (Wilson 1990)

10.7 Age at First Breeding and Last Breeding

Young *P. swainsonii* females have occasionally been known to breed at one year old but males have not been known to fertilise eggs until two years old. Generally breeding is more successful with pairs that are two or more years old. A prolific breeding pair of *P. swainsonii* has been known to produce young for twenty years. (Sindel and Gill 2003) (Wilson 1990)

10.8 Ability to Breed Every Year

P. swainsonii will produce one brood per year. This will depend on the birds being maintained on an appropriate diet, provided with sufficient space and a healthy environment in an enclosure. However, the breeding season may vary depending on the climatic conditions in a given year i.e. dry climatic conditions may influence the *proximate stimuli*. (Shephard 1989)

10.9 Ability to Breed More than Once Per Year

There are no records to suggest that *P. swainsonii* will produce more than one clutch of eggs per year.

10.10 Nesting, Hollow or Other Requirements

Nesting Facilities

P. swainsonii nest in the hollow limbs of native trees in the wild, mainly species of *Eucalyptus*. In captivity they will accept either natural hollow logs or artificial wooden nest boxes in which to breed. Although hollow logs provide a natural nest site, consideration should be given to the loss of native habitat of wild *P. swainsonii*. Threats to their habitat have largely resulted from clearance for agriculture. Live nest trees are threatened by logging, particularly on private land, and artificially high water levels as a result of irrigation. Dead nest trees may not be replaced when they fall or are cut for firewood. Therefore to assist in preserving nest trees in the natural habitat of *P. swainsonii* the use of hollow logs in captivity should be discouraged and preference be given to providing different types of artificial wooden nest boxes.

Although hollow logs have the advantage of being natural and perhaps more attractive in an aviary compared to nest boxes the disadvantages far out weigh the advantages. The disadvantages of hollow logs are that they are difficult to clean, inspect, obtain and replace. Usually the logs are heavy and difficult to hang and manoeuvre in an aviary.

In comparison artificial nest boxes may not be as attractive as logs and generally constructed of dressed timber or plywood are more likely to be chewed by *P. swainsonii*. However, this in itself becomes an advantage allowing nest boxes to be renewed adding to the hygienic benefits of nest boxes. The other advantages for nest boxes are that they are easy to obtain, prepare, clean, inspect, hang, replace and manoeuvre in an aviary.

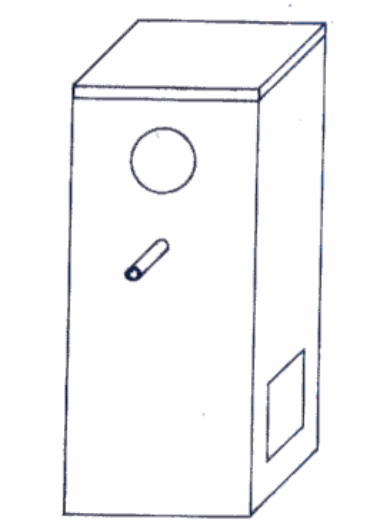

Figure 29. Suitable design for a vertical nest box.

An ideal nest box for *P. swainsonii* is a vertical type (refer Figure 29) with the minimum measurements of 400-900mm in height, with an internal base of 200-300mm square with an entrance hole diameter of 75-100mm. There should be a removable lid for cleaning purposes, an inspection door, large enough to pass a hand through, about 100-150mm from the bottom, either on the side or front, and a perch or landing block near the entrance hole. Internal climbing cleats or a weldmesh wire ladder are essential to provide easy entry and exit from the nest box, but should end about 150mm above the nest filling to avoid any unfortunate accidents as nestlings grow. Ventilation holes about 10mm in diameter should be drilled in the sides of the nest box approximately 100mm above the nest filling to help to reduce internal temperatures during hot weather. There are various shaped designs of nest boxes now commercially available, including "A" and "Z" shaped, which have been accepted for breeding by *P. swainsonii*. Two or three different shaped nest boxes could be provided in an aviary to give breeding pairs alternatives to choose from for nesting.

Overall the main requirements of a nest site for these species are acceptability by the birds, adequate size, good access and easy to clean. (Garnett and Crowley 2000) (Shephard 1989) (Sindel and Gill 2003)

Nesting Materials/Filling

The main materials that have been successfully used for nest filling are; peat moss, wood dirt, sand, sawdust (fine and untreated), pet litter, rice hulls, garden dirt, wood shavings or any mixture of these materials. An ideal mixture has been suggested as 75% peat moss and 25% wood dirt.

Nesting materials should be lightly moistened and packed to a depth of 80-100mm. The female will spend several days working the filling before she begins to lay her eggs. It is important for hygiene purposes to remove used nesting material after each breeding season and replace with fresh material. (Shephard 1989)

Installing Nesting Facilities

Nest boxes should be hung in the shelter/covered section of an enclosure (aviary), as high as possible but still accessible for inspections to be carried out. Nest boxes can be hung in the open section of an enclosure provided there is sufficient cover to protect the nest boxes from inclement weather, in particular rain and direct sun light. If there is an enclosed rear service walkway to an enclosure it may be possible to have nest boxes hung outside an aviary with an accessible entrance hole for the birds. This system would provide fewer disturbances to breeding birds by reducing the necessity to enter enclosures to conduct nest box inspections. It is possible to leave nest boxes in enclosures all year round but preference is given to removing nest boxes at the end of each breeding season to ensure nest boxes are completely cleaned out and disinfected ready for or replaced for the following season. (Sindel and Gill 2003) (Shephard 1989)

10.11 Breeding Diet

Non-breeding and breeding diet has been outlined in section 6 Feeding Requirements.

10.12 Incubation Period

Incubation periods of 20, 21 and 22 days have been recorded. Incubation usually starts with the laying of the second or third egg and is carried out by the female only. (Sindel and Gill 2003) (Shephard 1989)

10.13 Clutch Size

Clutches have been recorded for four to seven eggs. Usually five or six, white, rounded, oval eggs are the normal clutch size for *P. swainsonii*. The eggs are laid at two day and occasionally three-day intervals. (Sindel and Gill 2003)

10.14 Age at Fledging

Recorded fledging periods are from 35 to 43 days including each intermediate day from early November to early January. Long fledging periods appear to be normal for this species. (Sindel and Gill 2003)

10.15 Age of Removal from Parents

Fledglings can be removed from their parents three weeks after they leave the nest. Their removal is usually not essential with *P. swainsonii* as they are quite a tolerant species even if the young are allowed to remain until the following breeding season. (Sindel and Gill 2003)

10.16 Growth and Development

P. swainsonii chicks hatch with pale grey down and orange beaks, at 5 days the down is longer and slightly darker, then at 8 days old the eyes are opening. At 14 days the thicker grey secondary down and early pin feathers on the wings and tail are visible. When 20 days the secondary down is thick and woolly, while the pin feathers on the tail and wings are opening, then at 27 days they are half feathered and three-quarter feathered at 32 days. When 35 to 37 days they are fully feathered and ready to fledge. (Sindel and Gill 2003)

Figure 30. *P. swainsonii* chicks 7, 8, 10 and 11 days old

Figure 31. *P. swainsonii* chicks, from the right, 14, 15, 17 and 18 days old

11 ARTIFICIAL REARING

11.1 Incubator Type

Good hatching results have been obtained using a “Rotarex” brand of incubator manufactured in New Zealand by Dominion Incubators Pty Ltd. Fan forced auto turn incubator models that have also been indicated as reliable are the Brinsea ™ Octagon 20 Mark III and the Marsh ™ Rolex. (Digney 1998) (Sindel and Gill 2003)

11.2 Incubation Temperatures and Humidity

The normal incubator operating temperature for parrot eggs is 37.2°C, although temperatures of 0.2°C higher or lower than 37.2°C have also been successful. A relative humidity of 55% is advisable which is equivalent to a wet bulb thermometer reading of 29°C to 31.2°C. (Digney 1998) (Sindel and Gill 2003)

11.3 Desired % Egg Mass Loss

The theoretically accepted ideal weight loss for eggs is 16% during an entire incubation period. This is calculated by dividing the initial weight of the fresh egg by 6.25 to establish the preferred 16% overall weight loss, which then should be divided by the number of days in the normal incubation period for the particular species, to ascertain the ideal weight loss per day. (Sindel and Gill 2003)

11.4 Hatching Temperature and Humidity

There is no specific information relating to hatching temperature for *P. swainsonii* eggs. It is suggested that an incubator should be maintained at the incubation temperature of 37.2°C, although not lower than 36.9°C. Ideally, three days prior to the eggs hatching the humidity of an incubator should be increased to 75% or 33.3°C on a wet bulb thermometer. However, 60% humidity has been successful when used for mixed species egg incubation and hatching. (Digney 1998) (Sindel and Gill 2003)

11.5 Normal Pip to Hatch Interval

No information available specific to *P. swainsonii*. Generally the first signs of external pip should appear within 24-48 hours after internal pip or collapse of the air cell. Occasionally it can be as soon as 12 hours after internal pip. Between 24-72 hours after external pip the chick should be completely hatched. (Digney 1998)

11.6 Brooder Types/Design

No information is available on brooder types specifically for *P. swainsonii* but any brooder should be designed to ensure that the chicks have no contact with the heat and humidity sources. Generally the design of brooders can vary from the manufactured to the homemade types (refer Figure 33) but the selection of the brooder type is dependent on the cost, usage and value of the species to be hand reared. Fan forced brooders that have been indicated as being popular and suitable for smaller parrot chicks include the Lyons ™ Intensive Care Brooder, the WAPE ™ Parrot Brooder, the AB™ Newlife Brooder and the Brinsea™ Octagon 20 Parrot Rearing Module. (Digney 1998) (Low 2004)

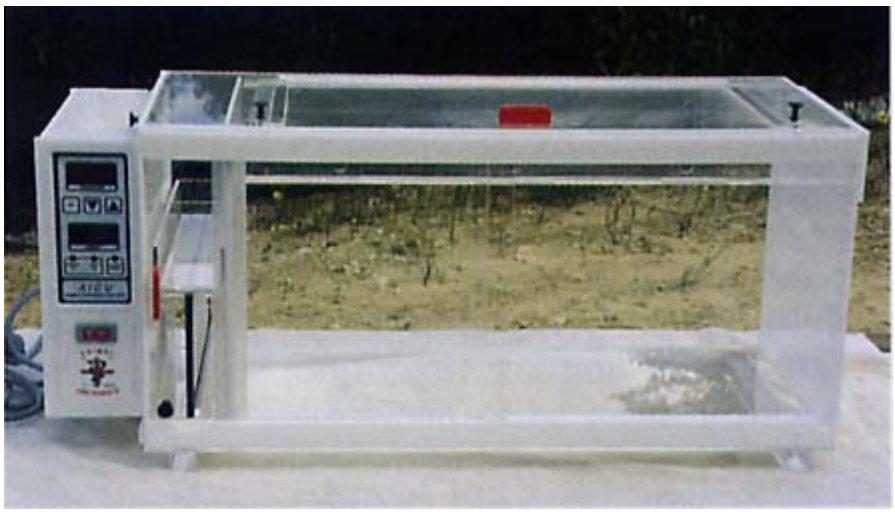

Figure 32. The Lyons ™ Intensive Care Brooder a widely used fan forced brooder

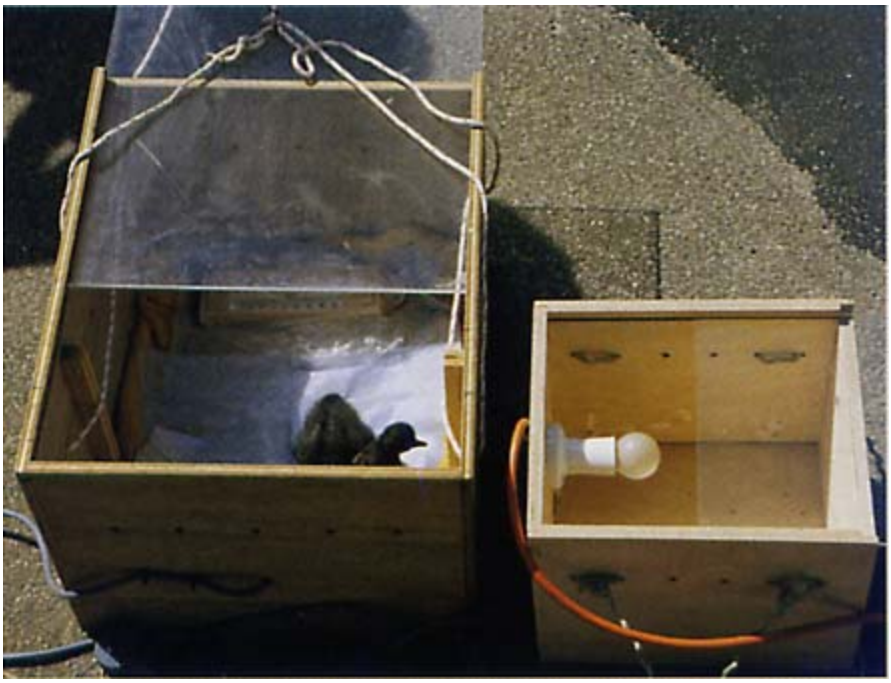

Figure 33. Homemade brooders successfully used by Perth Zoo, WA

11.7 Brooder Temperatures

The following are temperature guidelines for the brooding of parrot chicks:

Newly hatched	36.6°C
5-12 days old	35° - 31.6°C
12 days – pin-feather	31° - 28°C
Once feathers begin to cover most of the body	26.5°C

(Digney 1998)

11.8 Diet and Feeding Routine

Hand-rearing diet for day one to seven-day-old chicks: It has been indicated that currently the best results when rearing day one to seven-day-old chicks is gained by the use of commercially prepared diets such as Lakes Hand-rearing Formula or Wombaroo "granivore".

As soon as chicks are started on a hand-rearing food it is advisable to introduce digestion-assisting bacteria into their crop. This process can be achieved by adding one of the many products available for human use containing Lactobacillus acidophilus. Enough of the product to cover the head of a match in a level teaspoon of rearing food in each feed for two days is sufficient to introduce the desired bacteria.

Hand-rearing diet for chicks over seven days: The following hand-rearing recipe has provided optimum growth rates for *Polytelis* species:

1 cup ground chicken starter crumbles approximately 20% protein
1 cup egg and biscuit canary rearing food or preferably ¼ cup of whole egg powder
1 cup of sunflower meal
1 cup Farex Baby Cereal or Heinz High Protein Baby Cereal
1 level teaspoon of multi-vitamin and mineral powder
1 level teaspoon of calcium carbonate powder

The dry mix is best stored in an airtight container and kept in a cool place. To prepare the mix for feeding add hot, not boiling, water and allow cooling to a suitable temperature of about 40°C so as not to burn the chicks. A few drops of a liquid vitamin supplement such as Penta-vite or Avi Drops are added to one feed each day.

Feeding routine: Feeding should commence about two hours after hatching and continue at two hour intervals until 10-00 p.m. approximately, during the night feed at 2-00 a.m. and then commence the two hourly feeding at 6-00 a.m.

During the first few hours or until the chick passes its first motion, feed only hydrating fluids, such as Gastrolyte, mixed with Lakes Hand-rearing formula mixed into a runny consistency. This fluid mixture should be fed for the first three days while gradually

increasing to a thicker consistency to 30% solids. Then the Gastrolyte is discontinued and replaced with cooled boiled water for the remaining rearing period.

When seven days old the 2-00 a.m. feed can be discontinued, allowing the chicks crop to empty overnight. As the chicks grow so does the capacity of the crop capacity and the food intake increases while the duration between feeds is extended to three hours then four hours and so on. Generally the feeding intervals are determined by the speed of the crop emptying. The hand-rearing diet is changed at seven days old to the hand-rearing recipe specified above. The hand-rearing food should be fed at a temperature of 42.7°C for very young chicks, gradually reducing to 40°C for older chicks.

Normally weaning off the hand-rearing diet would take place at about eight to ten weeks of age. This may vary between individual young birds. The first indication that the birds are ready to be weaned is their growing lack of interest in the hand-rearing food. When this behaviour begins a variety of appropriate foods can be placed in a shallow dish in the young birds brooder or cage for them to start to experiment with. Soft foods are ideal such as corn kernels, peas, spinach, soft pear, carrot, and sprouted mung beans should all be offered in small-diced pieces. A pre-soaked parrot mix containing sunflower, canary seed, oats and millets can also be offered. The soaking makes the seed husks easy to break and weaning parrots will soon learn to extract the flesh, play with it for a while and then experiment with chewing it. The same parrot mix could also be run through a blender and offered as a crunchy mix and may take a young birds fancy quicker than lumps of food.

Hand-rearing food should be gradually reduced in quantity and regular feeds per day cut down to once daily. Preferably the one daily feed should be in the evenings to ensure young birds have sufficient food in their crops to sustain them through the night. The reduction in hand-rearing food will also encourage the young birds to feed themselves. When the young birds have been observed, eating and swallowing properly, and there is at least a level teaspoon of food in their crops during the late afternoon hand-feeding should cease. However, close monitoring of food intake should take place for several days to sure that the young birds are definitely feeding themselves. (Low 2004) (Sindel and Gill 2003) (Wilson 1990)

11.9 Specific Requirements

The best substrate to brood a small chick on for the first few days of its life is tissues, which are replaced every feed. When changing the tissues every feed, any unusual features or changes in faeces will be detected immediately. Use several layers of tissue at a time, as a single layer soon breaks up with moisture from the faeces and the chick will begin slipping on the under surface.

Once the chick enters the growth phase, sawdust is by far the most popular substrate used. It is cheap, fairly easily obtained and an excellent absorber of fluids. The one problem with sawdust is that from the pin-feather stage chicks can begin to pick at the base materials. This may result in a full crop of sawdust. To assist in the preventing the

swallowing of sawdust a mat of weld mesh wire can be cut to fit neatly inside the brooder container on top of the sawdust. By using 12mm x 12mm, 18 gauge wire it will act as a cover and pack the sawdust down. The smaller the aperture of the wire the better as it prevents the chicks from picking at the base material while still absorbing the dampness from the faeces. It is suggested that several sections of wire are available for regular interchanging and disinfecting. Crushed popcorn, untreated pine bark, vegetable based kitty litter and even maize/wheat have also proved successful as substrates for brooder containers.

Once the chicks begin to feather up, a simple wire floor that is elevated to allow faeces to drop through on to a tray or newspaper works well, providing the aperture of the wire is small enough to prevent feet and toes being caught. (Digney 1998)

11.10 Pinioning Requirements

There is no information relating to the practice of pinioning for *P. swainsonii.*

11.11 Data Recording

On arrival at the hand-rearing unit the sex and age of the bird (chick) should be noted (use growth charts to determine approximate age if the details are not known). The information recorded during the hand-rearing process (1) provides background information, such as food consumption, that will assist a veterinarian reach a diagnosis if the bird (chick) becomes sick or fails to grow or gain weight, (2) allows comparison with established growth curves to assess development or (3) facilitates the creation of standard growth curves if not already available.

The following information should be recorded on a daily basis:

- Date
- Time when information is recorded
- Body mass to the nearest 1g, if possible
- General activity and demeanour
- Characteristics and frequency of defecation and urination
- Amount (g or ml) and types of food offered
- Food consumption (g or ml) at each feed
- Veterinary examination and results

(Jackson 2002)

11.12 Identification Methods

Refer section 5.3 Methods of Identification

11.13 Hygiene

If attention is paid to good hygiene through out the period of hand-rearing there should be very few problems experienced. General hygiene should be the cleaning of hands before and after handling and feeding young birds, using an iodophor or chlorhexidine wash. Hands should be scrubbed for at least five minutes, as most disinfectants need 5-10 minutes of contact to effectively clean hands.

All feeding utensils should be cleaned with disinfectant after each feed. To stop any possible infection spreading feeding utensils should be cleaned between feeding each individual chick if several chicks are being hand-reared at the same time.

Incubators, brooders, holding containers and weaning cages should be disinfected before, during and after use. If paper is used to cover surfaces it should be changed daily. Any tissues or any other material used to provide warmth and pack out holding containers should be changed regularly if soiled by the chicks. During the entire hand-feeding period the chicks must be wiped clean of any excess food after each feeding with tissues or toilet paper.

Effective disinfectants that are safe to use by humans and with young birds are; chlorhexidine sold as Aviclens, Hibiclens, Hibitane or Nolvosan, chloramines sold as Halamid or Halasept and sodium hypochlorite a common form of chlorine used at a 5% dilution rate. (Cannon 1996) (Low 2004) (Sindel and Gill 2003)

11.14 Behavioural Considerations

Hyperactivity and blood flecking have been recorded as problems with *P. swainsonii* chicks from about five to ten days old in brooders. The first indications are constant movement of the chick and fine blood flecks on the paper lining of the brooders. The bleeding is the result of constant movement of the chick on abrasive paper such as paper towel and toilet paper. Confining the chick in a container lined with several thicknesses of tissue paper, with some tissue paper screwed up, seems to comfort and settle the chick as it huddles up to or under the tissue similarly as it would a brooding hen. This behaviour may be temperature related as adjusting the brooder temperature until the chick appears more settled and comfortable tends to resolve the problem. Alteration to the diet and increased food input is also indicated as being of benefit to this type of problem.

Generally hand-reared *P. swainsonii* do not have any behavioural problems still remaining friendly once placed into an aviary situation with other similar birds. Occasionally *P. swainsonii* have been known to be flighty when first released into a large aviary, tending to fly directly into the ends of aviaries. Young *P. swainsonii* will quieten down after a short period of time during an initial release period if hessian or cut branches can be fixed at the ends of aviaries to prevent the young birds injuring themselves. (Low 2004) (Sindel and Gill 2003) (Wilson 1990)

11.15 Use of Foster Species

Each of the species of *Polytelis* make good foster parents and are generally safe for cross fostering, although constant monitoring of untried pairs is advisable. *Psephotus haematonotus* (Red-rumped Parrot) are usually good foster parents for *P. swainsonii*, this is providing that there are not too many young in the nest and they do not grow beyond the capabilities of the smaller foster parents. (Sindel and Gill 2003)

11.16 Weaning

Refer to the information contained in section 11.8 Diet and Feeding Routine.

11.17 Rehabilitation Procedures

Rehabilitating hand-reared parrots to be fully independent and to have natural behaviour to be able to fully socialise with their own species, requires several stages for the procedure to be considered complete as follows:

Stage 1

To finalise the weaning process it is important that a hand-reared parrot should be allowed to gain independence, condition and fitness by being placed in a weaning cage. The weaning cage is simply any type of wire cage or cabinet in which a young bird can learn to perch, use its wings properly and begin to more independently eat food. Ideally the weaning cage should be big enough to allow free movement and exercise of the wings, even short flights, but should be small enough to keep the bird in relatively close contact with the food supply. An ideal weaning cage is one elevated on legs with wheels for ease of movement with a suitably sized access door.

During the early stages of introduction to the cage, place the perch on the cage floor securely in a position where it will not roll around. Perching itself is a learning process and the young parrot will learn to step on to the perch and grip much quicker this way than if the perch is suspended. Keeping the perch initially low ensures that the parrot and food are close together. Gradually raise the perch to encourage the parrot to become active and explore the cage. This final stage of weaning with young *P. swainsonii* may only take a matter of weeks.

Stage 2

Acclimatisation to outdoor conditions is especially important for young birds that have been hand-reared in a controlled environment indoors. This can be achieved by using a mobile weaning cage, which can be moved outdoors. The weaning cage must be sheltered to give the young birds an area to retreat into if they become frightened for any reason and for protection from sudden changes in climatic conditions. Young *P. swainsonii* should have the period's outdoors gradually extended until they have fully

adjusted to seasonal temperatures and photoperiods (day length). It is important during acclimatisation to avoid exposing young birds to extreme climatic conditions.

Stage 3

Once acclimatised young *P. swainsonii* can be placed in a small holding enclosure where they can start to develop their flying skills and generally exercise to gain a higher level of fitness and condition. Perches at various heights and different thicknesses will assist with this process. Providing food in a way that increases activity levels such as spiking food on perches or branches around the enclosure and having several feeding stations will encourage the young birds to move around the enclosure. Having several young *P. swainsonii* together or at least different species of young parrots that are compatible with *P. swainsonii* together will stimulate competition for food and at the same time increase activity.

Stage 4

All of the rehabilitation procedures should be leading to the most important stage for hand-reared parrots, which is normal or natural behaviour and socialising with their own species. This can be achieved by housing the young birds with non-breeding adult *P. swainsonii* to enable them to learn to interact with their own species. Human contact should be reduced except for regular feeding and cleaning practices. Housing young *P. swainsonii* in an outdoor enclosure with their own species will also help to develop traits or skills relating to predator avoidance, how to manipulate food items, social structure and moving confidently around an enclosure. Behavioural enrichment should be utilised to encourage natural behaviour. (Digney 1998) (Walraven 1994)

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15 Glossary

Equinox The time at which the sun crosses the equator and day and night are equal.

Lesion Damage or injury, especially a change in the function or texture of an organ.

Orbital Border around, outer ring.

Riparian Growing on a riverbank.

Riverine Of or on a river or its banks.

Vector Carrier of disease or infection.

16 Appendix

Appendix 1

Preparation method for baked nutritional cake.

- Add enough water to make a mix the consistency of a regular cake mix with all the ingredients.
- Place into cake pans to a depth of about 50mm.
- Place in an oven at 180°C for 45 minutes or until cooked.
- When cool feed fresh to birds or slice into small cubes and store in a freezer, thaw out as required.

Appendix 2

PARROT ENRICHMENT LIST FROM CHESTER ZOO.

* Half a white cabbage can be suspended by a rope from the top of the enclosure / other ropes and nuts are pushed between the layers of leaves. For larger parrots dense cabbages can be hung up whole.

* Egg cartons can be filled with wood shavings and a few nuts. The sides can then be fixed with long, thin nuts by feeding them through the edge of the carton halves. Large walnuts can be placed in the spaces on the underside.
* Bamboo tubes with beak-sized holes drilled into the sides can be filled with pine cones and hung up in the enclosure. The birds will take small chunks out of the cones by reaching into the holes.
* Mashed banana can be wrapped up in 'curly green cabbage' leaves.
* 'Fruit kebabs'. Pieces of fruit are threaded onto a piece of wire and hung at one or both ends from the top of the enclosure.
* Whole apples can be 'spiked' with sunflower seeds and placed around the enclosure.
* Scatter feed of pine nuts and sunflower seeds on soil in avairy.
* Large pieces of rotting bark placed in the enclosures are usually being stripped quite happily! They can also have pine nuts sprinkled on them.
* Wood with large pieces of bark can be spiked with sunflower seeds by pushing the seeds under loose bark layers. The bark itself is an enrichment and parrots love to strip it off a log.
* Cardboard boxes can be filled with whole fruits and then the lid shut tight.
* Various nuts can be placed on a paper towel and then the ends can be sealed by twisting them.
* Large cardbaord tubes can be filled with nuts but both ends are sealed with paper bags.
* Seeds can be hidden in a pile of wood shavings.
* Pine cones spiked with pumpkin seeds and sunflower seeds can be placed in holes (already pre-drilled) on a wooden disc. The disc is suspended from the top of the enclosure or a branch. Cones are removable and the birds play with them after extracting the seeds.
* Seeds can be hidden in a litter tray filled with bark chips, wood shavings, soil or leaf litter.
* A bunch of washed Kale is tied together tightly with wire and suspended from the avairy roof.
* A whole hollow coconut (halves tied together through small holes) can be filled with cabbage and then suspended from the roof of the aviary. The parrots have to pull the cabbage out through holes drilled in the coconut.
* Pineapple tops can be sprinkled with seeds and placed on the food tray or on the floor in an upright position.
* A log with holes drilled into it can be filled with mealworms so they either fall out randomly or are pulled out!
* Suitable food can be placed in trays with water.
* A bag/net can be suspended from a rope, containing a food item. This had worked well with the Keas.
* Flowers are hung up in bunches.
* For lories, nectar feeders are made by drilling out the inside of a log and then drilling a hole for a water bottle funnel. The water bottle is filled with nectar and placed inside the log so the lories can feed from the funnel.

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Appendix 3 - Species Fact Sheet

VU **Superb Parrot** ***Polytelis swainsonii***

2004 IUCN Red List Category: **Vulnerable**

2004 IUCN Red List justification This species may have a small population and has been declining for over a century, due primarily to agricultural clearance. As such, it is Vulnerable.

Family / Sub-family PSITTACIDAE

Species name author (Desmarest, 1826)

Taxonomic sources Christidis and Boles (1994), Sibley and Monroe (1990, 1993)

Identification 40 cm. Bright green parrot with long, graduated tail. Adult male bright green with diagnostic bright yellow face sharply demarcated by bright red band across lower throat. Mainly grey undertail. Adult female duller than male with bluish-green on face, grey undertail feathers with conspicuous rose-pink edges. Juvenile similar to adult female, but with paler bill. **Voice** Not well known. One call is prolonged warbling note terminating abruptly or rolling, grating *currack currack*.

Population estimate	Population trend	Range estimate	Country endemic
6,500	decreasing	81,000 km^2	Australia

Range & population *Polytelis swainsonii* is endemic to Victoria and New South Wales, **Australia**. It has undergone substantial range contraction. In Victoria, it is now largely confined to the Nathalia area, especially Barmah State Forest, birds having disappeared from central and southern areas in the early 1900s, and has substantially declined in northern Victoria by 1930. In New South Wales, it has declined in the Parkes district since the 1960s. However, the range may have extended to Deniliquin and in northern New South Wales over the same period. The breeding population has been estimated at fewer than 5,000 pairs, and continues to decline.

Ecology It nests in the New South Wales and Victorian Riverina in loose colonies in riparian woodland of river red gum *Eucalyptus camaldulensis* and forages in box woodland. On the slopes of the Great Dividing Range, it forages and nests in box woodland. In the Riverina, it feeds on seeds of herbaceous plants, switching to lerp, mistletoe berries, eucalypt flowers and grass seed in winter, and forages up to 15 km from the nest.

Threats Range contraction is largely the result of clearing for agriculture. Remaining habitat is often fragmented, dividing feeding from breeding habitat. Regeneration is commonly prevented by high grazing levels by stock and rabbits or inappropriate fire regimes. Foraging areas and nest-sites may be scarce. Many nest trees are dead, particularly on the inland slopes, and there may be no replacements when these fall or are cut for firewood. In the Riverina, altered flooding regimes may compromise the health and extent of riparian woodlands where this species nests[1]. Competition with other species for a decreasing number of nest-sites may be fierce. Illegal trapping occurs, but is a far less significant threat than habitat loss. Birds are also killed on roadsides and possibly suffer from pesticide poisoning.

Conservation measures underway CITES Appendix II. All populations were surveyed in the 1980s, and regular surveys of Barmah State Forest and along Murray, Murrumbidgee and Edward Rivers have been instigated. Annual community based surveys occur in northern Victoria and southern New South Wales[1]. Guidelines have been developed for forestry in riparian breeding habitat.

Conservation measures proposed Refine monitoring techniques. Extend surveys of nest trees. Determine extent of wildlife trade. Protect all known breeding and feeding habitat from clearance. Reduce firewood-collection. Promote good habitat management and revegetation on private land. Develop regional operations groups.

References Garnett and Crowley (2000). **1.** C. Tzaros and M. A. Weston *in litt.* (2003).

Appendix 4

Management for Conservation of the Superb Parrot (*Polytelis swainsonii*) in New South Wales and Victoria

Rick Webster[1] and Leigh Ahern[2]

A plan prepared jointly for the National Parks & Wildlife Service, New South Wales, and the Department of Conservation and Natural Resources, Victoria.
November 1992

1 Armata Environmental Consultants, 227 River Street, Deniliquin, New South Wales, 2710.
2 Flora and Fauna Branch, Department of Conservation and Natural Resources, Arthur Rylah Institute for Environmental Research, P.O. Box 137, Heidelberg, Victoria, 3084.

PROBLEM STATEMENT

The Superb Parrot currently breeds only in the Riverina and South-west Slopes of New South Wales, and in northern Victoria. There has been a substantial reduction in breeding distribution of the species, particularly in southern parts of its range, during this century.

Concern is now held for the species. It is classified as 'vulnerable and rare' in New South Wales, and as 'vulnerable' in Victoria.

The main threat is identified as the clearing of box-woodland, which forms the major foraging habitat throughout the breeding season and is an important habitat during the non-breeding season. Both in the Murray-Riverina and on the South-west Slopes, nesting does not take place unless a suitable nest tree is located within about ten kilometres of box-woodland in which nesting birds may forage. The availability and condition of box-woodland foraging habitat may therefore have great influence upon the conservation status of the Superb Parrot.

Nesting habitat in the Murray-Riverina requires special controls with regard to the harvesting and silviculture of River Red Gum, an important nest tree species.

On the South-west Slopes of New South Wales, where over 40% of known nests occur in dead trees, the removal of dead trees for firewood may constitute a threat.

Direct causes of population reduction include poaching and road-kills. However, these are currently considered of secondary importance compared with clearing and disturbance of habitat.

ACTION PLAN

AIM

To ensure the long-term conservation of the Superb Parrot through the protection of wild populations and through appropriate management of habitat, over the available natural range of the species in New South Wales and Victoria.

ACTIONS

Lead Agencies referred to below are :

* *National Parks & Wildlife Service—New South Wales*
* *Department of Conservation and Natural Resources—Victoria*

The following actions should be initiated by the lead agencies and pursued through collaboration with other relevant government departments and agencies where necessary:

1 In both New South Wales and Victoria, further clearing or inappropriate alteration of box-woodland should be discouraged and, where possible, prevented, especially within 10 km of known Superb Parrot nest colonies, but also in areas utilised by the Superb Parrot outside the breeding season. Re-planting programs should be encouraged. Extension programs and interstate collaboration should be fostered.
(Section 5.1)

2 Grazing likely to cause significant ecological damage in box-woodland important as Superb Parrot foraging habitat should be discouraged, and greater awareness of this problem fostered. Further information on grazing effects should be sought.
(Section 5.2)

3 Superb Parrot nest trees in riverine forests should be protected and conserved and, on Crown reserve areas, special restrictions (or alternatively reservation) should apply to Superb Parrot nest sites in River Red Gum areas subject to logging or silviculture proposals. Forest management aims should include identification and protection of additional nest trees and provision for suitable future nest trees for the Superb Parrot. Landholders should be urged to protect nest trees on private land.
(Section 5.3)

4 Superb Parrot nest trees in box-gum woodland on Crown reserve areas of the South-west Slopes of New South Wales should be conserved, and suitable future nest trees provided for, by controlling firewood collection and by aiming extension programs at consumers.
(Section 5.4)

5 Public recreational use of riverine forests, and management activities related to this use, should not be permitted to adversely affect the conservation status of the Superb Parrot.
(Section 5.5)

1
INTRODUCTION

During 1985-87, a survey of the breeding distribution and habitat requirements of the Superb Parrot (*Polytelis swainsonii*) was undertaken (Webster 1988). This survey was funded by the Australian National Parks and Wildlife Service, and proceeded under the guidance of an Interdepartmental Steering Committee, with administrative assistance provided by the National Parks and Wildlife Service of New South Wales.

The Steering Committee included representatives from New South Wales National Parks and Wildlife Service; Department of Conservation, Forests and Lands (now Conservation and Natural Resources), Victoria; Forestry Commission of New South Wales; and Australian National Parks and Wildlife Service, Canberra. A final report was published by the Australian National Parks and Wildlife Service (Webster 1988) and, included with the report (Annex, p.39), were seven recommendations formulated by the Steering Committee at the conclusion of the survey.

The recommendations framed by the Steering Committee, whilst only advisory, identified a number of fundamental land management problems affecting the status of the Superb Parrot throughout its range, and made obvious the need for developing a joint New South Wales–Victoria management plan for the species. With the support of the respective state Ministers, the present plan has therefore been prepared through the collaborative efforts of the National Parks and Wildlife Service in New South Wales and the Department of Conservation and Natural Resources in Victoria.

Knowledge of the Superb Parrot's use of breeding and foraging areas is not yet sufficient to permit a rigidly prescriptive approach (e.g. zoning of management areas) to be taken. As identified by the Steering Com-ittee, field monitoring and a range of further research investigations would greatly aid management for this species. Therefore, whilst encouraging such further work, this plan primarily attempts to minimise further environmental impacts upon the habitats used by the Superb Parrot. It also aims to provide a basis of understanding of those factors likely to be of greatest influence upon the species' survival, so that future planning by relevant land and resource management authorities in both States may take these factors into account.

2
STATUS

2.1 DISTRIBUTION

The natural range of the Superb Parrot is limited to New South Wales and northern Victoria, with the current distribution (Figure 1) covering eastern inland New South Wales and north-central Victoria (Blakers, Davies and Reilly 1984).

The breeding range of the Superb Parrot (Figure 1; Map 1) includes the River Red Gum (*Eucalyptus camaldulensis*) forests of both northern Victoria and the Riverina (Webster 1988), but also takes in the South-west Slopes of New South Wales (as defined by Webster 1988), an area roughly bounded on the east by Cowra, Rye Park and Yass, and on the west by Grenfell, Young, Cootamundra and Coolac.

By 1988, Webster had identified 114 individual nests of the Superb Parrot across the New South Wales portion of its range, and one nest in Barmah State Forest, on the Murray River north-east of Echuca, Victoria. Further searches by the Department of Conservation and Natural Resources in Victoria during October and November 1990 yielded an additional 13 nests in Barmah State Forest and Barmah State Park (Bye 1990; Webster 1991). Two additional nests were located in Barmah State Forest during late 1991 (Davidson and Chambers 1991). General locations of nest sites in both States (to the end of 1991) are shown on Map 1, with site numbers corresponding to nest records of Webster (1988, 1991).

The species has been observed further north, along the Namoi River between Narrabri and Gunnedah, along the Castlereagh River between Coonamble and Gilgandra, and in the districts surrounding Hermidale, Tottenham, Warren and Parkes (Kaveney 1979, Schrader 1980, Forshaw and Cooper 1981, Webster 1988). However, breeding has not been confirmed in any of these areas.

The majority of sightings recorded from north-central New South Wales are for the winter months (June-August) (Wheeler 1969, Kaveney 1979, Schrader 1980, Lindsey 1984, Webster 1988), at which time the species appears to be largely absent from Victoria (W. Labbett pers. comm.).

Although the historical distribution of the Superb Parrot has undergone little overall change within New South Wales, there has been a contraction of the range in Victoria. Reports by Cotton (1849), Wheelwright (1861), Keartland (1903) and Batey (1907) indicate that the Superb Parrot was once found much further south than currently observed, including near Melbourne (Figure 1).

As land was cleared and grazing stock introduced, woodland species such as the Superb Parrot were forced to search for alternative habitat (Le Souef 1923). By the 1930's, the Superb Parrot was seen only occasionally in the Wangaratta district (Miller 1933). Bedggood (1958) made a similar observation regarding the Mooroopna district in the 1950s. Webster (1988) ascertained that sightings of the Superb Parrot in these two districts had, in recent years, become very infrequent (A. Hall pers. comm., D. Roberts *in litt.*).

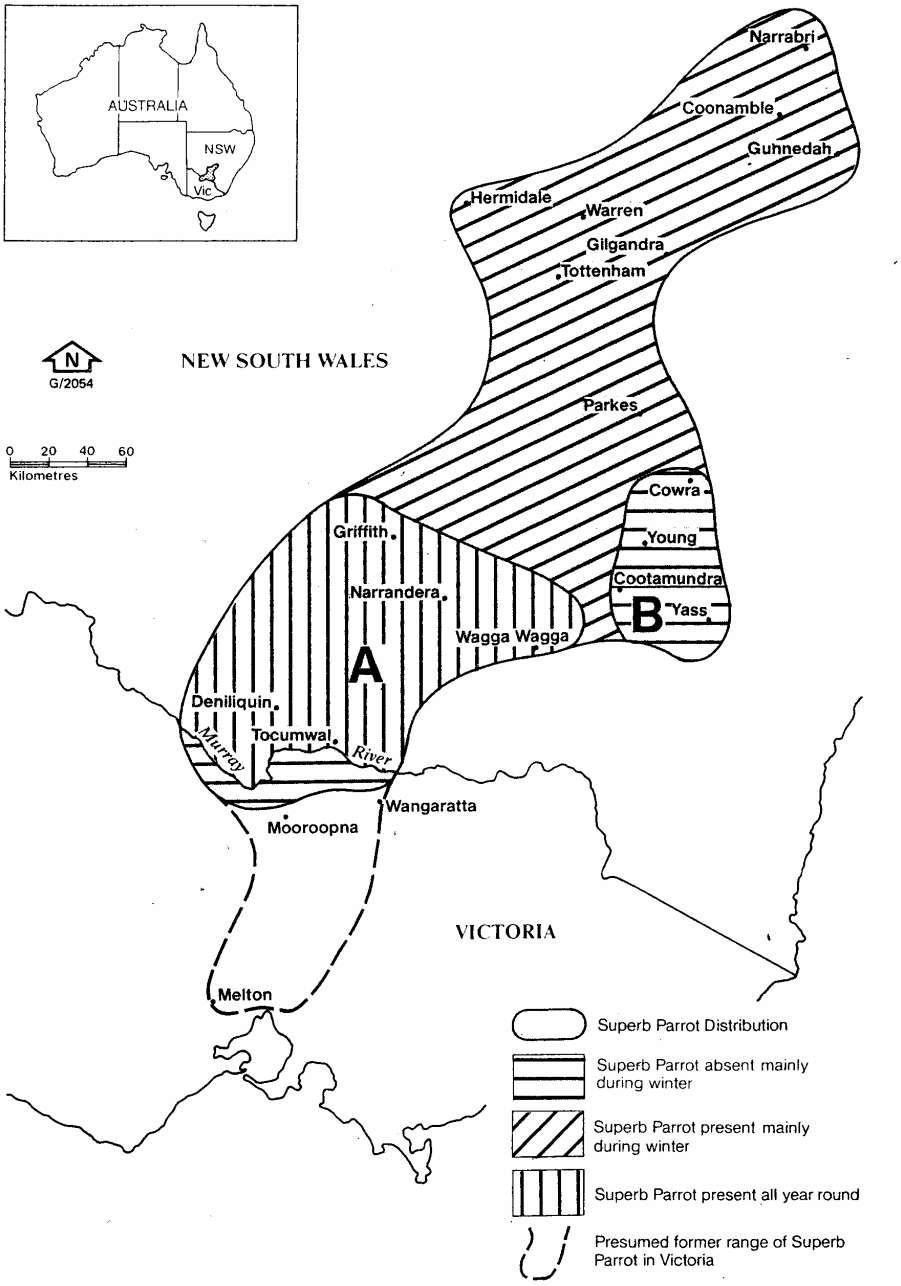

Figure 1 Distribution of Superb Parrot, indicating general areas of occurrence throughout the year and location of breeding areas in Murray-Riverina (A) and South-west Slopes (B).

2.2 ABUNDANCE

The population size of the Superb Parrot throughout northern Victoria, the Riverina and the South-west Slopes of New South Wales is difficult to estimate, but is currently considered by the authors to be at least several thousand birds.

Historical evidence suggests that, within New South Wales, population abundance of the Superb Parrot has fluctuated as a consequence of various factors. Le Souef (1924) reported that, after poisoning of the Rabbit (*Oryctolagus cuniculus*) and Galah (*Cacatua roseicapilla*) ceased, there had been a significant increase in numbers of the Superb Parrot in the Riverina. Frith and Calaby (1953) reported that the Superb Parrot population had increased to what was probably the highest point for many years.

This resurgence, at least in some localities, appears to have been sustained up to the present day, with local observers reporting that the species appears more common at present than previously in the northern Riverina and certain areas of the South-west Slopes (Webster 1988). An observer in the Tocumwal-Barmah area of Victoria believes that numbers seen in that area decreased during the 1940's, but have since remained relatively stable (W. Labbett pers. comm.).

While it is typical of animal populations of inland areas to fluctuate in response to good and bad seasons (H. J. Frith, in Schodde and Tidemann, 1986), it is not clear whether the Superb Parrot responds in this way. However, if the observed resurgence in Superb Parrot numbers is attributable to such a response, then the species could potentially become vulnerable when numbers diminish during droughts.

2.3 CURRENT STATUS

In New South Wales, the Superb Parrot was listed on Part 2 of Schedule 12 ('Vulnerable and Rare Fauna') of the *National Parks and Wildlife Act* 1974. This classification is applied to species which are 'especially vulnerable to exploitation in New South Wales' or 'whose population is naturally small in New South Wales and, while not immediately threatened, may rapidly become extinct should any adverse development occur'. Both of these criteria have relevance to the Superb Parrot. The new *Endangered Fauna (Interim Protection) Act* 1991 also places the Superb Parrot on Part 2 of Schedule 12 ('Vulnerable and Rare Species'). The Scientific Committee responsible for this classification was requested to have regard to the following when considering species for this schedule:

a) whether the population of a species is decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance;
b) whether the population of a species has been seriously depleted and its ultimate security has not yet been assured;
c) whether the population of a species is still abundant but is under threat from severe adverse factors throughout its range;
d) whether a species has a small population contained in restricted areas or habitats or thinly scattered over a more extensive area;
e) any other matter which the Committee considers relevant.

In Victoria, the Superb Parrot is classified by the Department of Conservation and Natural Resources as 'vulnerable' threatened fauna (Baker-Gabb 1991) and is listed on Schedule 2 ('Taxa or Communities of Flora or Fauna which are Threatened') of the *Flora and Fauna Guarantee Act* 1988. Davidson and Chambers (1991) noted that staff of the (then) Department of Conservation and Environment believed that the number of Superb Parrots returning to Victoria each year may be as low as 100 breeding pairs.

In a review of the conservation status of Australian parrots, prepared in 1987 for the Parrot Specialist Group of the International Council for Bird Preservation, Joseph (1988) lists the Superb Parrot as being under threat from loss or degradation of both feeding and

nesting habitat, and as requiring research into its breeding biology. He includes the Superb Parrot amongst those south-eastern Australian parrots described as having 'geographically restricted and small populations' requiring continuing ecological studies and monitoring.

In a report to the Australian National Parks and Wildlife Service, Garnett (1992) attributed 'vulnerable' status to the Superb Parrot and considered the national population to have possibly been declining at more than 1% per year for the last 10 years, in a habitat 'that has been extensively cleared and degraded and is still deteriorating'.

3
BIOLOGY AND ECOLOGY

3.1 NESTING AND REARING YOUNG

The Superb Parrot nests between September and December (Forshaw and Cooper 1981, Simpson and Day 1984, Webster 1988). Prior to nesting, Superb Parrots congregate into small flocks (Forshaw and Cooper 1981). During September, females disappear from these flocks to begin nesting and do not reappear until the chicks have hatched and are well developed (RW pers. obs.).

Over the nesting period, flocks of males can be seen feeding together and travelling to and from foraging sites where they collect food for the nesting females. These journeys occur two or three times a day, over the first four weeks of the breeding season, during which time the females do not leave the nest other than to be fed by the male (RW pers. obs., Forshaw and Cooper 1981). The female begs food from the male in, or at the entrance to, the nest hollow, or in a nearby tree (RW pers. obs.).

The nest entrance is usually in a broken hollow limb (spout) or in a hole in the limb of a eucalypt. The Superb Parrot is known to nest well down within the tree, sometimes even at ground level (North 1911; J. Rook pers. comm.). Usually the eggs are laid upon a decayed wood-dust lining at the bottom of the hollow (Forshaw and Cooper 1981).

Between four and six eggs are laid (Beruldsen 1980) and incubation lasts approximately 20 days (Forshaw and Cooper 1981). The hatchlings are then fed by both parents until fledged approximately 40 days after hatching (Forshaw and Cooper 1981).

The number of young surviving to the fledgling stage is variable, with between one and five young birds leaving the nest (RW pers. obs., P. Maher pers. comm.).

Superb Parrot nests may be solitary, or clustered in one or several trees. Where the distance between one cluster of Superb Parrot nests and another is at least 200 m, each of these nest clusters is considered to be a separate *colony* (Webster 1988). Colonies of up to nine nests have been recorded.

3.2 BREEDING HABITAT

Across its range, the species uses two distinct habitat types for breeding :

i) *River Red Gum forests of the Murray-Riverina*
The most extensive current breeding habitat is River Red Gum forest, primarily along the Murrumbidgee, Edward and Murray Rivers. Within this forest type, the majority of Superb Parrot nest trees are large, mature, healthy trees with many spouts, and typically located close to a watercourse. The statistical mean and range of a number of characteristics of Murray-Riverina nest trees appear in Webster (1988). Key characteristics are summarised in Table 1 below, which also presents characteristics of Barmah Forest nest trees (after Webster 1991) as a separate group. The relatively few dead trees so far observed to be used for breeding in riverine River Red Gum forests display similar characteristics (apart from crown diameter) to the typical live tree described above.

ii) *Forests and Woodlands of the South-west Slopes*
The other breeding habitat, on the South-west Slopes of New South Wales, is not as clearly defined as that of the Murray-Riverina (Webster 1988).

Table 1 Major characteristics of Superb Parrot nest trees of the Murray-Riverina and the South-west Slopes, including diameter at breast height over bark (DBHOB), height, maximum crown diameter, height of nest above ground and distance of tree from a watercourse (from Webster 1988). Characteristics of nest trees located within Barmah State Forest/State Park up to the end of 1990 (from Webster 1991) are shown separately.

Of the 79 nest trees in the Murray-Riverina, six were dead. However, other than crown diameter (absent in dead specimens), the above characteristics did not differ significantly between living and dead nest trees.

Nest trees of the Murray-Riverina

Nest Tree Characteristic	Mean	Range	Nest sample size
DBHOB (m)	1.57	0.67-2.70	101
Height (m)	32.6	18-51	102
Max. crown diameter (m)	11.37	6-21	95
Height of nest (m)	17.44	7-32	102
Distance to water (m)	25.8	0-201	101

Of the 21 nest trees on the South-west Slopes, nine were dead. Because the characteristics of living and dead trees in this breeding habitat differed significantly, they are presented separately in the table below.

Nest trees of the South-west Slopes

Nest Tree Characteristic	Mean	Range	Nest sample size
Live trees			
DBHOB (m)	0.99	0.36-1.20	12
Height (m)	20.23	11-28	12
Max. crown diameter (m)	8.15	2-13	12
Height of nest (m)	9.69	5-13	12
Distance to water (m)	161.31	23-500	12
Dead trees			
DBHOB (m)	0.84	0.49-1.17	9
Height (m)	17.11	9-25	9
Max. crown diameter (m)	-	-	-
Height of nest (m)	9.67	5-13	9
Distance to water (m)	181.78	7-800	9

Of the 14 nest trees located in Barmah State Forest/Park up to 1990-91 breeding season, all were living.

Nest trees of Barmah State Forest/Park

Nest Tree Characteristic	Mean	Range	Nest sample size
DBHOB (m)	1.42	0.7-1.97	14
Height (m)	33.93	26-42	14
Max. crown diameter (m)	14.64	7-29	14
Height of nest (m)	23.86	15-34	14
Distance to water (m)	20.83	1-96	12

In this portion of the breeding range at least five species of eucalypt, in addition to River Red Gum, are used for nesting. Additional species include Blakely's Red Gum (*Eucalyptus blakelyi*), Apple Box (*E. bridgesiana*), Grey Box (*E. microcarpa*), White Box (*E. albens*) and Red Box (*E. polyanthemos*).

Unlike nest trees of the Murray-Riverina, living and dead nest trees of the South-west Slopes show significantly different characteristics (Webster 1988), the major details of which are summarised in Table 1.

Map 1 shows the general distribution of known nest sites throughout the Murray-Riverina and South-west Slopes breeding areas. For both breeding habitats, Webster (1988) has demonstrated a positive correlation between the locations of Superb Parrot nest sites and the occurrence of extensive tracts of suitable foraging habitat.

In the Murray-Riverina, nest sites are usually located no further than nine kilometres from box-woodland, primarily Black Box *(E. largiflorens)*, Yellow Box *(E. melliodora)* and Grey Box.

On the South-west Slopes, nesting habitats and natural foraging habitats (box-gum woodland) may coincide. Webster (1988) found that, in this area, nest trees were located not more than ten kilometres away from foraging sites (box-gum woodland) carrying various eucalypt species (notably White Box, Yellow Box and Blakely's Red Gum), and crops of wheat (*Triticum aestivum*) or oats (*Avena sativa*).

Restricted access applies to details of the specific locations of currently known nests (See Section 5).

3.3 POST-BREEDING DISPERSAL AND HABITAT USE

Between January and April, Superb Parrots generally disperse away from the breeding areas.

Immediately after fledging, dispersal occurs from the Murray-Riverina nesting sites into the box-woodland surrounding the riverine forests (with the exception of the Edward River area, where there appears to be little initial net movement). On the South-west Slopes, a corresponding early movement occurs into box-gum woodlands to the west (Webster 1988).

Subsequently, adults and young gradually distribute themselves over a far greater range, possibly following different food sources as these become available.

It is known that, during mid-January, part of the Superb Parrot population forages on the Boree (*Acacia pendula*) trees which form scattered woodlands between the Murrumbidgee and Murray Rivers (RW pers. obs., P. Maher *in litt.*). Whilst the distribution of the entire population from mid-January to early April is unclear, the breeding habitats are definitely not frequented during this time (Webster 1988).

Between April and August, the population appears to be scattered from the Riverina to north-central New South Wales and, during this time, a variety of habitats are exploited. In north-central New South Wales, River Red Gum forest and box-pine woodland are utilised whilst, in the Riverina, River Red Gum forest, box-pine woodland, box-woodland, pine woodland, and Boree woodland are all used.

During winter (May-August), Superb Parrots begin returning to the riverine forests of the Murray-Riverina, to the surrounding box woodlands and (in some instances) to the White Cypress Pine (*Callitris columellaris*) forests (R. Fussell pers. comm.) of this area. During this period, large flocks consisting of adult pairs and immature birds are often seen (RW pers. obs.; R. Fussell, J. Rook, pers. comm.). These flocks appear to roam in search of food and may be observed in various habitats.

On the South-west Slopes, the Superb Parrot is observed only rarely during winter, the few birds seen being presumed breeding pairs (Webster 1988). The bulk of the population from the South-west Slopes appears to disperse through the eucalypt-pine woodlands of

west-central and north-central New South Wales (Kaveney 1979, Schrader 1980, Webster 1988).

3.4 FOOD AND DIETARY PREFERENCES

The Superb Parrot forages on a large number of plant species (Webster 1988). Frith and Calaby (1953) found that it fed mainly on the ground, but observed that it also took eucalypt flowers during spring and summer. Webster (1988) found that 55% of all foraging observations collected during his two-year survey were made while the species was foraging on the ground. The most common plants exploited during ground-feeding included the native Common Wallaby-grass (*Danthonia caespitosa*), barley- grasses (*Critesion spp.*), wheat and oats. Seed pods of numerous wattle species (e.g. *Acacia acinacea, A. dealbata*), which form part of the woodland understorey, are also taken (Webster 1988, 1991).

Nevertheless, considerable food is also obtained from the forest canopy, including all stages of the flowers and fruits of eucalypt species (Webster 1988). Keartland (1902) commented that the Superb Parrot appeared to be living almost entirely upon nectar, since honey 'simply poured from their mouths' when specimens were collected.

Eucalypts and acacias are hosts to other plants, and to insects, which also provide the Superb Parrot with food. The berries of both Box Mistletoe (*Amyema miquelii*—parasitic on eucalypts) and Grey Mistletoe (*A. quandang*—parasitic on acacias, notably Boree) are favoured foods (RW pers. obs., P. Maher *in litt*). During the winter, in north-central New South Wales (and probably elsewhere), lerps (Fam. Psyllidae) are taken from the foliage (RW pers. obs.).

In the Cootamundra district, Superb Parrots were observed to exploit feed put out for horses (Webster 1988).

3.5 LONGEVITY AND NEST FIDELITY

The Superb Parrot, like many parrot species, is probably quite long-lived. Anecdotal information suggests that the species may live for 25 years or more (H. Greenwood, W. Ryan, W. Warren, pers. comm.). For the Regent Parrot (*Polytelis anthopeplus*), Burbidge (1985) provides anecdotal evidence of the continual use of one nest tree for at least 15 years, but makes no comment on the possibility that more than one single pair may have been involved.

Observations on Superb Parrot nesting activity at individual nest sites (Webster 1988) suggest that many nests are traditionally re-used by the species, year after year. Occasionally, a different hollow in the same tree may be subsequently used. There is also some evidence that traditional nest trees may continue to be used by the species after the tree has died. Furthermore, whilst no evidence is yet to hand, it is possible that dead trees are themselves occasionally selected for nesting.

Whilst many Superb Parrot nests identified by Webster (1988, 1991) are confirmed to have been used over two or more seasons, there is as yet no evidence that the same pairs of birds repeatedly use these nests, nor are data available on whether particular nests may be used only intermittently. It is therefore prudent not to discount the possibility of future re-use of currently unused Superb Parrot nests.

4
MAJOR ISSUES

4.1 CLEARING OF FORAGING HABITAT

The major threat to the Superb Parrot is the widespread unplanned clearing of box-dominated woodland throughout the parrot's range (Webster 1988). The presence of box-woodland plays a major role in determining the location of nest sites since, during the breeding season, nesting Superb Parrots forage within the box-woodland, utilising the trees, shrubs and native grasses. Webster (1988) observed that, in the Murray-Riverina, these box-woodland foraging areas were linked to the riverine breeding habitat by regularly used flight paths which, in most cases, followed tracts of natural woodland and only briefly crossed open ground. Clearing of box-woodland appears historically to have dictated the successive abandonment, by the species, of traditional breeding areas.

In areas containing typical River Red Gum breeding habitat, but now having little or no box-woodland within about ten kilometres of this habitat (e.g. along the Murray River, between Tocumwal and Yarrawonga), nesting no longer occurs, even though apparently suitable nest trees are still available. Continued removal of box-woodland is likely to result in further fragmentation of the breeding range of the Superb Parrot.

Outside the breeding season, the Superb Parrot's nomadic habits allow it to utilise a variety of habitats, depending on food availability. Over much of the range, agricultural development has been extensive and has resulted in the clearing of large tracts of natural habitat. In particular, large areas of box-woodland within the winter range of the Superb Parrot (that is, in north-eastern inland New South Wales) have been cleared for cotton-growing during the past twenty years.

The South-west Slopes district has been extensively cleared and favourable habitat for the Superb Parrot now exists only in roadside reserves, *Travelling Stock and Camping Reserves*, and other small remnant patches of woodland, many on freehold land. It is notable that, on the South-west Slopes and in the Goolgowi area, the woodland foraging habitat also provides breeding sites.

The clearing of woodland through northern and central Victoria has eliminated much potential foraging (and possibly nesting) habitat and has resulted in a major reduction in the distribution of the Superb Parrot. Clearing of these woodlands, if continued, will place further pressure on the Superb Parrot.

In New South Wales, suitable foraging habitat occurs on private land, and on public land managed by the Forestry Commission, Lands Department, Rural Lands Protection Board and Department of Water Resources. The only relevant land units managed wholly by the National Parks & Wildlife Service are Ingalba Nature Reserve (J. Brickhill pers. comm.) and Narrandera Nature Reserve (L. Llewellyn pers. comm.).

Barmah Forest, Victoria's only currently known Superb Parrot breeding area, is managed by the Department of Conservation and Natural Resources. Scattered box ridges occur throughout the forest, and significant box-woodland exists (though much has been cleared) on private property and roadside verges around the district outside the forest boundary. The movement of Superb Parrot flocks between the River Red Gum forest and the adjacent remaining box-woodland suggests that the latter may be extremely important to the continued existence of breeding colonies within Barmah Forest.

At present there is no wholesale clearing of box-woodland occurring within the Victorian range of the Superb Parrot. However several processes may threaten the long-term viability of the remaining box-woodland areas. These processes include grazing, removal or decline of native vegetation, fire protection works, weed invasion, introduction of exotic or non-indigenous predator or competitors and excavation for fish-bait collection ('bardi-grubbing').

[Note: The Victorian Government, on 5 June 1991, introduced planning controls requiring that a permit be issued before native vegetation may be cleared on most of the state's private rural land. These permanent controls, under the Planning and Environment Act 1987, require, inter alia, the issue of a Council planning permit before any removal of native vegetation (unless a specified exemption applies). Formal referral is required of certain classes of applications (especially areas of 10 hectares or more), particularly to the Department of Conservation and Natural Resources, which has the power of veto or restriction.]

Although box-woodlands (comprising mainly Black, Yellow and Grey Box) within the breeding range of the Superb Parrot are not generally regarded as valuable for sawlogs, they are extensively utilised as fencing and firewood timbers (Forestry Commission of New South Wales 1985, 1986; Land Conservation Council 1985). There appears to be no evidence available on whether this utilisation and its associated management presents any specific threat to forage resources used by the Superb Parrot.

The recent management plan for Barmah State Park and State Forest (DCE 1992) excludes harvesting of box species within the State Park component, but provides for review of this decision during the next three years. The plan allows for low intensity harvesting of Grey Box within *Zone 4* (*Multiple Use*) of Barmah State Forest in accordance with prescriptions yet to be finalised in the Mid-Murray Forest Management Plan (in prep.).

4.2 COMMERCIAL FOREST USE

4.2.1 Grazing

The practice of grazing domestic stock on both public and private forested lands is widespread throughout the range of the Superb Parrot. Within the riverine forests in both States, grazing occurs primarily to supplement the freehold enterprises of local graziers, however it is also seen as a means of reducing fire hazard (LCC 1985) and as a management tool for reducing grass levels in regeneration stands, thus producing higher seedling regeneration levels in the subsequent year, with grazing diminished (Forestry Comm. of N.S.W. 1985).

Grazing of domestic stock in forests used for foraging by the Superb Parrot has the potential to reduce available forage which, at times, may be important to the parrot. For example, in Gulpa Island State Forest (NSW), the fruit of Dwarf Cherry (*Exocarpus strictus*) is used to a large extent by the Superb Parrot as food for fledglings. During dry years, when grass cover within the forest is patchy, Dwarf Cherry bushes are grazed heavily by stock (P. Maher pers. comm., RW pers.obs.). Parrot fledgling survival may therefore be influenced to the extent of its dependence upon this resource.

When concentrated, especially during floods or droughts, stock (together with native and feral animals) may cause destruction of, or damage to, River Red Gum seedlings, with sheep tending to cause more damage than cattle due to their flocking and close-grazing habits (Forestry Comm. of N.S.W. 1985).

In Barmah Forest, grazing tends to be concentrated on the box ridges at times when the River Red Gum understorey is dormant or flooded. Available evidence suggests that changes have occurred to the structure and composition of the Black Box woodlands, and of the Grey Box-Yellow Box woodlands, as a result of grazing due at least in part to

domestic stock. Rushland communities have also altered as a result of stock grazing coupled with changed water regimes. However observable effects upon the structure and composition of the grassland and River Red Gum communities in Barmah Forest thus far appear not to have been significant (LCC 1985).

Grazing may also cause repeated disturbance to Superb Parrots during ground foraging, thus increasing the overall amount of foraging time required, an important consideration during the breeding season when foraging sites may be as far as nine kilometers from the nest.

The management plans for both the Murray and Murrumbidgee Management Areas (Forestry Commission of New South Wales 1985, 1986) and the Barmah State Park and State Forest Management Plan (DCE 1992) provide guidelines aimed at ensuring that grazing management of relevant State Park, State Forest and other Crown-timber lands takes due account of other forest values (see Appendix). However, in both States, where forest grazing occurs, there is a need for clearer identification of local breeding and feeding areas of the Superb Parrot within which grazing may be a potentially adverse factor.

4.2.2 Nest trees of the riverine forests

Nests of the Superb Parrot occur in River Red Gum trees of the Murray-Riverina and in a variety of eucalypt species on the South-west Slopes.

In River Red Gum forests, the proximity of Superb Parrot nest trees to water (hence high 'site quality') and the large, mature and healthy form of trees typically used for nesting (*mean* DBHOB[1] 1.57 m, *range* 0.67-2.70 m; Table 1) introduce potential conflicts with hardwood timber production. Also, silviculture practices may be expected to be most intensive in locations of high site quality (I. Davidson, pers. comm.). Current harvesting and silviculture activities in these riverine forests supply sawlogs, piles, poles, sleepers, bridge timbers, fencing material, landscape and gardening materials, firewood and charcoal (Forestry Commission of New South Wales 1985, 1986; LCC 1985).

In the past, many large River Red Gums, which may have been potential or actual Superb Parrot nest trees, have been felled, and many others ring-barked to enhance forest regeneration. In addition, there has no doubt been successive removal over many decades of stout trees which were approaching the age of suitability for nest trees (Fahey 1987).

It remains unclear whether nest site availability has been a limiting factor to Superb Parrot breeding in recent times. Clearly, suitable foraging habitat must be in close proximity to nest sites for breeding to occur (Webster 1988). Provision to minimise the impact of timber production (whether on Crown or private land) upon potential breeding sites of the Superb Parrot is an essential component of any future strategy to conserve the parrot, but must be done in parallel with protection of nearby foraging habitat.

There is a need to ensure that current and recent nest sites of the Superb Parrot are maintained in as stable a condition as possible, in order to encourage their future use and provide scope for establishment or expansion of a colony on the site. Where several breeding colonies occur in proximity (e.g. in Barmah State Forest and State Park), this argument is especially compelling, since it is feasible that a program of enhancement or improved management of associated box-woodland foraging areas (such as occur on roadsides and private land to the south of Barmah Forest) could lead to the occupation of additional trees within or between existing colonies.

In such circumstances (for example, where three or more colonies occur within one kilometer), it would be desirable for forest managers to rationalise the boundaries of harvesting exclusion areas around clustered colonies (even though these may exceed the minimum exclusion buffer prescribed in Section 5.3.6), such that a continuum of suitable habitat may be retained both between and around each colony. This may be an important

[1] tree diameter at breast height over bark

strategy in the long-term recovery of Superb Parrot populations, especially in districts where historical range reductions are known to have been substantial (e.g. north-central Victoria).

The major potential source of disturbance to existing nest sites (apart from wildfire) is from hardwood production in the immediate vicinity. It is important not to risk disruption to breeding at remaining known nest sites as a result of disturbance near the nest. Recent information on nest locations (Webster 1988) and supplementary unpublished details provide a starting point for protecting known nest trees from harvesting and silviculture operations. Available details include AMG map specifications down to a 100 m grid square, a rough sketch of the nest tree and nest position, and other relevant site data (see Section 5 regarding access to this information).

The Appendix summarises, for both New South Wales and Victoria, current forest harvesting and silviculture prescriptions having direct relevance to the protection of Superb Parrot nest trees in River Red Gum forests under Crown control. In both States, many sites carrying known or potential nest trees currently gain protection under harvesting restrictions by virtue of their proximity to rivers, streams, drainage lines, swamps and other standing water bodies where harvesting is excluded or otherwise modified. Individual trees may also be retained because of their likely 'habitat' value, or because they or their sites of occurrence are deemed environmentally sensitive or significant.

The Forestry Commission of New South Wales identifies, among other controls, maximum tree diameters (1.50 m DBHOB in Murray Management Area, 1.70 m DBHOB in Murrumbidgee Management Area) above which River Red Gum trees must not be harvested (Forestry Commission of New South Wales 1985, 1986). It also establishes harvesting guidelines for tree retention, with at least one tree per hectare being retained, each tree needing to have existing or potential Superb Parrot nest tree characteristics. Silviculture prescriptions adopted in the above Management Areas no longer provide for the use of ring-barking, but advocate that silviculture treatment be achieved through the harvesting of stems primarily in association with sawlog operations.

Victoria has adopted interim guidelines (see Appendix) which specify a minimum of 25 live habitat trees per ten hectares (and 'as many habitat trees as practical') to be retained for fauna, but which do not specify a minimum size for habitat trees or a diameter above which trees should be retained. Preference is given to retention of small groups rather than individual trees, to a range of size classes, and to trees with actual or potential hollows. Standing dead trees are to be retained, unless otherwise authorised. As in New South Wales, silviculture prescriptions no longer provide for ring-barking.

The Action Statement for Superb Parrot (CNR 1992), prepared as a requirement under the *Flora and Fauna Guarantee Act* 1988, provides for exclusion zones around known breeding colonies of the parrot within Barmah State Park and State Forest. These zones will exclude logging and silviculture for a minimum radius of 100 m around each nest tree contained within the colony. Any additional nest trees discovered in future are required to be immediately afforded 100 m buffers from which logging and silviculture are excluded. The Department of Conservation and Natural Resources is required to review the need for Superb Parrot buffers and exclusion zones after 10 years, or if the total area of buffer zones exceeds 200 hectares, whichever occurs first.

In the Barmah and State Forest Management Plan (DCE 1992), prescriptions for River Red Gum harvesting within the State Park component specify that:

> Harvesting will attempt to provide a balanced distribution of age class and tree forms, and a representative proportion of the dominant class will be retained in each coup. These dominant trees will be reserved from harvesting in future cutting cycles.

A related prescription for River Red Gum harvesting within the adjacent Barmah State Forest states that:

A representative proportion of the present dominant class will be retained in each coup after harvest.

Additional prescriptions in the plan (see Appendix)

encourage research into the effects of timber harvesting on native flora and fauna and aim to improve management prescriptions as further information becomes available.

They also encourage 'further silvicultural research on topics such as thinning, regeneration, culling unmerchantable trees, and harvesting techniques', and specifically require the ongoing protection of Superb Parrot nest trees.

While guidelines aimed at perpetuating a variety of age classes on harvesting coupes are now becoming recognised as a necessary component of forest management plans, little is known of the full effect, especially upon hollow-dependent wildlife, of reducing the number of mature trees on coupes to substantially below natural levels through harvesting. Where post-harvest levels impose a severe limitation on suitable habitat for nesting, those species which are most adaptable with respect to nest requirements may be expected to be favoured, to the detriment of more specialised species, including the Superb Parrot.

Existing data on nest tree characteristics (Table 1) provided by Webster (1988, 1991) can serve forest managers as a guide to the characteristics of individual trees required to be retained, or enabled to develop, as potential Superb Parrot nest trees of the future, but guidelines are still needed on the minimum density required of such trees (as a long-term average).

It must be emphasised that the broad management objective for both Murrumbidgee and Murray Management Areas in New South Wales is the maintenance of the natural River Red Gum floodplain ecosystem with its many values, including timber production (Forestry Commission of New South Wales 1985, 1986). Similar broad management goals, of which timber production is only one facet, have been described for Barmah Forest (Dexter 1978, LCC 1985), now the focus of remaining Superb Parrot breeding activity in Victoria.

Forest management must ensure that, in both harvesting and silviculture operations, the long-term viability of other values, including wildlife, is sustained. At present, many of the known Superb Parrot nest trees lie within the girth range of trees currently permitted to be felled in both States. Protection of existing large trees and provision for continued recruitment of younger trees into the larger (>70 cm DBHOB) size-classes (*defined in*: Forestry Commission of New South Wales 1985) will be increasingly important elements in future forest management plans.

With respect to nests occurring on freehold land, five (6.3%) of the 79 nest trees recorded in the Murray-Riverina by Webster (1988) fell within this category (unpubl. data). In New South Wales, logging on private property is not controlled as rigorously as on Crown Land, hence the loss of valuable nesting habitat on freehold or leasehold is still a distinct possibility, particularly on the Murrumbidgee River, where it is believed that such properties carry substantial potential nesting habitat (Webster 1988). The only Superb Parrot nesting areas currently known in Victoria are situated within Barmah Forest and therefore are not within proximity of freehold land where private logging of potential nest trees might occur.

4.2.3 Nest trees of the South-west Slopes (NSW)

It is of concern that more than half of the 21 known Superb Parrot nest trees in the box-gum woodlands of the South-west Slopes were found in remnant patches of woodland. Fourteen (67%) of the nest trees occurred on freehold land, and nine (43%) of the known nests were situated in dead trees (Webster 1988).

Within these woodland remnants, the cutting of standing dead trees to supply firewood to local towns and to Canberra may further limit breeding opportunities for the

Superb Parrot by removing potential or existing nest trees. In many cases, such trees may be traditional nest sites, the loss of which can be ill-afforded. Recognition of this pressure from firewood collecting, much of which occurs under inadequate supervision on *Travelling Stock and Camping Reserves* and other Crown reserves, emphasises the need for conservation of the remaining trees, dead and alive.

Many *Travelling Stock and Camping Reserves* and roadside reserves, depending upon their condition, may be of local importance to the Superb Parrot. To maintain and enhance this role, and discourage further fragmentation of habitat, indiscriminate commercial firewood collecting within all of these reserves will need to be avoided wherever possible. In addition, there is a need to recognise that other local demands upon these woodlands (e.g. for posts or poles) may have the potential to influence the future recruitment of suitable nest trees, however research will be required to clarify the likely relevance of this problem and to identify any necessary management response.

4.3 RECREATIONAL FOREST USE

The River Red Gum forests of the Murrumbidgee and Murray are popular recreational areas (Murrumbidgee Management Plan 1986; Murray Management Plan 1985; Land Conservation Council 1983, 1985). At a number of locations throughout these forests, picnic and camping sites coincide with Superb Parrot nest sites. At such sites, there may be a potential conflict between the retention of old and hollow trees (required as parrot nest trees) and the responsibility of the forest manager to ensure public safety (from falling timber).

Although it is unclear whether human presence may significantly disrupt breeding Superb Parrots, the species has been observed to become agitated and to avoid entering the nest hollow when people are present near the nest tree (RW, pers. obs.). Fortunately, access to many riverine nest locations is rendered difficult, due to flooding, at about the same time that the parrots are breeding (e.g. Barmah Forest), hence potential human disturbance to breeding is likely to be minimal at these sites.

4.4 BURNING IN FOREST OR WOODLAND

4.4.1 *Planned* burning

Controlled burning of logging debris and forest litter, under mild conditions, is used both for fuel reduction and, in mature and over-mature stands lacking significant regeneration, to produce desired seed bed conditions. Burning may occur in autumn, winter or early spring (Forestry Commission of N.S.W. 1985).

Possible effects upon the Superb Parrot of burning forest or woodland are unlikely to become clear until the ecology of the species is better understood, however the following factors may be relevant management considerations:

Incorrect timing or placement of a burn may reduce or destroy forage known to be important to the Superb Parrot during either breeding or post-breeding periods, and thus may influence breeding success. It may induce changes in the structure or composition (or both) of plant communities, and possibly encourage invasion by exotics. Furthermore, it may disturb the nesting process at a particular nest or colony site, due to smoke or human disturbance, and may even destroy the nest tree or, at least, some hollows within it (with those nests which extend far down inside the trunk being particularly vulnerable).

Conversely, carefully *planned* burning may have some future potential to benefit the Superb Parrot through stimulation of flowering, seeding, and regeneration of desirable or essential food plant species or communities, and by inducing structural diversification of forests and woodlands.

4.4.2 *Unplanned* burning

An *unplanned* burn (wild-fire) potentially has all the disadvantages of a mismanaged *planned* burn and is likely to be more destructive. However an *unplanned* burn may also yield beneficial results through the re-initiation of natural ecological cycles in the forest, and may substantially influence the future diversity of tree forms.

Regional or district contingency planning generally aims to ensure that, in the event of fire, those sites of greatest conservation value within the forest (including Superb Parrot nest trees) receive preferential protection, if possible, during suppression activities. Following an *unplanned* burn, accurate fire-mapping and related evaluation can provide useful information for future fire management considerations.

Recent (1990) burning of known Superb Parrot breeding habitat on Toganmain Station (between Darlington Point and Hay) and on the Murray west of Tocumwal offer immediate challenges to lead agencies to monitor the effects of these wildfires upon local Superb Parrot populations.

4.5 HUMAN-INDUCED POPULATION REDUCTION

Reduction of the wild Superb Parrot population may be 'direct', where birds are killed outright, or 'effective', where live birds are permanently removed from the population.

4.5.1 Trapping

The NSW National Parks and Wildlife Service believes that many thousands of wild-caught Superb Parrots have illegally entered the aviculture trade during the past decade. It is probable that a high percentage of all immature birds and mature males traded through bird shops are wild-caught (J. Hardy pers. comm.).

Evidence suggests that trapping occurs mainly during the period October to January. During approximately the first five weeks of the breeding season, the females remain at their nests, either incubating eggs or brooding young. At this time, breeding males form foraging flocks and are easily trapped, forcing the sitting females to then desert their nests or starve. A preponderance of mature males often appears on the aviculture market in October-November and immature birds predominate in January (J. Hardy pers. comm.).

Removal of a large number of Superb Parrots from the wild, especially during the breeding season, could ultimately threaten the survival of the species locally or, in the long term, the species as a whole.

4.5.2 Taking of eggs or chicks

The illegal removal of Superb Parrot eggs or chicks from nests is known to have occurred in the past (J. Rook, H. Greenwood, pers. comm.), however the current scale of this activity is unknown. Poachers often destroy the nest hollow in the removal process, thus preventing the species from using the hollow again. Since at least some nest sites are used for successive years, the significance of nest destruction by the poacher may far exceed the effective loss of one year's brood.

4.5.3 Road-kills

Road-kills of Superb Parrots occur sporadically throughout the species' range. However, on certain sections of road in New South Wales, during the grain-carting season, numbers of birds are sometimes struck by vehicles as they feed on spilt grain along the roadsides (P. Maher, J. Rook, J. Brickhill, pers. comm.). As many as twenty-seven Superb Parrots have been found dead at one location in one year (W. Boles pers. comm.). Such substantial mortalities may well exert some influence upon the local status of the species in certain parts of its range.

4.5.4 Crop spraying

Concern has been expressed that agricultural sprays, used for control of Black Beetle in the Young district of New South Wales, may be affecting the breeding success of the Superb Parrot (L. Llewellyn pers. comm.)(see Section 6.3).

4.6 COMPETITION FOR NEST HOLLOWS

One of the 49 Superb Parrot nests located during the 1985 breeding season, when re-examined during the 1986 breeding season, was found to be occupied by a Common Starling (*Sturnus vulgaris*) (Webster 1988). Although this single observation suggests only a minor loss of nest sites to introduced species, the significance may escalate if introduced competitor numbers increase. In north-west Victoria, introduced honey bees have taken over a number of known nest hollows of the Regent Parrot (G. Johnson pers. comm.).

Three nest hollows used in 1985 by the Superb Parrot were found in 1986 to be occupied by other native species - Galah (*Cacatua roseicapilla)*, Cockatiel (*Nymphicus hollandicus*) and Yellow Rosella (*Platycercus flaveolus*) (Webster 1988). It is unlikely that the latter two species, or most other hollow-using native birds, mammals or reptiles, would compete significantly with the Superb Parrot for hollows. However, the Galah and Little Corella (*Cacatua sanguinea*) have dramatically increased their populations in recent years and, in some areas, have become agricultural pests. These birds may conceivably become serious nest site competitors in grain-growing areas.

5
MANAGEMENT

Lead Agencies referred to below are :

* *National Parks & Wildlife Service - New South Wales*
* *Department of Conservation and Natural Resources - Victoria*

Important note on nest site locations: Although Figure 1 and Map 1 indicate the general distribution of Superb Parrot nest sites, actual ground details of nest locations are not included in this plan, in order to protect nests. However, these details may be made available for use by bona-fide managers and researchers. Details of all known nest sites are held by each lead agency and by Forestry Commission of N.S.W. In New South Wales, application should be made in writing to:

The Director,
National Parks and Wildlife Service,
P.O. Box 1967
HURSTVILLE NSW 2220

In Victoria, application should be made in writing to:

The Regional Manager,
Department of Conservation and Natural Resources
57 Bridge Street West
BENALLA Victoria 3672

5.1 PREVENTING AND DISCOURAGING FURTHER CLEARING

Both lead agencies recognise broad-scale clearing of box-dominated woodland throughout the range of the Superb Parrot to be the foremost current threat to the species. In particular, it is recognised that suitable woodland must occur within about 10 km of nest sites, and preferably nearer, to enable successful breeding of the species.

Opportunities to provide for present and future nesting requirements of the Superb Parrot should be pursued (see Section 5.3 and 5.4) in tandem with efforts to conserve box-woodland habitat in the same area.

With respect to the breeding range of the Superb Parrot (see Section 2.1), lead agencies should each:

5.1.1 Adopt a departmental policy advocating no further clearing or inappropriate alteration of box-woodland within the breeding range of the Superb Parrot, especially within 10 km of known Superb Parrot nest colonies, due to adverse effects upon this (and other) threatened species. This may be facilitated by a suitably worded pamphlet advising where guidance may be obtained on how best to manage remaining box-woodland areas for their conservation values, and

making mention of other potential direct and indirect benefits to landholders of retaining these remnant areas.

5.1.2 Ensure that the above policy is officially expressed to all other Government departments having statutory or discretionary powers relating to planning and/or land use practices, existing or proposed, on public and/or freehold land, within the breeding range of the Superb Parrot; and encourage the restriction of further broad-scale clearing within this range.

5.1.3 Ensure that the above policy statement is appropriately expressed and promoted to relevant non-Government agencies having a significant public advisory role or providing other landholder services within the species' breeding range; for example, rural fire brigade networks, major agricultural consultants, commercial plant nurseries, and farm suppliers.

5.1.4 Ensure that Government departments and non-Government agencies referred to in Section 5.1.2 and 5.1.3 receive sufficient follow-up or reminder advice that the policy of the lead agency is satisfactorily acknowledged and, where appropriate, responded to.

5.1.5 Ensure that relevant resource management staff are clearly aware of the locations of all known Superb Parrot nest sites within or near to their region or district, so that efforts to consolidate retained box-woodland, and to protect significant remnants, can be co-ordinated and efforts to oppose or discourage broad-scale clearing can be soundly based.

5.1.6 Ensure that any existing wildlife extension programs, administered by the lead agency or related departments, reflect and effectively promote, within the rural community, the above policy relating to clearing of box-woodland; or ensure that a suitable extension program is established for that purpose. Such programs should encourage replanting, especially of indigenous box species, and should include guidance on sources for obtaining local seedlings of suitable species so that seedlings are planted in localities from whence they were originally collected.

5.1.7 Ensure that relevant resource management staff are swiftly notified of full details of any new nesting colonies, and that those staff accordingly re-assess the distribution of Superb Parrot breeding colonies in relation to box-woodland, such that plans (as in Section 5.1.5) to consolidate box-woodland or to oppose or discourage broad-scale clearing can be adjusted or expanded accordingly.

5.1.8 Ensure, through inter-state liaison at both head office and regional/district levels, that neighbouring lead agencies are each aware of the priorities of the other with respect to management of Superb Parrot habitat.

Although priority should be given to the breeding range of the Superb Parrot, lead agencies should take the following initiatives with respect to foraging habitat located outside the breeding range:

5.1.9 Ensure that relevant aspects of the above initiatives also be applied to box-woodland outside the breeding range, where such areas are known or expected to constitute suitable foraging habitat for the Superb Parrot.

5.1.10 Ensure that relevant resource management staff are clearly aware of areas described in Section 5.1.7, in order to encourage planned retention or consolidation of native woodland and to discourage or oppose further broad-scale clearing of foraging habitat.

5.2 REDUCING THE GRAZING THREAT

Lead agencies recognise that grazing of domestic stock on public land may constitute a threat to elements of the habitat of the Superb Parrot, and should:

5.2.1 Adopt a departmental policy of encouraging the removal of stock grazing from box-woodland within 10 km of known Superb Parrot nesting colonies at those times and in those locations (Section 4.2.1) where significant ecological damage is likely to result, especially within Barmah Forest.

5.2.2 Ensure that relevant aspects of the above initiative also be applied wherever possible to box-woodland outside of the breeding range (that is, in the wintering range) where grazed areas are known or suspected to constitute important foraging habitat for the Superb Parrot.

5.2.3 Ensure that lead agency policy regarding grazing is officially expressed (by pamphlet, etc.) to other Government departments or agencies having statutory or discretionary powers relating to grazing on public, leasehold and/or freehold land within the prescribed range.

5.2.4 Ensure that lead agency policy regarding grazing is officially expressed to relevant non-Government agencies having a significant public advisory role or providing other landholder services; for example, rural fire brigade networks and major agricultural consultants.

5.2.5 Ensure that Government departments and non-Government agencies referred to in Section 5.2.3 and 5.2.4 receive sufficient follow-up or reminder advice that the lead agency policy is satisfactorily acknowledged and, where appropriate, responded to.

It is recognised that research work to date on foraging habitats of the Superb Parrot has been insufficient to enable relevant areas warranting protection from grazing to be detailed in this plan, beyond the criteria given in Section 5.2.1. Lead agencies (in accord with Section 5.9) should therefore also :

5.2.6 Ensure that, within both the breeding range and the wintering range (north-central New South Wales) of the species, relevant resource management staff are enabled to collate information regarding foraging areas used by the Superb Parrot, and to investigate whether these areas need protection from grazing.

5.2.7 Examine opportunities (preferably in collaboration) to improve information on areas used by the Superb Parrot for foraging and which may warrant reduction or removal of grazing. In particular, possible interrelations between cattle grazing and Superb Parrot forage requirements within Barmah State Park and Barmah State Forest in Victoria should be examined.

5.3 PROTECTING NEST TREES OF THE RIVERINE FORESTS

Lead agencies recognise the need to protect existing Superb Parrot nest trees from disturbance or destruction during commercial forest operations, and to provide for the future development of suitable nest trees for the species.

With respect to River Red Gum nest trees of riverine forests on public or leasehold land, lead agencies should each:

5.3.1 Adopt a departmental policy that sites containing Superb Parrot nest trees (whether living or dead, and whether nests are presently active or not) should be permanently exempted from logging and silviculture treatments, either under harvesting prescriptions adopted by the relevant forest management agency or by

reservation for conservation purposes, as appropriate. Any provision to revoke this exemption for a particular site should require consultation with, and approval from, the lead agency.

5.3.2 Recommend that the above policy be officially adopted by the relevant forest management agency or division, and offer assistance to provide relevant nest site details.

5.3.3 Recommend to the relevant forest management agency or division that details of nest site locations, along with prescriptions to permanently protect nest sites, colonies or clusters of colonies from logging, be included (or referred to) in any management policies and plans pertaining to riverine forests within the breeding range of the Superb Parrot.

5.3.4 Recommend to the relevant forest management agency or division, and subsequently to government as appropriate, reservation of any areas which contain one or more Superb Parrot nest trees and which would remain inadequately protected under the above proposed restrictions upon harvesting and silviculture or would be more appropriately incorporated into existing or proposed conservation reserves.

5.3.5 Ensure that lead agency resource management staff are clearly aware of the locations of all known Superb Parrot nest sites within their relevant district or region and of corresponding forestry policies or management plans which relate to controls on logging or other disturbance at those sites. These staff should be responsible for the on-ground familiarisation of relevant forest management staff with the locations of individual Superb Parrot nest trees, nest colonies and clusters of colonies.

5.3.6 Recommend to the relevant forest management agency or division that, irrespective of any other harvesting prescriptions restricting logging on or near a known nest site, no commercial harvesting or silviculture treatments should be authorised within 100 m of any Superb Parrot nest tree(s) (whether containing presently active nests or not). Any proposal to lessen or revoke this restriction at a particular nest site should require specific approval by the lead agency, after consideration by relevant wildlife experts.

5.3.7 Recommend to the relevant forest management agency or division that any timber production activities proposed in accordance with 5.3.6 within 100 m of a known Superb Parrot nest tree and not precluded by seasonal flooding should be scheduled to avoid the breeding season of the Superb Parrot (1 September to 31 December).

5.3.8 Recommend to the relevant forest management agency or division the commencement of a research program which may increase our understanding of the ecological requirements of the Superb Parrot (and associated riverine forest fauna) with respect to its use of hollows, and which may elucidate relationships between hollow availability and other structural parameters of the River Red Gum forest (see Section 6.1). A collaborative approach between Victoria and New South Wales is suggested for this study (at least with regard to data required on the Superb Parrot).

5.3.9 Recommend to the relevant forest management agency or division the development of a management model for River Red Gum production forests based upon data derived from 5.3.8, and aimed at ensuring adequate

and continuous supplies of hollow-bearing trees suitable for Superb Parrot nest trees.

5.3.10 Recommend to the relevant forest management agency or division that, where the presence of nest sites is unconfirmed but likely (based upon observed movements of Superb Parrots during the breeding season or other reliable information), specific surveys by experienced searchers should be carried out, and the results considered by the lead agency in consultation with relevant forest management staff, prior to the approval of any wood utilisation plan or silviculture proposal for the area.

With respect to River Red Gum nest trees of riverine forests on freehold land, lead agencies should each:

5.3.11 Seek opportunities to advise landholders of the relevance of their property to the future survival of the Superb Parrot, in a local context, and to offer possible assistance to ensure that these nest sites are appropriately managed and protected. Participation by the landholder in a relevant voluntary conservation scheme (e.g. *Land for Wildlife* in Victoria) should be encouraged. In the case of a landholder whose activities may directly threaten the security of a nest tree, or threaten its likely continued use by the Superb Parrot, the lead agency should consider exercising appropriate statutory powers (e.g. *Flora and Fauna Guarantee Act* 1988 in Victoria) to ensure protection of the nest tree.

(Note: Currently no Superb Parrot nest trees are known to exist on freehold land within Victoria).

5.4 CONSERVING SUPERB PARROT NESTING HABITAT ON THE SOUTH-WEST SLOPES (NSW)

The lead agencies recognise that the box-gum woodlands of the South-west Slopes contain nest sites of the Superb Parrot, that these woodlands are in an advanced state of fragmentation, and that dead trees support a substantial proportion of nesting activity within this part of the breeding range.

In addition to relevant measures proposed in Section 5.1 and 5.3, the New South Wales National Parks & Wildlife Service should:

5.4.1 Adopt a departmental policy that sites on the South-west Slopes containing Superb Parrot nest trees (whether living or dead, and whether nests are presently active or not) should be permanently exempted from firewood harvesting involving felling of standing dead timber, either under prescriptions adopted by the relevant management agency or by reservation for conservation purposes, as appropriate; and that future management of woodland (both public and freehold) on the South-west Slopes should take account (inter alia) of the need for a continuous supply of adequate nesting resources for conservation of the Superb Parrot.

5.4.2 Recommend that the above policy be officially adopted by the relevant land management agency (the Rural Lands Protection Board of New South Wales) and offer to provide relevant details of nest sites and nesting requirements to appropriate managers.

5.4.3 Recommend to the relevant land management agency that details of nest site locations, along with prescriptions to permanently protect nest sites from firewood-felling and to provide for future nesting, be included (or referred to) in any land management policies and plans pertaining to Crown reserve woodlands on the South-west Slopes.

5.4.4 Recommend to the relevant land management agency that, in an effort to permanently protect nesting sites from firewood-felling, no such harvesting on public land should be permitted within 100m of any Superb Parrot nest tree(s) (whether containing presently active nests or not), unless specifically approved by the lead agency after inspection.

5.4.5 Recommend to the relevant land management agency, and subsequently to government as appropriate, reservation (or similar protection) of any areas which contain one or more Superb Parrot nest trees and which would remain inadequately protected under the above proposed firewood harvesting restrictions or would be more appropriately incorporated into existing or proposed conservation reserves.

5.4.6 Ensure that existing wildlife extension programs, administered by the lead agency or related departments, reflect, and effectively promote, within the rural and urban community, the above policy (Section 5.4.1) relating to the strong dependence of the Superb Parrot upon dead trees for nesting on the South-west Slopes; or ensure that a suitable extension program is established for that purpose. Such extension programs may be co-ordinated with, or combined with, those called for under Section 5.1.6.

5.4.7 Ensure that lead agency resource management staff are clearly aware of the locations of all Superb Parrot nest sites within their relevant district or region, and of corresponding land management policies or plans which relate to controls on firewood harvesting at those sites.

5.4.8 Recommend to the relevant land management agency adoption of the following (or similar) firewood harvesting prescriptions to provide for future Superb Parrot nest tree resources on Crown reserve woodlands on the South-west Slopes :

a) Licensed firewood contractors should operate under the regular supervision of the land manager, and be familiar with the prescriptions and with the general locations of significant fauna sites excluded from harvesting. Firewood collection should, as far as possible, be excluded from Travelling Stock and Camping Reserves and roadside reserves within the area, and be restricted to the collection of naturally fallen timber.

b) No living or partly-dead tree, or standing dead tree, having reasonable potential to provide wildlife nest hollows (refer Section 3.1 and 3.2) should be felled for firewood. The characteristics of typical Superb Parrot nest trees of the South-west Slopes (Webster 1988) should be taken into account during this selection process, which should be considered an interim management measure pending further research into the hollow requirements of the Superb Parrot, and nest tree recruitment, within the woodlands of the South-west Slopes (see Section 6.2).

c) Trees to be retained should be permanently marked by the land manager, and their position noted, such that the same trees may remain protected during subsequent firewood harvesting activities in the area.

5.5 MINIMISING THE EFFECTS OF RECREATIONAL FOREST USE UPON SUPERB PARROT NEST SITES

The lead agencies recognise the need, in River Red Gum forests of the Murrumbidgee and Murray, to protect Superb Parrot nest sites from levels of human recreational activity

which may disrupt the parrot's normal breeding behaviour, and to maintain a balance of management at these sites such that sustained recreational use of the site does not impinge upon the habitat requirements of the parrot.

Lead agencies should:

5.5.1 Adopt a policy of extreme caution in regard to any proposed increase in present levels of recreational activity near known nest sites. Such increased activity should be avoided wherever possible, and further observations and monitoring by relevant resource management staff (see Section 5.9) should be encouraged.

5.5.2 Recommend to the relevant forest management agency or division that, if tree felling within 100m of one or more Superb Parrot nest trees is proposed for safety purposes, all possible alternatives to felling (e.g. track diversion, restriction of access, selective lopping) should first be investigated. If felling is considered necessary, only the individual tree(s) considered unsafe should be removed.

5.6 MINIMISING ADVERSE EFFECTS OF FIRE ON SUPERB PARROT NESTING AND FORAGING HABITAT

The lead agencies recognise that *planned* or *unplanned* fires may threaten components of the habitat of the Superb Parrot, or may influence breeding success.

In order to minimise adverse effects of fire upon the Superb Parrot, lead agencies should:

5.6.1 Recommend to the relevant forest management agency or division that Superb Parrot nest sites be afforded the same protective measures against *unplanned* fire as are afforded other specific sites of faunal significance within public forests.

5.6.2 Recommend to the relevant land or forest management agency or division that *planned* burning does not proceed at any time within 100m of any known Superb Parrot nest tree, except after consultation and agreement with the relevant lead agency; and that, where reduction of fuel load is essential at such locations, manual slashing be used at any time except between 1 September and 31 December each year.

5.6.3 Advise the relevant land or forest management agency or division that nest site location details are available from resource management staff of the lead agency (see also Section 5.1.5, 5.3.5 and 5.4.7) for fire planning and suppression purposes; and ensure that appropriate liaison occurs.

5.6.4 Recommend to the relevant land or forest management agency or division the avoidance of extensive planned burns in the vicinity of any known major foraging areas frequented by flocks of the Superb Parrot, especially where these sites are within 10 km of known nest sites; and provide any available details on the specific resources utilised by the parrot in that particular foraging area (see also Section 5.6.6), in order that fire management programs may be appropriately planned and executed.

5.6.5 Recommend to the relevant land or forest management agency or division that planned burning within the breeding range of the Superb Parrot is best timed to occur between 1 May and 31 July, when the species is generally absent from Victoria and is primarily focussed upon north-central New South Wales.

5.6.6 Ensure that relevant lead agency resource management staff are able to ascertain, in collaboration with relevant land or forest management agency staff, the fire history of nest sites and known or likely foraging habitats of the Superb Parrot,

and to collate information regarding fire effects on these areas with respect to the parrot.

5.7 PREVENTING HUMAN-INDUCED REDUCTION OF THE SUPERB PARROT POPULATION

The lead agencies view human-induced population reduction as a significant pressure which has the potential to adversely affect the conservation status of the Superb Parrot.

In order to minimise such pressures, each lead agency should:

5.7.1 Ensure that enforcement resources of the lead agency (and of other relevant law enforcement agencies) are effectively and appropriately applied to the prevention of illegal trapping or taking of Superb Parrot adults, young or eggs from the wild, and that these efforts are at a peak around the parrot's breeding period.

5.7.2 Examine ways by which the lead agencies may improve upon the effectiveness of relevant wildlife licensing procedures in their state.

5.7.3 Establish local publicity programs throughout that part of the range of the Superb Parrot over which road-kills are likely as a result of grain spillage along road-sides. Farmers, trucking contractors and motorists should be the primary targets of such publicity. Programs should be pre-arranged with local councils, state police and transport authorities, and be timed to lead up to the grain harvesting period.

5.7.4 Ensure that existing wildlife extension programs, administered by the lead agency or related departments, reflect and effectively promote (possibly in combination with Section 5.1.6), within the entire community, the concerns of the lead agencies regarding human-induced population reduction of the Superb Parrot due to poaching and road-kills, or ensure that a suitable extension program is established for that purpose. Such programs should emphasise the precarious status of the species, and encourage public co-operation to report poaching or suspected illegal trafficking, as well as significant or repeated spillages from grain shipments.

5.8 REDUCING COMPETITION FOR NEST HOLLOWS

Lead agencies recognise the need to utilise pest control techniques to maximise the number of suitable nest hollows available to the Superb Parrot. Lead agencies should:

5.8.1 Request relevant resource management staff to respond swiftly to observations (see also Section 5.9.1) or reports of known Superb Parrot nest hollows being occupied by introduced fauna. Advice on the most appropriate, target-specific, effective and ecologically benign eradication method for the fauna concerned should be sought from the relevant state advisory agency on pest animal control, or from other relevant government agencies.

5.8.2 Take no action to remove competing native species from known Superb Parrot nest hollows, unless this action has been fully considered and endorsed by relevant resource management staff of the lead agency.

5.9 MONITORING THE STATUS OF ALL SUPERB PARROT NEST SITES AND FORAGING HABITATS

Lead agencies recognise the need to monitor, for at least five years, the breeding status of the Superb Parrot, as well as other facets of the ecology of the species, and related flora and fauna. Responsibility for this role lies with relevant resource management staff of each lead agency. Lead agencies should:

5.9.1 Arrange for all Superb Parrot nest sites (including any discovered in future) to be inspected (preferably in co-ordination with initiatives under Sections 5.1.7, 5.2.7, 5.2.8, 5.3.5, 5.5.1, 5.6.6 and 5.7.1) at least once each year, either during or just prior to the Superb Parrot breeding season, to ensure that the natural and undisturbed condition of each site is maintained. More intensive monitoring of breeding activity, at least at some nesting sites, should be encouraged. Nest site inspections should be primarily the responsibility of relevant resource management staff, however the assistance of approved members of the public and responsible volunteer groups should be utilised wherever possible.

5.9.2 Ensure that a brief status report on each nesting site is prepared annually and filed at the relevant regional/divisional offices of the lead agency, and that the lead agencies annually exchange status reports on the Superb Parrot.

5.9.3 Ensure that management concerns or recommendations of the lead agency arising from monitoring (undertaken in Section 5.9.1) are promptly considered by relevant lead agency staff, and that any necessary issues be expediently addressed, through liaison with other relevant management agencies, organisations or individuals, or through other action as appropriate.

5.10 REVIEWING THE STATUS OF THE SUPERB PARROT AND ASSESSING MANAGEMENT EFFECTIVENESS

Lead agencies recognise the need for future reappraisal of the national status of the Superb Parrot, and for this to include evaluation of the extent to which status may have been influenced by the above management initiatives. They should therefore:

5.10.1 Ensure that, within five years of the release of this plan, an interdepartmental advisory committee is convened to report on the national status of the Superb Parrot. The committee should comprise representatives from the lead agencies, relevant land and forest management agencies, Australian National Parks and Wildlife Service, and any other agencies, groups or individuals deemed to have a significant role in conservation of the Superb Parrot or its habitat. The committee should be convened by the New South Wales lead agency, and should report jointly to the Directors of the lead agencies and ANPWS. Business of the Committee might be largely performed by correspondence, if this approach appears feasible to all parties.

5.10.2 Ensure that the charter of the interdepartmental advisory committee includes review of the effectiveness of management initiatives laid out in this plan, with the success or otherwise of these initiatives being gauged by the committee in respect of the status of the Superb Parrot at that time.

5.10.3 Ensure that any amendments or other changes recommended by the interdepartmental advisory committee to the existing management plan be incorporated through agreement between the lead agencies, by way of a revised management plan.

6
FURTHER RESEARCH

Projects developed in the following areas of research are likely to have direct and immediate relevance to the Superb Parrot conservation program outlined in this plan. Lead agencies should seek opportunities to encourage and support research in these subject areas:

6.1 REQUIREMENTS IN RELATION TO THE LONG-TERM SUPPLY OF RIVERINE NEST TREES

Research is urgently required on the fauna of riverine production forests in order to obtain sound base-line data on the relationship between forest structure and wildlife resource needs (see also Section 4.2.2). In particular, a long-term management strategy must be developed which ensures that sufficient wildlife habitat should be continually available through time to wholly sustain local fauna. The time required for appropriate hollow development in trees of larger size-classes, and effective management mechanisms for maintaining appropriate diversity of size-classes on coupes, must be properly determined.

The project would focus on the ecological requirements of the Superb Parrot (and possibly other riverine forest fauna simultaneously) in relation to its use of River Red Gums containing hollows for breeding sites. This should help to explain the extent to which the availability of hollow-bearing trees, or other forest parameters, may affect the distribution and abundance of the Superb Parrot, and how predicted future supplies of potential nest trees can be expected to affect the long-term conservation status of the parrot.

Additional data collection would be aimed at clarifying the relationships between size-class (DBHOB), tree age, and the nature and abundance of suitable hollows in trees of River Red Gum forests, with a view to developing formulae which better enable forest managers to assess the forest's potential values to wildlife using established forestry parameters.

In 1990, the Benalla Region of the (then) Department of Conservation and Environment in Victoria sponsored a preliminary investigation (by Mr J. Newton-John) of some relationships between tree and hollow parameters of River Red Gums in Barmah State Forest, with respect to their potential for use by wildlife. The results of this unpublished study may form a useful starting point for more extensive research towards the ultimate development of a management model for ensuring continuous and adequate supplies of hollow trees for fauna in riverine production forests.

6.2 REQUIREMENTS IN RELATION TO THE LONG-TERM SUPPLY OF NEST TREES ON THE SOUTH-WEST SLOPES (NSW)

Data on current hollow use, compared with hollow availability, should be used to investigate whether nest tree availability is a limiting factor for Superb Parrots using Crown reserve woodlands of the South-west Slopes. The project would aim to clarify what management is needed to ensure that suitable nest trees, if limiting, are continually available at levels sufficient to support the Superb Parrot population using the area. The removal of young growing timber for construction purposes (e.g. posts and poles) should

also be examined with respect to its possible influence upon the long-term recruitment prospects for suitable parrot nest trees.

6.3 RECRUITMENT AND SURVIVAL

Systematic survey of multiple nests throughout the breeding range would be used to provide data on clutch and brood size, and on fledgling survival. The detection of any significant variation in these parameters across sub-populations would be a major aim, with at least one regional focus being the Young district of New South Wales, where concern has been expressed that agricultural pesticides may be affecting Superb Parrot recruitment.

The collection of data on post-fledgling survival would require the use of mark-recapture techniques over a number of years, but would be valuable in the assessment of the species' status, and may have applications in the management of foraging and nesting areas.

6.4 POST-BREEDING DISPERSAL AND THE SIGNIFICANCE OF SUB-POPULATIONS

Local movements and net dispersal of the Superb Parrot, following breeding and during winter, would be investigated using a mark-recapture program. The project would focus on sub-populations of the Murray-Riverina and the South-west Slopes, and would require periods of intensive field work involving the assistance of expert bird-banders. The extent of interchange or overlap in net movement between the two sub-populations would be investigated. The study would also examine Superb Parrot breeding colonies in Barmah State Park and State Forest, to clarify any relationship of these birds to those of adjacent colonies in New South Wales.

Telemetry tracking techniques may be applicable to this project, but constraints would include the high cost of equipment, as well as the swift and long-ranging movements of the subject species.

Project results would help clarify key foraging areas, both within and outside the breeding range, thus allowing habitat management to become more specific. Data on the relative contribution of breeding areas to the overall population may also be obtained.

6.5 ASSESSMENT OF FORAGING HABITATS AND PROCESSES LIKELY TO AFFECT THEIR USE BY THE SUPERB PARROT

Detailed systematic studies would be made of selected Superb Parrot foraging areas, to more clearly identify the resources attracting the parrots to these areas, to examine the likely significance of current degrading processes, and to consider the appropriateness of current management. Factors warranting concern may include grazing, removal or decline of native vegetation, fire protection works, weed invasion, introduction of exotic or non-indigenous predators or competitors and excavation for bait collection ('bardi-grubbing').

Although the study should include a wide selection of foraging sites from throughout the parrot's range, the increasing familiarity of Department of Conservation and Natural Resources field staff with the breeding sites and local movements of Superb Parrots within Barmah State Park and State Forest, and the marked reduction in range which has occurred in Victoria, suggest that this area may warrant priority attention.

Such investigations would weigh heavily upon the available knowledge of local parrot movements, and would demand periods of intensive field observation. Recently-burnt breeding areas on Toganmain Station and near Tocumwal (see Section 4.4) may also constitute useful study sites.

Results would add to the efficacy of fire and grazing management initiatives proposed in this plan (Section 5.2, 5.6).

6.6 MAPPING OF WOODLAND HABITATS WITHIN THE RANGE OF THE SUPERB PARROT

Detailed maps of the distribution of box-eucalypt species and woodland conformations should be produced for the entire range of the Superb Parrot.

Such mapping would permit a closer investigation of correlations between parrot movements and habitat characteristics, and may have implications for more target-specific habitat management. In line with proposals in Section 6.5 above, priority should be given in Victoria to the mapping of box-woodland habitats, and relics thereof, both throughout Barmah State Park and State Forest and on freehold lands, Shire roadsides, unused roads and other Crown reserves, within approximately ten kilometers to the south of the entire forest margin.

6.7 NEST SITE FIDELITY AND COMPETITION FOR NEST SITES

Intensive studies of individual nest colonies, during the breeding season, should be designed to gather data on inter- and intra-seasonal use of nest sites. Factors of interest include the level and pattern of re-use of nests or nest trees from year to year, the extent of nest site fidelity of individual breeding pairs, and the extent of inter-specific competition encountered by Superb Parrots for nest hollows. The information output of this project will depend greatly upon the extent to which mark-recapture techniques can be applied.

Prescriptions relating to nest site management in both riverine forests and the South-west Slopes may be greatly improved, using the results.

6.8 SURVEY OF POTENTIAL BREEDING SITES IN VICTORIA

A nest site survey in Victoria would concentrate on riverine forests between Barmah and Yarrawonga, and the Gunbower Island State Forest north-west of Echuca. Areas where Superb Parrots are observed within Barmah Forest during the breeding season warrant priority for survey, especially in view of the Victorian Government's policy to continue to permit limited logging and grazing within Barmah State Park, as well as within Barmah State Forest.

Location of additional Victorian nesting sites to those currently known or suspected in Barmah Forest may necessitate the expansion of management initiatives undertaken in this plan.

8
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