

Nestboxes

in your

Neighbourhood



Environmental and Conservation Sciences

School of
Health and Life Sciences

Contents

1. Why use Nestboxes?
2. Building Nestboxes
3. Nestbox Design Notes
4. Nestbox Dimensions
 - Birds
 - Ducks
 - Mammals
 - Open-fronted Boxes
 - Platforms
5. Location and Installation
6. Inspection and Maintenance of Nestboxes
7. What has been in my Nestbox?
8. Safety and Conservation
9. Natural Cavities

*These notes are the work of Dr Graeme Ambrose
who taught environmental sciences at Federation University
and its predecessor institutions from
January 1981 until his retirement in March 2014.*

The illustrations, except for the nestbox, were drawn by Dr Ambrose.

1. Why use Nestboxes?

A surprisingly large number of Australian animal species including birds, mammals, reptiles and amphibians, use natural cavities such as tree holes, fallen hollow logs, burrows and crevices in rocks and behind bark. Cavities may be used for roosting at night or by day, as a den, food source, refuge or breeding site.

Ideally, tree holes and other cavities will be abundant and varied enough to supply the differing needs of these animals. In practice, there are many reasons why natural cavities are in short supply:

- Older trees can supply tree holes and crevices under peeling bark. These are often absent or rare in younger forests and plantations.
- Tree surgery in parks and gardens removes potentially unsafe tree limbs, which are often hollow.
- Firewood collection removes many hollow logs from the ground, especially near settled areas.
- Old hollow snags and stumps may be removed from forests managed for timber production because they are a potential reservoir of timber diseases and a hazard following a bushfire if live coals persist in the hollow trunk.
- Past clearing or felling has left some forests with few or no older trees.

Wherever possible, retaining natural cavities should be the first priority, but in areas where they are already in short supply, nestboxes designed to resemble the natural cavities as closely as possible, are a good alternative.

If you get the opportunity, and have adventurous inclinations, try something new - perhaps a nestbox design used overseas which has not yet been trialled with Australian species. Keep in mind that you should always keep records of your results, and spread the good word if you break new ground.

Innovate, observe, document and disseminate!

2. Building Nestboxes

Before you begin

Before you begin to build and install nestboxes, carefully investigate what potential hollow-using animals may be present in your area. Try to determine if your area meets their habitat requirements and ensure that by hanging nestboxes, you are not inadvertently encouraging the animals into a hazardous situation.

Expect nestboxes to only have a lifetime of ten or fifteen years at best, depending on box construction and the degree of exposure to the elements.

Materials

Nestboxes can be constructed from many different materials. The most useful materials will be durable, have insulating properties, be weather proof and “breathe” to avoid condensation problems.

One of the best materials is 25 mm thick rough-cut kiln – dried hardwood. Rough-cut wood is preferable to finished timber as it is cheaper and allows animals a better grip. Thick wood provides good insulation, although it is also heavy and expensive. Kiln dried hardwood is stable and will not warp, twist or buckle as it dries as will “green” hardwood. Green hardwood is significantly cheaper however and where a large number of boxes is being constructed it may be the preferred choice. Note that if green timber is used, significant gaps may develop over the first year and require filling with a caulking agent. Animals will not use a box that allows drafts to enter.

For practical reasons timber may not be the best choice for very large boxes – weight and cost increase significantly, and “green” timbers over 20cm wide will allow too much warping. For larger boxes Marine or Exterior Grade plywood is recommended.

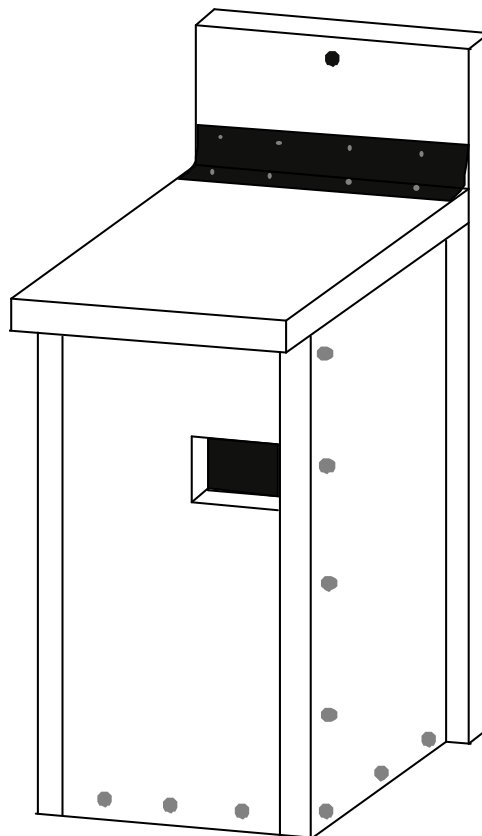
Avoid chipboard and also treated pine and other timbers impregnated with preservatives, since animals could be harmed by fumes or by chewing on the wood. For the same reason, internal walls should never be painted, stained or preserved.

Use galvanised or brass nails, screws, hinges and other fittings to avoid rust. Screws are recommended over nails as they are less likely to pull out with time.

Construction Tips

- Growth rings in timber panels should radiate outwards from the centre of the box. Any future warping will then force the panels together rather than opening or widening gaps. The grain of wood should run down the lid rather than across it.
- Where possible, recess the floor within the bases of the walls. This will reduce the chances of rain penetrating.

- Drill starter holes for screws to avoid splitting timber.
- Fill any gaps with a non-toxic gap filler such as latex siliconised caulk.
- A block of wood with the same sized hole as the nest box entrance, can be attached to the outside of the box. The holes should be lined up and the block screwed into place. This will produce an entrance spout making the inside of the box darker, keep out more rain and make it harder for large predators to reach inside.
- If you are hanging several nestboxes in an area and intend keeping records of their occupancy, clearly mark each box on the outside with large identifying numbers or letters. Use weatherproof exterior paint.
- When attaching to the tree, hang from a galvanised nail or screw so that the nestbox has a slight forward lean. This will help animals to climb in and out. Rough-sawn timber, preferably scored with grooves by a saw, will also assist climbing.



Standard nestbox design for many birds and mammals

3. Nestbox Design Notes

Many nestbox designs will suit a number of bird or mammal species.

In the following tables *Nestbox Dimensions*;

Height - the height for mounting the nest box above the ground or water.

Orientation - describes whether the box would be best aligned to the horizontal (H), vertical (V) or either (V/H). A slight forward tilt of approximately 10° is always recommended however and means that no box will be precisely oriented at either of these angles.

Entrance - the diameter of the entrance, which is presumed to be circular. Where slits are suggested, these are horizontal and the dimension is the width of the slit.

The length of the slit is less important, although 5 cm is possibly a useful minimum for small species. In most boxes, it is easiest to make the slit as a gap between an upper and lower front panel, in which case it extends right across the front of the box.

Depth - the distance from the lower rim of the entrance to the floor. Except in bats, and maybe roosting treecreepers, the distance from the entrance to the ceiling is unimportant. It may be desirable to place the entrance close to the lid to allow the overhang to better protect the entrance.

Floor - describes an internal dimension of the box. Floor measurements are width, (left to right) by breadth, (front to back.) The exact floor size is often not critical.

Notes - contains any comments which apply to the particular species.

Wedges – are nestboxes which are broader at the top and narrow down towards the floor.

Chimneys or grandfather clock-style boxes are those which are very deep.

Hollow-using animals will not always conform to our expectations about preferences. (After all, they can't read!) Remember, then, that the figures given in the tables are guidelines only. In some cases they are derived from known preferences for natural cavities or extrapolations based on similar-sized animals. Expect a few surprises, for you are certain to get them. In addition, do not expect a species to use a box just because you have used the "ideal" dimensions. There may be problems with disturbance, access to the area, or the lack of other necessary resources. Even presuming that these problems are inconsequential, territorial interactions and multiple hollow use by some animals will ensure that occupancy rates are not high. Suitable, or superior, alternatives may exist: natural tree holes, burrows, crevices under bark, between rocks or in buildings and so forth. Expect a low to moderate occupancy rate, with many unoccupied boxes showing evidence of animal visits in between inspections. If you do better than this, you will be pleasantly surprised!

4. Nestbox Dimensions - Native Birds

Species	Height/ Orientation	Entrance	Depth	Floor	Notes
Ducks					Refer to the "Duck boxes" section.
Black-cockatoos <i>Calyptorhynchus</i> species	As high as possible. V	?	As deep as possible: 1-2+ m.	At least 30x30 cm	Difficult to cater for because they prefer very large cavities, as high as possible in trees. Chew on entrance. Chimney.
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	As high as possible. V/H	15-20 cm	45+ cm	25x25 cm	Deeper boxes or chimneys preferred. Chew on entrance.
Little Corella <i>Cacatua sanguinea</i>	As above.	15-20 cm	45+ cm	25x25 cm	As above.
Long-billed Corella <i>C. tenuirostris</i>	As above.	15-20 cm	45+ cm	25x25 cm	As above.
Galah <i>C. roseicapilla</i>	As above.	15-20 cm	45-60+ cm	25x25 cm	As above.
Major Mitchell's (Pink) Cockatoo <i>C. leadbeateri</i>	As above.	15-17 cm	35-45+ cm?	25x25 cm	As above.
Sulphur-crested (White) Cockatoo <i>C. galerita</i>	As above.	15-20 cm	50-60+ cm	25x25 cm?	As above. Box may be best placed near water. Prefer deep boxes/ chimneys.
Cockatiel <i>Nymphicus hollandicus</i>	As above.	6-8 cm?	30-40+ cm	18-20x 18-20 cm	As above. Possibly boxes suited to Galahs, or those with a little smaller floor, might be successful.
Rainbow Lorikeet <i>Trichoglossus haematodus</i>	5+ m V/H	9 cm	80 cm	30x30 or 20x45 cm	Chimney. Chew around entrance.

Scaly-breasted Lorikeet <i>T. chlorolepidotus</i>	5+ m V/H	8-9 cm	80 cm	30x30 or 20x45 cm	As above.
Smaller lorikeets: Musk, Purple-crowned, Little <i>Glossopsitta</i> species.	5+ m V/H	(6-)8 cm	45-60 cm	12x 12 up to 20x20 cm	As above.
King Parrot <i>Alisterus scapularis</i>	5+ m	10-12 cm	60+ cm	30x30 up to 50x50 cm	As above.
Long-tailed Parrots: Regent, Superb, Princess <i>Polytelis</i> species.	5+ m	6.5-7.5 cm	35-40+ cm or pref- erably larger.*	20x20 to 22x28 cm	As above. *eg. Princess Parrot: 60 cm depth. Regent Parrot: 120-150 cm depth.
Budgerigar <i>Melopsittacus undulatus</i>	4+ m	4 cm	15+ cm	15-18x 15- 18 cm	Deeper boxes are probably more attractive. Chew around entrance.
Swift Parrot <i>Lathamus discolor</i>	5+ m?	8 cm?	?	?	Possibly boxes suited to larger lorikeets may be successful.
Red-capped Parrot <i>Purpuricephalus spurius</i>	5+ m?	10 cm?	45-50 cm?	20x20 cm?	Possibly Rosella-type boxes may be successful.
Rosellas: Crimson, Yellow, Adelaide, Green, Western, Eastern, Pale-headed: <i>Platycercus</i> species.	4-5+ m	7.5-9 (-10) cm	45-50+ cm	20x20 cm or larger	Dimensions towards the smaller end of the range for the Western Rosella, and the larger end for the Green Rosella.
Ringneck Parrots <i>Barnardius</i> species	4-5+ m	9-10 cm	45-60+ cm	23x23 cm	Vary according to body size.
Small "grass parrots" <i>Psephotus, Northiella, Neophema</i>	4+ m	5-6 cm	30-40+ cm	15-20 x 20 cm	Vary according to body size.

Owls other than Barn Owl	As high as possible.	?	?	?	Refer to the “Open-fronted boxes” section. Kestrel boxes may suit smaller owls such as Boobook Owls, while Barn Owl boxes may suit medium-sized <i>Tyto</i> species. Barn Owl boxes could possibly be scaled up for larger owls. For example, Powerful Owls use natural hollows 50+cm deep, with entrances 4.5-7.5 cm wide. Place boxes as high as possible in a large tree. Some owls overseas are known to use chimney-style logs or boxes,
Barn Owl <i>Tyto alba</i>	(4-)5+ m in a secluded place. H	15+ cm. If a square or rectangle, 15x15 or 15x20 cm.	30-45 cm	25x35 or 45x90 cm	Refer to the “Open-fronted boxes” section. Barn Owls overseas have been known to use chimney-style logs. Provide a solid platform, on which young birds can stand, outside the box.
Australian Owlet-nightjar <i>Aegotheles cristatus</i>	(2-)4-5+ m V	(4-)6-7 cm	(15-) 30-45+ cm	15-20 x15-20 cm	Owlet-nightjars use boxes for diurnal and nocturnal roosting and, (with a nest,) for breeding.
Laughing Kookaburra <i>Dacelo novaeguineae</i> and Blue-winged Kookaburra <i>D. leachii</i>	5+ m H	12-14 cm	(25-) 40-60+ cm	15-30 x30 cm or larger	Kookaburras accept quite a varied range of cavity heights and sizes.

Sacred Kingfisher <i>Todiramphus sanctus (Halcyon sancta)</i>	4+ m H	6-9 cm	(25-) 40-60 cm	13x13 cm	Possibly would accept broader floor dimensions. Other medium-sized kingfishers may accept similar boxes.
Dollarbird <i>Eurystomus orientalis</i>	As high as possible. H?	8 cm?	?	?	Spring-summer migrant which breed in hollows high in tall trees. Not recorded as using nest boxes, but known to use deserted kingfisher burrows in termite mounds. This suggests that horizontal boxes placed very high may be useful.
Welcome Swallow <i>Hirundo neoxena</i>	3 m	*	*	15x15 cm	* Platform: Refer to the "Platforms" section.
Woodswallows <i>Artamus</i> and other potential smaller users of open-fronted boxes.	?	?	?	?	Refer to the notes above. Woodswallows tend to be somewhat unselective about nest sites.
Tree Martin <i>Hirundo (Cecropis) nigricans</i>	2+ m H?	5 cm	?	15x15 cm?	May sometimes nest in loose colonies. Not yet known to use nest boxes. Might use wedge boxes or pardalote boxes. Breed in small hollows with a narrow entrance at a wide range of heights.
Chestnut-rumped Thornbill <i>Acanthiza uropygialis</i> and Buff-rumped Thornbill <i>A. reguloides</i>	2+ m H/(V)?	2.5-3 cm?	?	12x12-15 cm?	Known to nest in small knot-holes. Not recorded using nest boxes. Could possibly accept wedge boxes, or boxes with dimensions suited to pardalotes.

White-throated Treecreeper <i>Cormobates leucophaeus</i> (<i>Climacteris leucophaea</i>)	4-8 m V/(H)	(4-)5-8 cm	10-15 or 30-40 cm	9-15 x15-30 cm	Use boxes for breeding and nocturnal roosting. Probably not very selective about cavity dimensions.
Brown Treecreeper <i>Climacteris picumnus</i>	4-8 m V/(H)	4-5.5 cm	10-15 cm	9-15 x15-30 cm	As above. Probably other treecreeper species would use boxes similar to this and those used by the above species.
Pardalotes <i>Pardalotus</i> species particularly Striated and Forty-spotted Pardalotes.	(4-) 5 m V/H	2.5-3.5 cm	See notes #. In 14 cm high boxes, 6cm below the entry lip 20 ⁺ cm	12x12.5-15 cm, 9x20 cm	# Refer to the "Pardalote boxes" and "Tunnels" sections. Larger floors (eg. 40x40 cm) are acceptable. A narrow tubular entrance is desirable.
Falcons and Kestrels <i>Falco</i> spp.	If possible, 5 m or higher. V	Open front, with a sill covering the lower quarter.	50-75 cm. (Some authors suggest as little as 30- 40 cm)	30x50 or 40x40 cm. (Some authors suggest as small as 20x20 cm)	A lid which overhangs the front by at least 12 cm offers some protection from rain. Locate on a tree or pole, or attach to a building. Ensure that a tree with dead limbs, a power pole, or similar is available nearby. This will serve as a site where the parents can court, preen and also dismember prey before bringing it to the nest. Face the box away from prevailing winds.

Grey Shrike-thrush
Colluricincla harmonica

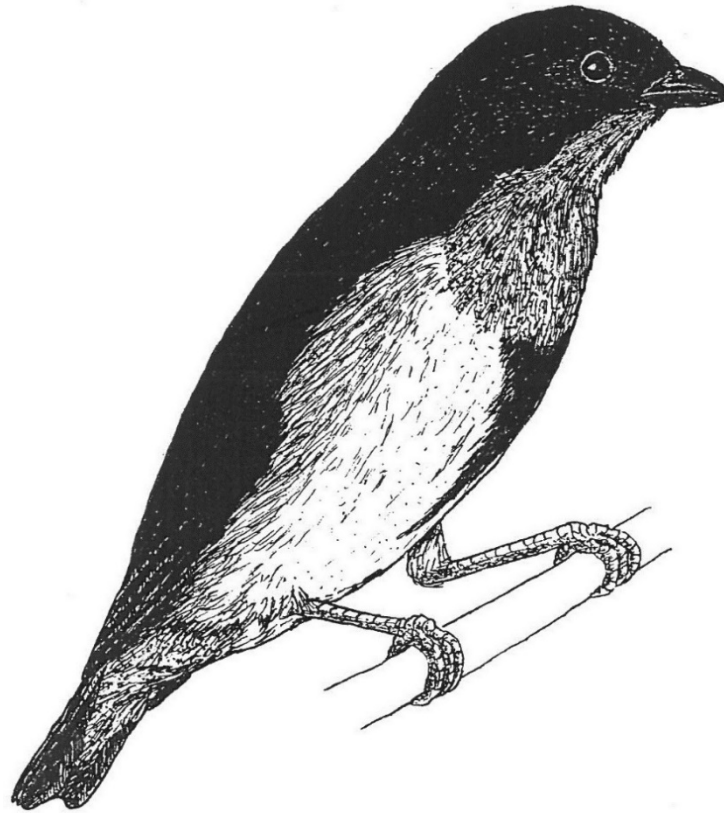
Less than 5-6
 m, and
 probably best
 sheltered
 amongst taller
 understorey
 shrubs.

15 cm+
 circular
 entrance, or
 an open
 front, but not
 in direct light.

20-30 cm

15-20x
 15-20 cm

The sill on front probably only
 needs to enclose the lower
 quarter or third.
 Keep out of reach of ground-
 based predators, but select a
 site that is secluded or
 sheltered by foliage or
 branches.



Mistletoebird *Dicaeum hirundinaceum*

4. Nestbox Dimensions - Ducks

Species	Height/ Orientation	Entrance	Depth	Floor	Notes
Australian Shelduck (Mountain Duck) <i>Tadorna tadornoides</i>	1.5-3 m above max. height of water or 3- 6 m ⁺ on land. V	14 cm	30 cm	40-45 x45- 60 cm?	Large species. May require more floorspace than smaller ducks.
Pacific Black Duck <i>Anas superciliosa</i>	As above	12 cm	30 cm	30x45 cm	-
Grey Teal <i>A. gracilis</i>	As above	8-10 cm	30 cm	30x45 cm	-
Chestnut Teal <i>A. castanea</i>	As above	8-10 cm	30 cm	30-45 cm	-
Australian Wood Duck <i>Chenonetta jubata</i>	As above	10-11 cm	30 cm	30-45 cm	-

4. Nestbox Dimensions - Mammals

Species	Height/ Orientation	Entrance	Depth	Floor	Notes
Quolls <i>Dasyurus</i> species H/V?	Low?	7-9 cm?	20 cm?	35x45 cm?	Hollow users but not known to use nest boxes.
Tuan/ Brush-tailed Phascogale <i>Phascogale tapoatafa</i> V	4+ m	3.5-4 cm	30-40 cm	15x15 cm or 20x24- 30 cm	Partition one-third off as a 'toilet' if using the larger set of floor dimensions. Scaled down, may suit the Red-tailed Phascogale <i>P. calura</i> .
Common Ringtail Possum <i>Pseudocheirus peregrinus</i> V?	4-5 m	6-8 cm	25-40 cm	20x24 cm or larger	Adaptable in the types of cavities it uses. Will also build a drey (stick nest) in shrub or tree foliage.
Greater Glider <i>Petauroides volans</i> V?	Preferably high. Used box 8 m above the ground in Gippsland (Menkhorst 1984)	18 cm (in natural hollows,) but recorded using a box with an 8 cm entrance.	30+ cm?	20x30 cm or larger?	May be difficult to cater for this species: would require large deep box mounted as high as possible in forest.
Yellow-bellied Glider <i>Petaurus australis</i> V?	?	?	?	?	As for Greater Glider. Smaller body size suggests a need for narrower entrance.
Sugar Glider <i>Petaurus breviceps</i> H/V?	4+ m	3-6 cm	20-45 cm	20x24 cm	May roost communally in leaf nest, so the floor can be larger to accommodate this.

Squirrel Glider <i>Petaurus norfolcensis</i> H/V?	Low	7-?9 cm	15+ cm	20x30 cm	Almost twice the size of the Sugar Glider. Floor space, again, could be increased.
Leadbeater's Possum <i>Gymnobelideus leadbeateri</i> H/V?	2 m to very high	3.5-5 cm	40 cm?	30x30 cm?	Very rare species dependant on hollows. More data on its cavity preferences would be valuable.
Common Brushtail Possum <i>Trichosurus vulpecula</i> (H)/V	(0-)4+ m	10-12+ cm	25-50 cm	25x30 cm	Very adaptable to a range of box heights and sizes.
Mountain Brushtail Possum/ Bobuck <i>T. caninus</i> H/V	3+ m	12-15 cm	25-30+ cm	25x30 cm or larger	Can use hollows in stumps and logs, so lower boxes may succeed.
Yellow-footed Antechinus/Mardo <i>Antechinus flavipes</i>	3-4.5 m H/V	3.5-4.5 cm (or slightly smaller entrances?)	25 cm	20-25 x25 cm	Smaller, longer floors could be tried. Slit entrances could be tried.
Brown Antechinus <i>Antechinus stuartii</i>	Low 1.5-3+ m H/V	3-7 cm (or slightly smaller entrances?)	10-15+ cm	15x 15-20 cm	Larger floors, (or just longer floors,) and deeper boxes are acceptable. Will also use slit entrances.
Fat-tailed Dunnart <i>Sminthopsis crassicaudata</i>	Low H/V?	4 cm	10 cm	10x20 cm	Try placing boxes on or close to the ground. This species will use boxes in captivity, and may possibly be enticed to do so in the wild.

Eastern Pigmy-possum <i>Cercatetus nanus</i>	?	2.8-3 cm (or a 2 cm slit)	20-40 cm	15x15 cm	Try similar dimensions for other <i>Cercatetus</i> species. Other floor sizes may also be suitable. Solitary or in family groups.
Feathertail Glider <i>Acrobates pygmaeus</i>	4+m	2.8-3 (-4) cm (or try a 2-2.5 cm slit)	(10-)30+ cm	15x15 cm	Being smaller bodied than most small mammals, Feathertails may be able to use even smaller entrances than those suggested.
Small insectivorous bats (many species.)	3-4+m. Higher for large high-flying species. V	1.5-2 cm slit in floor.	10-20 cm or up to 30 cm for larger species.	No floor or containing a narrow entry slit. Breadth, (front to back), of the cavity should not greatly exceed 10 cm.	Some variations on depth and width are possible. Varying internal dimensions may yet prove to be useful to select for some particular species, or to accommodate larger groups of bats. Width of the internal space is not critical, although it should be enough to accommodate a slit at least 5 cm long.

4. Nestbox Dimensions - Open-fronted Boxes

Species	Height/ orientation	Entrance	Depth	Floor	Notes
Falcons and Kestrels <i>Falco</i> spp.	If possible, 5 m or higher. V	Open front, with a sill covering the lower quarter.	50-75 cm. (Some authors suggest as little as 30-40 cm)	30x50 or 40x40 cm. (Some authors suggest as small as 20x20 cm)	<p>A lid which overhangs the front by at least 12 cm offers some protection from rain.</p> <p>Locate on a tree or pole, or attach to a building. Ensure that a tree with dead limbs, a power pole, or similar is available nearby. This will serve as a site where the parents can court, preen and also dismember prey before bringing it to the nest. Face the box away from prevailing winds.</p>
Owls other than Barn Owls.	?	?	?	?	<p>All Australian owls but one use tree-hollows and so may potentially use nest boxes. (Some prefer very high sites and may not be drawn to boxes, which are often placed low, of necessity.) Boxes can be scaled up or down to cater for different body sizes. (Refer to notes on Barn Owl boxes, below, and see "Owls" sites on the Internet list.)</p>

Barn Owl <i>Tyto alba</i>	As high as possible, (4-) 5+ m, in a secluded place. H	Often a square or rectangular entrance is used, the entrance being most conveniently cut into an upper corner of the front panel: 15x15 cm or 15x20 cm, with the rectangle being either horizontal or vertical.	30-45 cm	45x90 cm	The entrance may also be circular, and 15 cm in diameter, placed mid-front or upper mid- front. Provide a solid platform, on which young birds can stand, outside the box. Face the box away from strong light sources, draughts and prevailing winds. If the box is mounted inside a building, free access to the outside must always be available. (Check “Barn Owl” sites on the Internet for other box designs.)
Laughing Kookaburra <i>Dacelo novaeguineae,</i> Sacred Kingfisher <i>Todiramphus sanctus</i> (<i>Halcyon sancta</i>) and other kingfishers.	5+ m for kookaburras, 4+ m for Sacred Kingfisher. H	8-12 cm circular entrance (Kookaburras) or 6-9 cm (Sacred Kingfisher) or (both) an open front.	40-60+ cm	15-30 x30 cm (Kookab- urra) or 13x13 cm (Sacred Kingfish-er)	Potential users of open-fronted or large-entrance boxes, or perhaps artificial burrows. (Refer to table under the heading “General bird and mammal boxes” and to the section on “Burrows”.)

Grey Shrike-thrush <i>Colluricincla harmonica</i>	Less than 5-6 m, and probably best sheltered amongst taller understorey shrubs.	15 cm+ circular entrance, or an open front, but not in direct light.	20-30 cm	15-20x 15-20 cm	The sill on front probably only needs to enclose the lower quarter or third. Keep out of reach of ground-based predators, but select a site that is secluded or sheltered by foliage or branches.
Woodswallows <i>Artamus</i> and other potential smaller users of open-fronted boxes.	?	?	?	?	Refer to the notes above. Woodswallows tend to be somewhat unselective about nest sites.

4. Nestbox Dimensions - Platforms

Species	Height/ orientation	Entrance	Depth	Floor	Notes
Ducks, particularly the Pink-eared Duck <i>Malacorhynchus membranaceus</i>	Above water: 1.5-3 m. On land: 4+ m. H	N. A.	N. A.	30x30 cm to 50x50 cm	Board/platform size can be targetted to particular species. Fix firmly to tree, and allow a slight tilt. Sill optional.
Osprey <i>Pandion haliaetus</i>	As high as possible. H	N. A.	N. A.	120x120 cm	Ospreys nest in tall trees, on cliff faces, tall buildings, towers, etc. The large platform is to accomodate a bulky stick nest. See Internet list.
Kestrels and falcons <i>Falco spp.</i>	4+ m H	N. A.	N. A.	40x40 cm	Platform attached to tree or up high on building ledge, or inside barn or shed with good outside access. See Internet list.
Barn Owl <i>Tyto alba</i>	(4-) 5+ m H	N. A.	N. A.	Platform: 25-30x45 cm Divided tray: 40x75 cm	Platform or divided tray as described above. (See Barn Owl sites in Internet list.)

Welcome Swallow	3 m	N. A.	N. A.	15x15 cm	Place under eaves in a protected spot against a wall. Place where droppings will not cause a problem, or mount a tray beneath. Old seed trays, kettles, ceramic flowerpots and saucepans have been used as substitutes in Britain. Do not cluster the nest sites.
<i>Hirundo neoxena</i>	H				



Striated Pardalote, *Pardalotus striatus*

5. Location and Installation

Location

You will need to secure written permission if you intend to erect nestboxes on land other than your own – either public or private.

Nest boxes are best located away from public view in order to minimise the risk of vandalism.

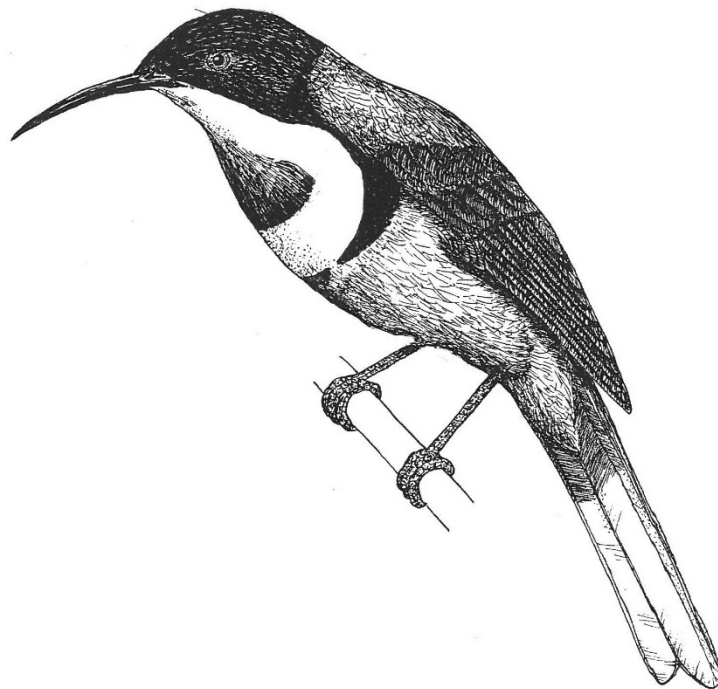
Make a map of your site which includes nest box number and GPS coordinates as well as prominent landmarks.

Installation

Nestboxes can be bulky and difficult to carry up a ladder. Ideally use a cherry picker or scissor lift to hang nestboxes. Otherwise have two ladders and at least two people present when the nest boxes are erected. Most boxes need to be hung at least 4 metres above ground level, so an extension ladder is recommended.

The easiest mounting systems involve a galvanised metal plate on the back of the box which has had holes pre-drilled into it. The box can then be screwed into position, or slid onto pegs already inserted into the trunk.

Wires, nails and screws could later cause serious injury to someone cutting the tree, so make sure that they can be removed later if the box is taken down.



Eastern Spinebill, *Acanthorhynchus tenuirostris*

6. Inspection and Maintenance of Nestboxes

Inspection

It is advisable to inspect nest boxes regularly throughout the year. If your nest boxes are in an area where starlings, mynas and sparrows are likely to be present, ensure that the boxes are inspected every fortnight between mid-August and late February. This will enable you to detect and remove their nests, (and possibly eggs) before any young hatch. Bees or wasps can also be despatched.

In some cases a roosting animal typically departs from a cavity upon your approach.

If you don't appreciate surprises, avoid initially putting your face in front of the exit.

The safety and well-being of nestbox occupants is paramount. With this in mind, keep your visits to a minimum and try not to be too intrusive. Don't leave the lid open any longer than is necessary and avoid reaching into boxes wherever possible. Try to minimise disturbance to the occupants when you inspect boxes. Handling the occupants to check numbers, determine sex, weight, length, etc. may cause them to desert the box. Incubating adults are best left undisturbed.

Resist the temptation to "tidy up" inside the boxes. Even if a structure has been abandoned by its occupants, there is always the possibility that later occupants may use it profitably. However, boxes filled with nesting material will be avoided by animals such as parrots which prefer boxes with no lining.

Record Keeping

Develop or download a proforma on which to keep records. Keep and file copies.

A good proforma would normally allow some space for additional information which doesn't fit into the standard categories: extra detail, sketches, incidental observations and so forth. Scats on top of the box, nearby scratches or shredded bark on the trunk, and chewed wood around the entrance, should all be included in your records.

Unless you plan to carry repair equipment with you during inspections, keep a record of which boxes need repair, and the nature of the damage.

Many animals could use nest boxes in the times between inspections, but not be present when you visit. In fact, you will often find more indirect evidence of animal use than you will animals. When a known animal is found using a box, it is useful to describe any nests, platforms, scats and other indicators for that species. This could be useful later for recognising materials left by unseen visitors. If you wish to detect animal visits to your boxes between inspections, remove all scats and other indicators after each inspection.

Maintenance

Maintenance problems can be minimised by constructing sound boxes from weatherproof materials and by paying attention to the means of attachment. See *Building Nestboxes*.

Over time, some damage to nestboxes is unavoidable. Falling tree branches can damage boxes, nails, lids, straps and panels can work loose. In some areas vandalism may be an issue. Keep spares of everything on hand for such times.



Feathertail Glider, *Acrobats pygmaeus*

7. What has been in my Nestbox?

Many animals could use nest boxes in the times between inspections, but not be present when you visit. In fact, you will often find more indirect evidence of animal use than you will animals.

The following key applies to common nestbox or hollow users in temperate southern Australia. It does not include information on invertebrates, platform-using birds of prey, nor animals which normally use cavities on the ground.

Animals sometimes take over and modify the nests of previous occupants, in which case nest identification may prove more difficult.

Nests, platforms and other indicators of cavity use.

- 1a. No nest constructed. (Some down may be added by ducks) 2.
- 1b. Nest or platform constructed, or cavity lined with various materials 3.
- 2a No **scats** (droppings) present in or on box 4.
- 2b. Bird **scats** (black/brown and white) or bird **pellets** (indigestible prey remains like insect head capsules, wings and legs, fur, bones and feathers held together, but without the cementing material between as found in mammal scats) in or on box 5.
- 2c. Mammal **scats** (usually brown, sometimes blackish or greenish, containing plant remains such as fibres and seeds and/or animal prey remains, cemented together) 6.
- 3a. Nest or platform mostly of bark 7.
- 3b. Nest or platform mostly of grass or straw, (some also with leaves, plastic, paper, etc) or small mud pellets held together by grass 8.
- 3c. Nest or platform (if fresh) mostly of green leaves 9#.
[# Old abandoned nests or platforms of this type may key out under step 10]
- 3d. Nest or platform mostly of dead leaves 10.
- 4. The box may not have been occupied. Alternatively, faeces may be excreted out the entrance, as in **kookaburras**, **Sacred Kingfishers** and other **kingfishers**. The rim of the entrance, or the front just below this, may be soiled with white excreta from this process. Some birds, such as **Owlet-nightjars** and **owls**, remove faecal sacs from the cavity. Faecal sac

removal may be abandoned during the busy time when young are being constantly fed, or when the young fly. Check the entrance for fresh chew marks and for hairs caught in the wood. Look inside for feathers. Pieces of eggshell or scratch marks may be found. If you know the range of potential hollow-users in your area, it is often possible to distinguish a bird species from a few feathers. Hair analysis is rather technical and difficult, although some hairs have a diagnostic external appearance. Details may be found in Brunner and Coman (1974). Bird eggs are pictured in Beruldsen (1980). **Pardalotes, Tree Martins, treecreepers** and **robins** are amongst other birds which practice nest sanitation. **Brushtail** and **Ringtail Possums**, and possibly non-breeding **Eastern Pigmy Possums**, are mammals which, when roosting, do not usually leave scats in cavities and require no lining or nest materials.

5. Most bird **scats** are not able to be identified by sight, although Triggs (1996) shows some more readily recognisable types. The excreted material tends to have a white surround or cap of uric acid, as do many reptile scats, which are otherwise rather mammal-like. Owl cavities can sometimes be strong smelling. Note that owls and some other larger birds regurgitate **pellets**, which consist of the indigestible remains of their prey, such as the head capsules, legs and wings of insects, as well as fur, bones seeds and feathers. These are distinguished from mammal scats by not being held together by a 'cement', which can become powdery when dry. Triggs (1996) covers pellets as well as scats. Also check the indicators noted in step 4. Bird occupants which do not line the cavity, or build a platform or nest, (except some ducks which add down,) include **ducks (Grey Teal, Chestnut Teal, Pacific Black Duck, Pink-eared Duck, Australian Wood Duck, Pigmy-geese), kingfishers, Dollarbirds, owls**, (not Eastern Grass Owl,) roosting, (but not breeding,) **Owlet-nightjars** and **Treecreepers, parrots**, (not Rock, Ground or Night Parrots,), **lorikeets, cockatoos** (except Galahs), **Australian Kestrel** and **Peregrine Falcon**. Reptiles and frogs which may occupy cavities include various **skinks, geckos, dragon-lizards, goannas, tree snakes** and **tree frogs**. Some may be recognisable by their scats, using Triggs (1996), but most will need to be seen directly to be identified.
6. Use Triggs (1996) to identify mammal scats. Herbivore scats tend to contain many plant fibres and perhaps seeds. Some smell of eucalyptus, while others lack a strong smell. Carnivore scats contain animal remains like bones, fur, feathers and hard parts of insects, millipedes, etc. Those of Brown and Yellow-footed Antechinus, (like those of the nest-building Tuans,) are left in heaps, along with undigested remains of prey such as insects. The scats tend to have an unpleasant rank smell when fresh. Some carnivores may have seeds or plant fibres in their scats as well. Mammalian cavities may have strong odours from urine, faeces or secretions from scent glands. See also the note on bird pellets in step 5, and check for non-scat indicators as described in step 4. Mammals which may leave scats but not

necessarily add materials to cavities include **bats**, **Yellow-footed** and **Brown Antechinus**, **Spot-tailed Quolls** and some possums, such as **Common** and **Mountain Brushtail Possums** and **Common Ringtail Possums**. Possum scats will be large cylinders, (13-25 mm x 6-12 mm) with many plant fibres. These may be left on top of the box, but will not be found in the nest, as with Tuans, quolls, bats and antechinus. Bat and antechinus scats are small, friable cylinders, and contain insect remains. They smell strongly when fresh. Bat scats tend to be smaller (3-6 mm x 1-2 mm) and less slender than those of antechinus (7-15 mm x 3-6 mm.) Quoll scats vary from straight cylinders with plant, insect and vertebrate remains to larger twisted cylinders with fur (16-60 mm x 8-18 mm.) They have a pungent smell, especially when fresh. Both bat and antechinus scats contain tiny insect fragments, as they chew their prey finely. Tuan scats have larger insect fragments, many 2-3 mm across. (Soderquist *et al* 1996). Antechinus tend to leave scats, but little or no leafy nest material when solitary, or as dispersing young from about mid/late summer.

- 7a. Large ball-shaped (roosting) nest of shredded bark lined with leaves, grass, wool, etc. and with a side entrance 10 cm or less in diameter. Nursery nests are more elaborate. They consist of a small finely woven spherical core of bark strips and feathers inside a larger interwoven sphere of bark, feathers and fur. Nest boxes will contain piles of large hard black scats. (Tuans may also take over the eucalypt leaf nests of **Sugar Gliders** and other animals and adapt them, in which case they may add shredded bark and other materials.) **Tuan (Brush-tailed Phascogale)**
- 7b. Large, (some measure about 30 cm wide,) ball-shaped nest of shredded bark, used communally, in a large hollow. Unlined **Leadbeater's Possum**
- 7c. Small (about 6cm) ball-shaped nest of fine shredded bark, sometimes with grass. (Breeding nest for pregnant and lactating females, so far not known from nest boxes. Roosting animals build no nest, but may appropriate the old nests of other animals.) No lining **Eastern Pigmy Possum**
- 7d. As 7c but rough nest of strips of bark. (Breeding nests and ? roosting nests) **Little Pigmy Possum**
- 7e. Hollow lined with small quantities of bark strips, and sometimes twigs and leaves from trees, shrubs and bracken **Common Ringtail Possum** and **Greater Glider**
- 7f. Roosting hollow lined with shredded bark. (Occasional; usually unlined) **Boobook Owl** and **Australian Owlet-nightjar**
- 7g. Cup-shaped nest of soft shredded bark, grasses, moss, hair, feathers, etc. The nest may extend down to form a platform below. Eggs, if present, are

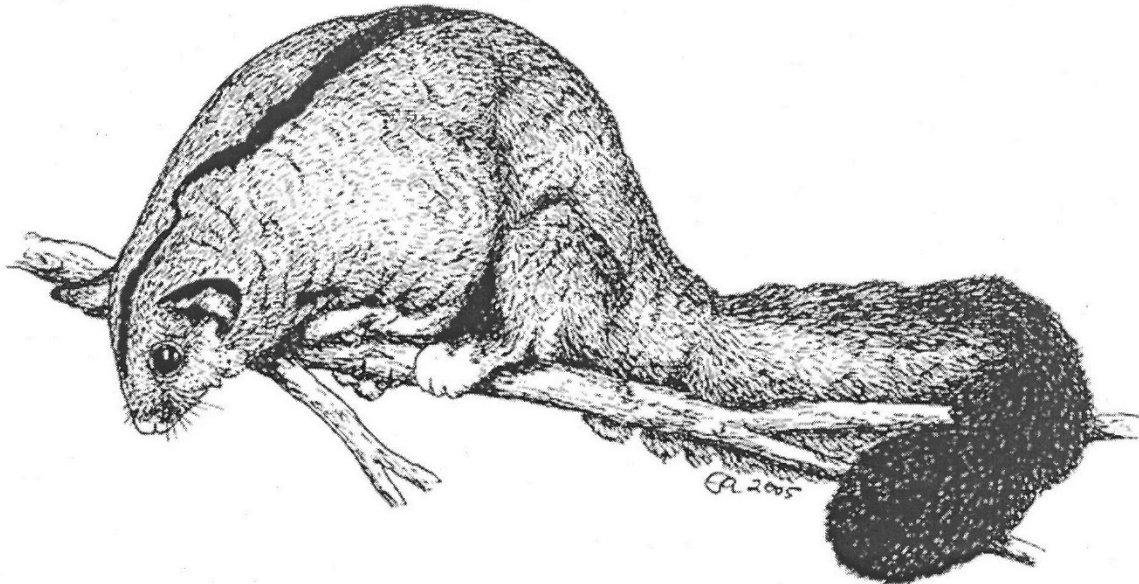
- pale pink with reddish freckles, especially over the larger end. Faeces removed from nests. all species of **Treecreepers** (**Brown** and **White-throated** are known to use nest boxes.)
- 7h. Nest a tight cup of fine bark fibres, dry grasses and perhaps moss or lichen, bound together with cobwebs. Lined with soft feathers, fur, plant material, etc. Usually open-nesters, but may use shallow cavities **Robins** (**Flame**, **Scarlet**, **Dusky**, **Hooded** and possibly other species.)
- 7i. Deep cup of strips of bark, fine short twigs, dry leaves and grass. Lined with soft grasses, shredded bark, etc. Eggs: pale bluish-white, boldly marked with lavender and brown, especially around larger end **Grey Shrike-thrush**
- 7j. Neat oval-shaped nest of finely shredded bark, sometimes lined with rootlets, and an entry at one end. Eggs white, swollen, oval **Striated and Redbrowed Pardalotes**
- 7k. As 7j, but lined with fine grass, fur, feathers, etc. (Tasmania only)..... **Forty-spotted Pardalote**
- 8a. Large untidy platform of grass, often with twigs, feathers, paper, leaves and plastic, usually built up to near the rim of the entrance, and with a cup-shaped depression with a soft lining such as feathers, paper or green leaves. In time, with much faeces around and in nest **Common Starling** (eggs pale sky-blue, glossy) and **Common Myna** (eggs bright blue, glossy.)
- 8b. Platform of grass and other plant material. Unlined. Eggs: creamy-white, lustrous and smooth **Australian Shelduck** and (usually a thin grass lining) **Pacific Black Duck**
- 8c. Untidy domed, bottle-shaped nest with side entrance. Cup-shaped if nest is incomplete. Grasses and other materials, often finer than those found in **Starling** and **Myna** nests. Lined with feathers. Later with faeces. Eggs white or greyish-white with blotches and speckles of greyish-white, dark grey and dark brown **House Sparrow** and (smaller and more brownish eggs) **Tree Sparrow**
- 8d. Bulky dome with side entrance, consisting of soft dry grasses with shredded bark. Lined with soft feathers, fur, etc **Southern Whiteface**
- 8e. Compact ball (dome) nest of grass +/- bark. Unlined. **Little and Eastern Pigmy Possums**
- 8f. Dome-shaped nest of soft dry grasses, bark, etc., bound to some extent with cobwebs. Slightly hooded entrance in side. Lined with feathers, soft grasses and plant down. Eggs: small, white or creamy to pinkish-white,

spotted and blotched reddish-brown
Buff-rumped and Chestnut-rumped Thornbills

- 8g. Shallow bowl-shaped nest of dry grass stems and leaves, rootlets and small twigs. Lined with fine soft grasses. Eggs: white to creamy-white, spotted and blotched with various shades of brown and with other colours, according to the species, like reddish-brown, purplish-red, bluish-grey and lavender **White-breasted, White-browed, Black-faced, Dusky, Masked, and Little Woodswallows.**)
- 8h. Saucer-shaped platform/nest of small dry leaves, sometimes with dry grasses and a few feathers, usually in a small horizontal cavity. Entrance may be narrowed with mud. Eggs: white and slightly lustrous, sparsely spotted and blotched with pale brown and lavender, especially around the larger end **Tree Martin**
- 8i. Half-bowl of small mud pellets held together by short pieces of grass. Thin lining of feathers, fur or other soft material. Eggs: oval, whitish, boldly marked with streaks and spots of lavender and brown **Welcome Swallow**
- 9a. Bulky globe (ball-shaped) nest, often appearing like a platform from above, of loosely arranged eucalypt leaves to which fresh leafy twigs and leaves are added. No scats present, but nest with strong musky odour. (If shredded bark and other materials are added, and piles of large hard black scats are present, see 7a.) **Sugar Glider, Squirrel Glider or Yellow-bellied Glider**
- 9b. Cavity lined with fresh leaves, usually eucalypt. Eggs: see 10d. and note below. Breeding nest. (ONJ roosts unlined.) **Owlet-nightjar or Galah** [Distinguish between these by whether the entrance is freshly chewed (Galah) or not (Owlet-nightjar) and egg size: approx. 35x26 mm and 29x22 mm respectively. This lining could also be an incomplete glider nest: see 9a]
- 9c. Cavity lined with eucalypt leaves and strips of bark **Greater Glider and Common Ringtail Possum**
- 10a. Compact globe nest, often about 8 cm across, of dry overlapping eucalypt leaves. No lining. No scats in nest. **Feathertail Glider**
- 10b. As for 10a, but may be larger, and leaves loosely rather than tightly arranged. Nest about 10 cm across, but losing its spherical shape in time. (Communal breeding nest formed from late winter to early/mid summer.) The small thin cylindrical scats, (pungent when fresh,) are less than 3 mm in diameter. They contain small insect fragments and occur in the nest or elsewhere in and on the cavity. The scats form a substantial pile in time....

..... **Brown (Stuart's) Antechinus** or **Yellow-footed Antechinus (Mardo)**

- 10c. Large bulky globe nest of loosely arranged dry eucalypt leaves, burrowed into by the animals. In time, collapsing and losing its shape. No lining or scats present. May retain a strong musky odour. Old or abandoned nest of **Sugar Glider, Squirrel Glider** or **Yellow-bellied Glider**, or alternatively an active, or old, nest of **Eastern or Western Quoll** [Very large communal breeding nests of **Brown (Stuart's) Antechinus** and **Yellow-footed Antechinus (Mardo)**, built in Spring and early summer, may look similar, but scats should be present in the cavity.]
- 10d. Hollow lined with dry and, (if active,) fresh eucalypt leaves. Eggs white with dull lustre, sometimes with pale brown markings. Breeding cavity (Roosting cavities are usually unlined.) **Owlet-nightjar**
- 10e. Platform/nest of small dry leaves, sometimes with dry grass and a few feathers. Usually in a small horizontal cavity. Entrance may be narrowed with mud. Eggs: white, slightly lustrous, sparsely spotted and blotched with pale brown and lavender around the larger end **Tree Martin**



Sugar Glider, *Petaurus breviceps*

8. Safety and Conservation

Depleting natural hollows

The numbers of hole-nesting animals in a forest can be limited by the number and quality of potential sites remaining.

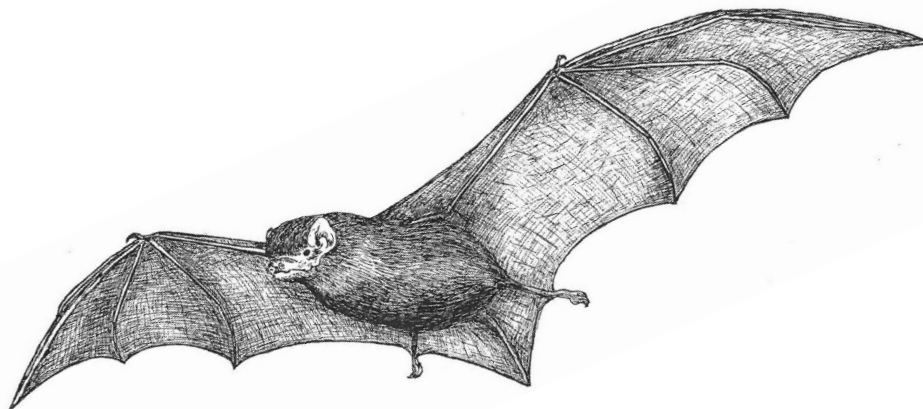
Various types of cavities have become, and are becoming, less abundant, even in areas managed for wildlife. In some instances, this is because other human needs such as firewood collection, timber getting and grazing have not been seen to have a significant impact on the resources needed by wildlife to survive.

Grazing, weed competition, fuel reduction burning and other processes may be greatly hindering the germination of new trees. Under other circumstances these would replace the old trees as they age, die and crumble.

Handling and disturbing wildlife

Almost all native vertebrates (backboned animals) are protected by law. Unless you have been given express written permission by the wildlife agency in your state or territory, it is illegal to handle, restrain, measure or tag them, or to keep their eggs, feathers, etc. It is not, however, illegal to erect nest boxes for protected animals.

Removing and destroying the nesting material or eggs of introduced animals such as starlings, sparrows and mynas is encouraged. You must ensure that your actions do not constitute cruelty to any nestbox inhabitants, protected or not. If you are unsure about the legality of these or any proposed actions, it would be wise to contact the local offices of the appropriate wildlife agency.



Chocolate Wattled Bat, *Chalinolobus morio*

9. Natural Cavities

There is a large range of natural cavities which are potentially available to various animals. Some of these are outlined below.

Not all cavity-users are able to use these alternatives; some will only use a very restricted ranges despite other alternatives being available.

Tree Holes – cavities in woody branches and trunks of trees and large shrubs which develop following injury to the bark and wood, allowing penetration by decay-causing fungi and bacteria.

Many Australian trees such as eucalypts and sheoaks are prolific producers of cavities as are the introduced Cypress-pines.

There are various types of tree holes.

- **Knot-holes** are formed by the loss of a large side branch. The cavity of the hollow is usually wider than the opening which tends to be on the side of the hole.
- **Pipes and Spouts** are formed by loss of the ends of medium to large branches. The hollow can vary greatly in depth from a few centimeters to several metres. Typically the entrance is about the same diameter as the cavity and the entry is on the end. Deep spouts are favoured by many Parrots.
- **Basal or Butt Hollows** are cavities at the base of a trunk which may extend many metres up into the tree. Possible causes are fire scars, growth stresses and mechanical damage. Inner walls are often irregular offering refuge for treecreepers and bats

Some animals chew repeatedly around the hollow entrance, exposing fresh bare wood. The reason for this is unknown – it may be to advertise that the hollow is in use and therefore deter other animals, it may be to widen the entrance or crumble wood fragments to create a bed on which to roost or lay eggs. It may even be that it is simply for beak or tooth sharpening.

Bark Crevices and Fissures – Strips or slabs of peeling bark on trunks and major branches are sometimes large and stable enough to permit animals to use the crevices beneath. Smaller birds, mammals and lizards (small goannas, geckos and skinks), nest, roost or shelter in these crevices as do spiders, insects and other small creatures.

Root Crevices – at ground level around older trees can sometimes be used by animals as a cover for burrow entrances and as a shelter.

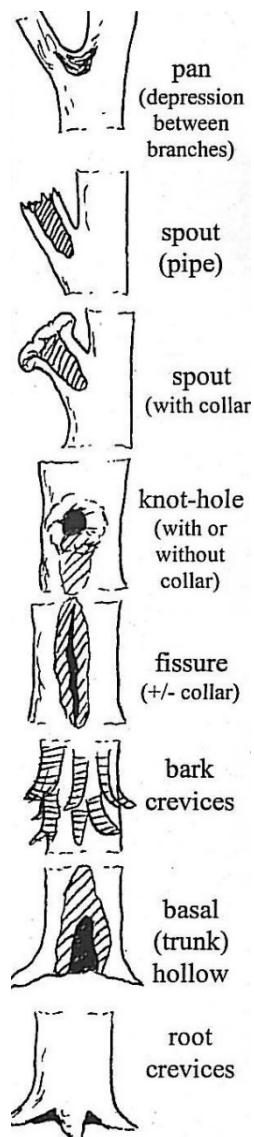
Hollow Logs and Stumps – offer cavities close to the ground which may be used by ground-dwelling species such as small marsupials, reptiles and invertebrates. In addition some arboreal species – Sugar Gliders and Brushtail Possums - may also occupy low hollows depending on the size of the cavity and the cover it affords.

Pans – shallow upward facing depressions in the angle between branches of trees and larger shrubs. As a result they tend to accumulate leaf-litter and water and may contain tree frogs and a distinctive invertebrate fauna of amphipods, slaters, millipedes and some insects.

Other Shelters - Crevices between rocks, abandoned nests and burrows of other species, dense foliage and leaf litter, termite mounds and earthen banks provide protection for many small animals.

A small number of species will occupy human-made structures such as roof cavities, eaves, mail boxes, compost heaps or mounds of soil.

Hollow Types



Tree Age Classes

