Flying-foxes

Grey-headed flying-fox "belly dips" in the Parramatta River to cool and rehydrate itself on a scorching hot Sydney summer day. Photo: Nick Edards (www.enigmatech.com.au)

Bats

One quarter of all mammal species in the world are bats, which belong to the order Chiroptera, meaning 'hand-winged'. Bats can be divided into two suborders:

- Megabats (Megachiroptera), which includes flying-foxes, as well as the lesser known tubenosed bats and blossom bats.
- Microbats (Microchiroptera), which are smaller insectivorous bats.

Megabats differ greatly from microbats (see Table 1); their main similarities are that they are the only winged mammals and are primarily nocturnal.

Flying-foxes

Flying-foxes, otherwise known as fruit bats, are members of the Pteropodidae family. They have the largest body size of all bats, weighing up to one kilogram, with a wing span which may exceed one metre. There are eight known species of flying-fox in Australia, of which only four are relatively widespread on the Australian mainland. These are the black, the spectacled, the grey-headed and the little red flying-foxes. The first three of these have similar habits and lifestyle but are found in different parts of Australia, their ranges partially overlapping. The little red flying-fox is smaller and gives birth at a different time to the others and tends to follow the flowering of the eucalypts inland, moving to the coast irregularly.

The grey-headed flying-fox (*Pteropus poliocephalus*) is the largest member of the family and is a native species that is endemic to Australia on the eastern seaboard – southern Queensland, New South Wales and Victoria.

The beautiful spectacled flying-fox (*Pteropus conspicillatus*), which is only found in tropical rainforest areas in north-eastern Queensland, is also listed as vulnerable at the national level.

The black flying-fox (*Pteropus alecto*) was previously listed as vulnerable under New South Wales legislation, ranging across most of the coast of northern Australia, but was recently delisted due to increasing numbers in NSW. However, many believe that this is likely to be due to a range shift southwards, rather than a range expansion or any actual overall population increase.

The little red flying-fox (*Pteropus scapulatus*) is both more numerous and more nomadic than the other three species. They roost much closer together in larger numbers and because of this often cause a lot of damage to vegetation where they decide to camp. This is one reason that they are so nomadic – if they were to stay too long in one place, the vegetation would struggle to recover, but if they keep moving regularly, the vegetation gets the chance to bounce back so that it is healthy again for the next time they might visit.

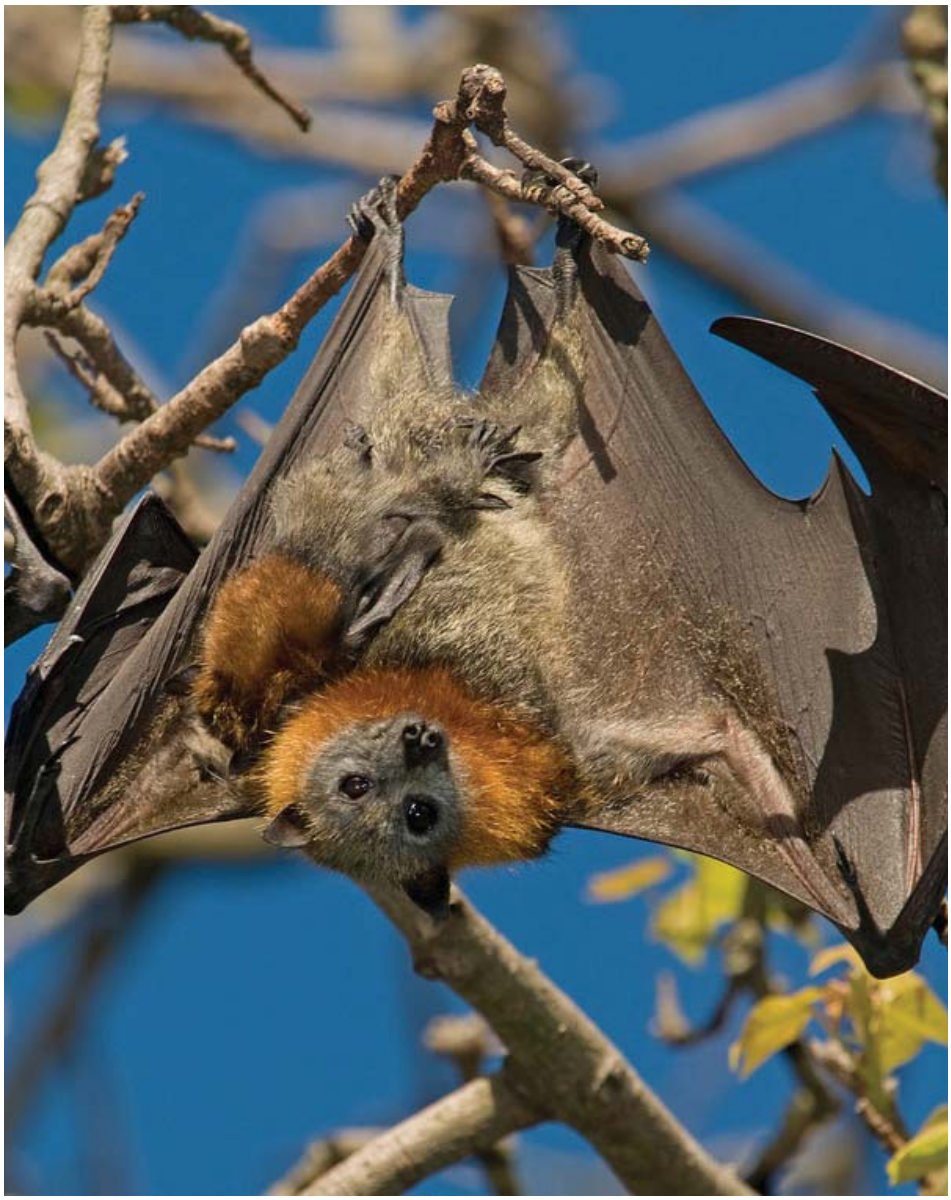
Flying-fox diet

Although flying-foxes are commonly known as fruit bats, their favourite food is actually the pollen and nectar of eucalypt blossoms, followed by other native hardwood blossoms, such as melaleuca (paperbark) and banksia, and rainforest fruits including lilly pillies and figs. Exotic fruits are generally not preferred, but often lack of preferred food sources will force flying-foxes into orchards and backyard fruit trees, where they face such dangers as shooters and loose netting.

This lack of preferred food sources is caused by two main factors. The first is the natural unreliability of flowering in the eucalypt forests. Nectar and pollen production varies considerably from year to year, with many species

flowering maybe only every three to five years. Because different species flower at different times throughout the year, most flying-foxes have to travel great distances, often hundreds of kilometres, following large flowering events in order to find enough of this high-energy food to eat. The second problem is that many of the flying-foxes' native food sources, as well as already being naturally unreliable, have been cleared. Rainforests and eucalypt forests have largely been cleared for agricultural land, while paperbark swamps have more recently been targeted for the popular canal developments in Queensland. This goes a long way to explaining why many people mistakenly believe that flying-fox numbers are increasing.

Many people are experiencing a higher level of conflict with flying-foxes than they used to. With the increase in popularity of native garden plants, backyard fruit growing, and native street and park trees, flying-foxes are finding a lot more food in urban and residential areas. These food sources tend to be more reliable than those in native bushland because they are regularly watered and well cared for and, with a greater variety of species over a relatively small area, there is always something that is flowering or fruiting. Just like people, flying-foxes like to live close to a regular food and water supply; hence a lot more flying-foxes are now camping in areas where people live, work and play.



Female grey-headed flying-fox stretches in the sun as her young pup takes milk from the nipple under her wing. Photo: Nick Edards (www.enigmatech.com.au)

Flying-fox camps

The term *camp* (or *colony*) is generally used to refer to a site where flying-foxes roost, rather than to a group of a particular number of flying-foxes, eg the flying-foxes have a 'permanent' camp at Ku-ring-gai in North Sydney, which is occupied all year round. However, there are 'annual' camps that the flying-foxes use at the same time every year, and also 'irregular' camps that the flying-foxes may roost in occasionally if there is a nearby food source available at the time.

Flying-fox numbers in a camp increase and decrease throughout the year, depending on the availability of food. The flowering of many species occurs irregularly in different areas and at different times of the year, governed mainly by variations in weather. A camp may contain a few hundred to tens of thousands of flying-foxes (or even more in the case of little red flying-foxes). Sometimes the camp may be empty if food is not available nearby. Some of these camps have been in use for more than 100 years.

Occasionally a smaller group may roost in a location for a short period, but these small groups will usually either attract more flying-foxes to the site, or will move on to join other larger flying-fox camps. Flying-foxes are very sociable and, because they are so focused on finding food in many different locations at night, they use

Table 1. Summary of general differences between megabats and microbats

	Megabats	Microbats
No. of species	170 species worldwide 12 Australian species	760 species worldwide 64 Australian species
Size	Large: wingspans about 1metre	Small: wingspans about 25centimetres
Diet	Nectar, pollen and fruit	Insects
Navigation	Sight and Smell	Echolocation*
Roost location	Hang from tree branches	In caves, roof cavities, under bridges, in tree hollows, under bark, etc.
Winter habits	Travel to locations where food is more abundant	Hibernation until insects become more abundant

* Echolocation involves emitting high-frequency sounds that bounce off objects to allow the bats to find their way around in pitch darkness.

'camps' for social contact (as well as for rest) when they are all together during the day.

Flying-foxes sleep during the day and feed on pollen, nectar and fruit at night. At dusk, flying-foxes depart from their camps to feed on various local food resources. As dawn approaches, some flying-foxes gradually start to return to the camp from which they came, whereas others may fly to another nearby camp to rest for the day. This means that camps have constant turnover of individuals – there are different flying-foxes there every day.

Camps tend to occur in relatively sheltered areas with tall trees, often in gullies and commonly near some form of water. To drink, flying-foxes swoop down to the water, dip their belly fur in, then land in a tree and lick the water from their fur. Belly-dipping normally occurs in still fresh water, but it has also been occasionally observed in estuarine or even salty water. Flying-foxes also lick dew from leaves.

Pollination

Most people do not realise just how essential flying-foxes are to the health of our native forests. Flying-foxes have adapted to an unreliable food resource by being nomadic. When a species of tree flowers well in a particular part of their range, tens of thousands of flying-foxes will congregate to feed on the blossom. Radio tracking of individual flying-foxes, combined with observations of population fluctuations at colony sites, has confirmed that individuals move many hundreds of kilometres to prolific flowering.

This female grey-headed flying-fox is tending her young pup which appears to be at most a week or so old. Photo: Nick Edards (www.enigmatech.com.au)

Flying-foxes are in fact our most effective seed dispersers and pollinators of our rainforests and native hardwood forests (including native timber plantations). Unlike the birds and insects that are usually given all of the credit for this role, flying-foxes have the advantages of a large body size combined with a fur coat that allows much pollen to stick to and be transported potentially up to 100 kilometres in one night. Flying-foxes can also carry small seeds of rainforest fruits in their gut for up to an hour, by which time they may have flown 30 kilometres away from where the fruit was eaten. Other pollinators, such as birds, bees (including native stingless bees), moths, butterflies, wasps, flies, beetles, other small mammals such as gliders, and the wind, operate over much smaller areas.

Little red flying-fox. Photo: Lib Ruytenberg

By dispersing rainforest seeds over wide areas and across cleared ground, flying-foxes give seeds a chance to grow away from the parent plant, and potentially expand remnant patches of valuable rainforest vegetation. It is estimated that a single flying-fox can

A young black flying-fox (*Pteropus alecto*) roosting in a Sydney colony which is the far southern end of their range. Photo: Nick Edards (www.enigmatech.com.au)

disperse up to 60,000 seeds in one night.

Through pollination and seed dispersal, flying-foxes help to provide habitat for other flora and fauna species and also help to sustain Australia's hardwood timber, honey and native plant industries. But to be effective in this role, flying-foxes need to be in large numbers.

Reproduction

It is sad how difficult it is to find an article or news item in the media about flying-foxes that does not use phrases such as 'bats out of hell', 'disease risk' or 'plague proportions'. This kind of propaganda not only fosters unnecessary hatred of these beautiful, intelligent and social animals that form an essential part of our ecosystem, but it also gives momentum to lies that are circulated as truth.

Plagues occur when environmental conditions allow a localised 'explosion' of numbers of a particular species that has the ability to reproduce at a very rapid rate. For example, a single Australian plague locust can lay 100–200 eggs, and one breeding pair of mice and their offspring has the potential to produce 500 mice in just 21 weeks. It is simply not possible for a flying-fox plague to occur – their slow rate of reproduction does not allow it.

Mating occurs between March and May and often results in excess noise in the camps as males mark a territory in a tree and defend it from other males. Females become pregnant in autumn (March–April) and, after a gestation period of about six months, give birth in spring (mainly October–November) to a single young (twins are rarely born, but often only one will survive).

As soon as the pup is born it begins to suckle from its mother. Its milk teeth curve backwards so that it can keep a firm hold. The mother protects her young with her wings during the daytime. At night when she flies to search for food the pup clings to its mother, with its mouth around the nipple and its claws in her fur. The pup is not able to maintain its own body temperature until it is 15–17 days old, so it stays close to its mother in the early weeks of its life. When the pup gets heavier and is able to thermoregulate, it is then left behind with a group of other pups in the colony at night while the mother goes out to feed. When the adults start returning to camp early the next morning, the mothers call out to their pups, and the pups call back. The mothers each recognise the voice of their own pup and this helps them to find their little pup among the branches and give it its morning feed. At this stage the pups are still unable to fly, and are dependent on their mother's milk. Unfortunately, these pups commonly become the unseen victims of orchardists that shoot their mothers who are desperately trying to find enough food near the camp that provides adequate nutrition to allow them to produce milk for their young at the same time of year as most orchards are producing fruit.

For this reason, the Queensland government recently banned the killing of flying-foxes as a method of fruit crop protection, but New South Wales has not yet followed suit and is still issuing licences to shoot flying-foxes, even those listed for protection under its own threatened species legislation. This is despite the fact that recent survey results indicate that shooting is, at best, around 60 percent effective as a crop protection

The wet belly of this grey-headed flying-fox means that she's just "belly dipped" in a nearby stream to cool and rehydrate herself.
Photo: Nick Edards (www.enigmatech.com.au)

measure, while properly installed full-exclusion netting is 100 percent effective. The added advantage of installing such netting is that fruit damage by other animals, such as birds and possums, is also prevented at the same time. Financially, netting is a very good investment; many fruit growers have now recognised this and have netted their crops, but others will need financial assistance in order to get started. The Wildlife Preservation Society fully supports government subsidies for orchard netting.

If the flying-fox pups survive the fruit-growing season, they begin to practice flying within the camp at night around December, and by January are flying out with the adults to feed.

Threats

There are currently estimated to be less than 450,000 grey-headed flying-foxes in Australia. The species suffered a population decline of around 30 percent over the ten years between 1989 and 1999, which contributed to its listing as a threatened species under both federal and some state legislation. Scientists believe that at the current rate of decline, grey-headed flying-foxes may be functionally extinct (as an effective pollinator and seed disperser) within 50 years and totally extinct within 70 years. It is believed that the main factor contributing to this decline is habitat loss (including loss of both roosting habitat and food trees), although shooting, electrocution, entanglements and severe heat events are also major contributors.

Predators known to eat flying-foxes include carpet pythons, goannas, sea-eagles and the powerful owl. Currawongs and ravens are known to attack flying-foxes found on their own in the daytime. These predators do not significantly reduce the overall flying-fox population. The most likely victims are the young, sick or old. Predators contribute to the health of a population by removing the least fit individuals.

Flying-foxes do not cope very well in extreme temperatures. Their ability to fly long distances means they can usually avoid the extremes of summer and winter by migrating. Although flying-foxes do have behavioural mechanisms for cooling themselves down, severe heat events (eg where temperatures reach over 40ºC for more than one day in a row) have been known to result in thousands of flying-foxes dying of heat stress. This can be exacerbated if circumstances (such as scarce food or forced relocation) have forced flying-foxes to camp in a site that may have less than adequate shelter. At the other end of the scale, black flying-foxes that used to be found primarily in northern Australia, but are now shifting southwards, are used to warmer temperatures. As far south as Sydney, individuals have been sighted with frostbitten ears, and some seem to have died from these cooler temperatures.

Parasites and diseases tend to affect flying-foxes more greatly when the population is under stress (by lack of food, camp disturbance, etc). The Australian bat lyssavirus is one disease that is fatal to them, though it is quite uncommon. But when the immune system is low, flying-foxes are more susceptible, so that parasites that have adapted to living in the flying-fox

population without causing undue illness suddenly start to make their hosts sick. Some of these issues have slightly more complex reasons for occurring, such as the tick poisoning in Queensland that you can read about in Steve Amesbury's article '*With wings on their fingers*' on page 15.

Flying-foxes have a very short intestine and absorb their mostly liquid diet very rapidly. The average time from mouth to anus (doing a poo) is about twenty minutes, although some material takes up to an hour to digest. This is important for seed dispersal because the small seeds contained in the faeces (poo) fall and germinate in new areas where they grow into new trees and vines.

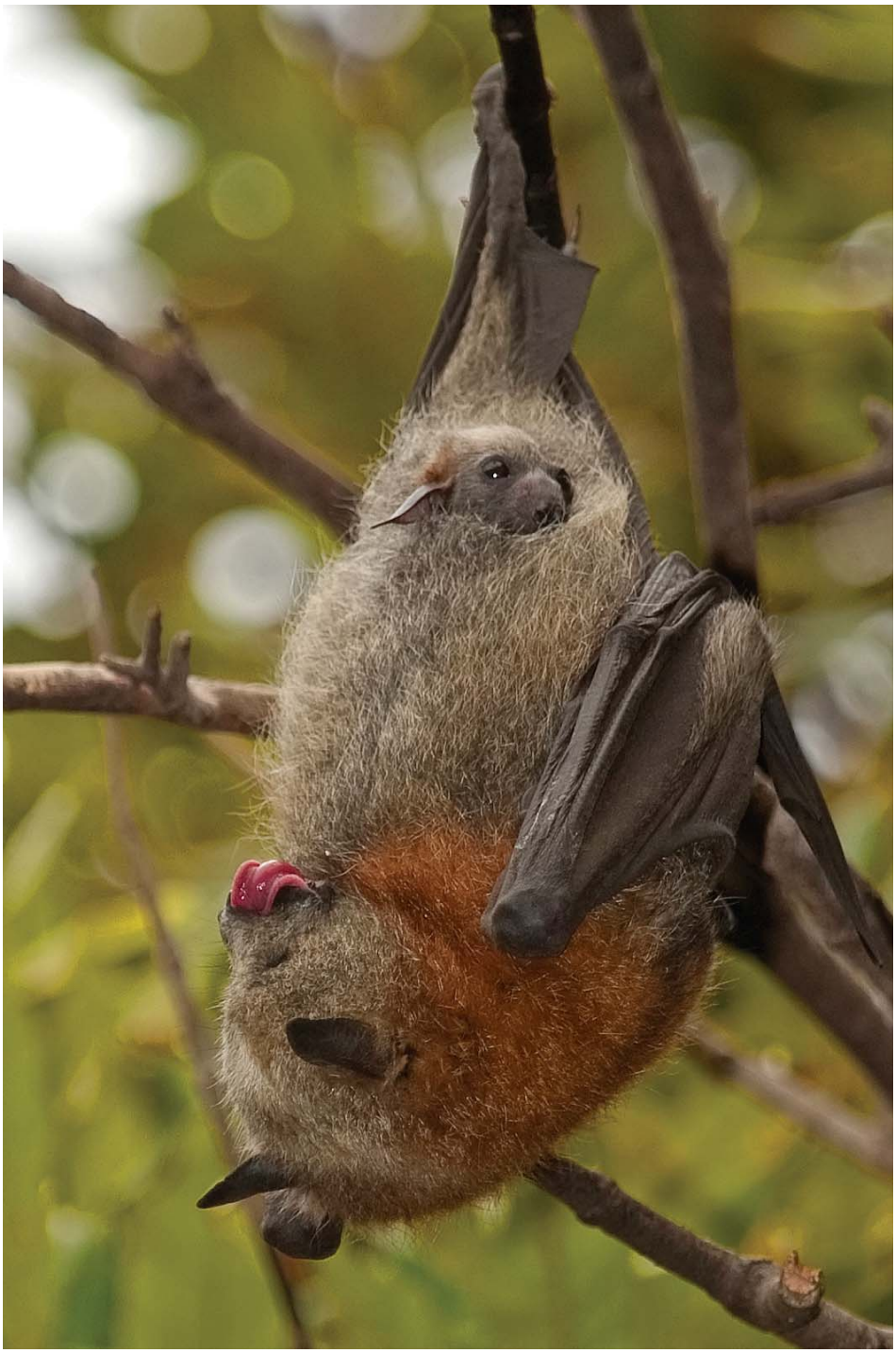
In the past, some fruit-growers have used electric grids to electrocute flying-foxes attempting to eat their fruit – these are now illegal. Now electrocution is mainly caused by overhead powerlines, killing flying-foxes if they touch two wires at the same time. If the animal happens to be a mother carrying a pup, the pup often survives the shock only to die a slow death of dehydration.

Entanglements are another problem that is happening more and more as starving flying-foxes searching for food come closer to humans. In rural and industrial areas, barbed wire is common, and where it is installed in close proximity to flying-fox food trees is where the most flying-foxes get entangled in it. The wing of a flying-fox is essentially like a large, elongated hand with a thin, stretchy webbing that joins the fingers. If a small amount of damage occurs to the webbing, then it can heal, but if large holes are torn or if severe damage occurs to the bones or ligaments that support the wings, then it is very unlikely that the animal will ever fly again – which is a death sentence for a flying-fox. Other animals, such as gliders, suffer horrific injuries from barbed wire. Studies show that 86 percent of wildlife entanglements occur on the top strand of wire, so if not all of the barbed wire can be replaced with wildlife-friendly fencing (see www.wildlifefriendlyfencing.com), then even replacing just the top strand with plain wire would make a lot of difference.

In residential areas, the more common entanglement problem is backyard fruit tree netting. If white knitted netting is installed correctly and pulled taut over a frame, then both wildlife and fruit can be kept safe. But unfortunately, many people are unaware that the cheap black monofilament netting that they buy from the local shop with few (if any) instructions is essentially a death trap for not only flying-foxes, but also other wildlife such as birds, possums, lizards and snakes. The trap works by providing an attractive lure (the fruit or the insects attracted to the fruit), with a type of net that cannot be easily seen but does easily entangle anything that tries to get to the tree, the monofilament strands painfully cutting into the skin of the animal as it struggles to get out. These animals often die of dehydration, or if they are rescued in time, may still die from the severe wounds that can result from their struggles. And of course during summer there is always the possibility that these are mothers with young pups waiting for them back at the camp.

With the increasing tendency for flying-foxes to find reliable food and water near people, there is increasing pressure from humans who sadly do not want to share their lives with flying-foxes. Camps can be noisy (particularly when the bats are mating or disturbed) and do have a distinctive smell that is not to everyone's taste. For this reason, many people object to camps being set up near their homes. Other people don't like flying-foxes because of the mess they make when feeding, or simply because they have been taught through folklore, media propaganda and rumours that flying-foxes are scary, diseased, ugly animals. If only they knew

Spectacled flying-fox and baby. Photo: Halley Design



Grey-headed flying fox giving birth. Photo: Nick Edards (www.enigmatech.com.au)

the truth! Unfortunately, too many people know very little about bats, and what they think they know is often misinformed. There is intense pressure on governments to relocate 'problem' flying-fox camps, but flying-fox advocates fear that there are so few 'acceptable' places for them to go, that they may end up being chased all over the countryside to no avail. Relocations are rarely successful, and often end up causing bigger problems than they solve. However, in the past, where governments resist communities wishing to move the bats on, colonies have occasionally been illegally disturbed, physically attacked, or even bulldozed by communities taking matters into their own hands. It is so important that people are taught how to live with and appreciate flying-foxes.

Living with flying-foxes

Regardless of what many people would have you believe, it is possible for people and flying-foxes to live harmoniously side-by-side, if only the people are willing. The first step is to learn more about flying-foxes – facts not rumours. The more you understand about an animal, the more you can come to appreciate it. And whatever you learn, teach it to others – because the more everyone understands what the cause of these issues really are, the closer we will get to finding real solutions.

If you live near a flying-fox camp and the noise is bothering you during the day, first of all look at why they are noisy. Are people disturbing them? Maybe some community education is needed to help the flying-foxes get undisturbed sleep (and hence reduce disturbance to the community). Is it mating season? Maybe you could plan some extra day trips during the season to avoid being around the noise. Or you could even get yourself some binoculars and find a good vantage point to watch the camp. You may actually find enjoyment in watching their social antics, and may even find that the noise doesn't bother you so much anymore (people learn to ignore and even enjoy many bird noises – why not flying-foxes?). But if all else fails, maybe soundproofing your home might be the way to go.

If flying-foxes are visiting your yard at night to feed in your trees, be proud that your garden is providing much-needed food for a species that is so important to our unique Australian environment. However, if they are feeding on the fruit of cocos palms, we recommend removing these palms, as the unripe fruits are toxic to the bats. If the flying-foxes (or other wildlife) are feeding on your fruit trees, you can either place paper bags over the low-hanging fruit that you wish to eat, or, if you don't want to share, place a sturdy frame over the whole tree and stretch a white knitted bird net (or wire mesh) over the frame and secure it to the ground to exclude animals from accessing the tree without entangling them.

If the noise of flying-foxes feeding at night is keeping you awake, remember that they will only be there for as long as that particular tree is flowering or fruiting and then they will move on to another food source. Ear plugs can be effective to get through that short period. Or if you have trees close by that are being visited more regularly by flying-foxes, you might also want to consider investing in soundproofing. Alternatively, if the tree is particularly close to your bedroom window, maybe pruning some branches back away from the window would help to reduce the noise.

Flying-foxes have a very fast metabolism. Food travels through their gut completely in about 20–60 minutes. For this reason, most of the mess is made by flying-foxes at night where they feed. If you have flying-foxes feeding around your home at night, we suggest bringing in your washing before going to bed and parking your car in a carport or garage, or using a car cover. If you do get 'mess' on your car, it should lift off with a wet rag. Although there is no known risk of disease transmission through flying-fox urine or faeces, in cases where flying-foxes leave behind a mess on your property, basic hygiene and cleaning practices are recommended, eg washing any outdoor food preparation surfaces with an appropriate cleaning solution, and cleaning with water any walking surfaces that may present a slip hazard.

Like all other animals, including humans, bats can be hosts to viruses and parasites. However, there are only two diseases known to be carried by flying-foxes that have ever been contracted by humans:

- **Australian bat lyssavirus** (ABL) is a rabies-like virus that has been identified in flying-foxes and microbats. Only two people have ever contracted the disease – one from a flying-fox and one from a microbat. Research indicates that less than one percent of wild flying-foxes carry the virus which is transmitted by a bite or severe scratch from an infected bat. The virus is fatal to both flying-foxes and humans, so it is important to never handle bats unless you are appropriately trained and have up-to-date rabies vaccinations. However, it is important to remember that this is not an easy disease to contract – it requires blood–saliva contact. Since we started using rabies vaccinations (including post-exposure shots) against this disease, not a single person has contracted it.
- **Hendra virus** (previously equine morbilli virus) has been detected in flying-foxes in the form of a respiratory disease (similar to a cold or influenza virus). This disease can also be contracted by horses, where the virus becomes dangerous and often fatal to the horse. In recent years there have been a few human deaths associated with the handling of horses infected with this disease. But as people are becoming more aware of the disease, more precautions are being taken in the handling of sick horses. There is a belief that the Hendra virus is transmitted to horses through flying-foxes urinating in horse feed – although conclusive evidence for this or any other method of transmission of the disease to horses is yet to be established. No human has ever caught the Hendra virus from a flying-fox.
- **Histoplasmosis**, a respiratory illness, may be contracted by breathing in the fungal spores found in some bird and microbat cave roosts, where there is high humidity and these organisms breed in the guano (droppings). Avoid breathing dust in caves where microbats or swifts roost. This disease has nothing to do with flying-foxes.

If you find a bat that is sick or injured, do not touch it, but contact your local wildlife rescue organisation immediately. If the bat is on the ground, place a washing basket or similar over it and wait with it until the rescuer arrives, taking care to shield it from the sun and following any other instructions given to you by the rescuer.

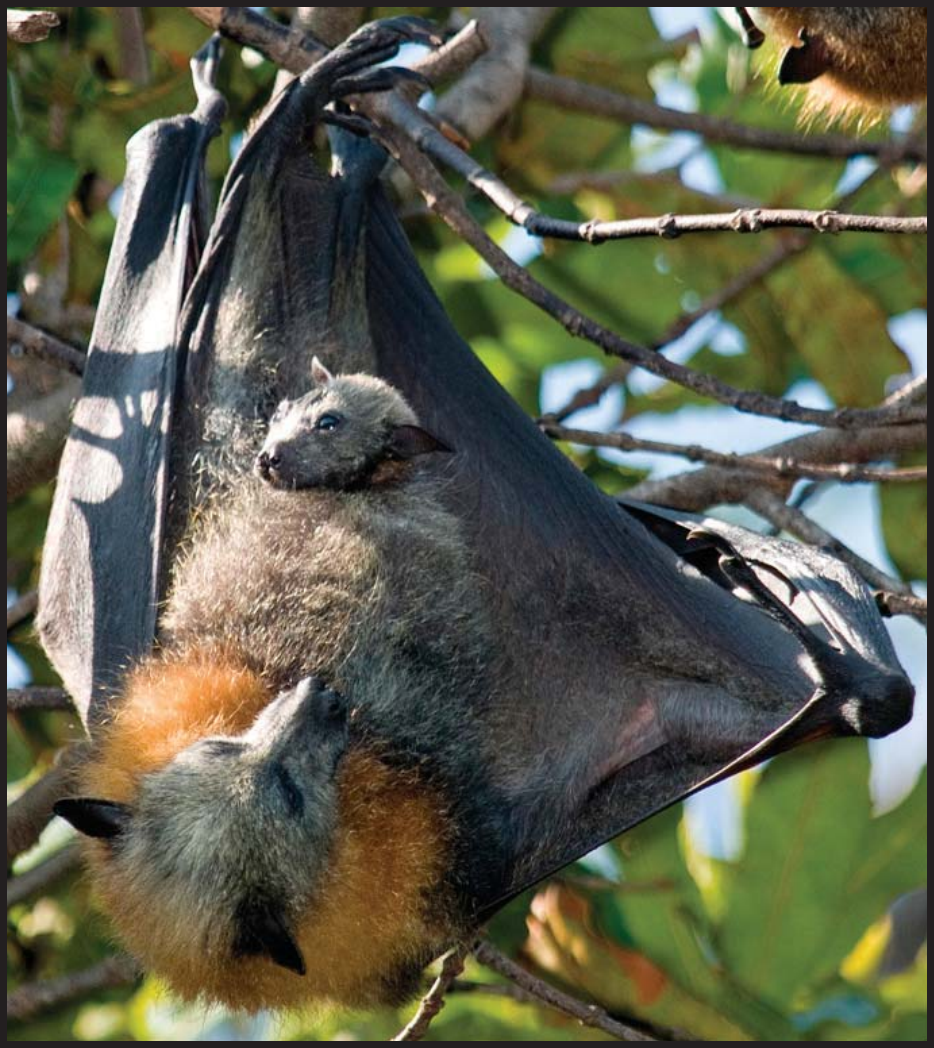
Flying-foxes that are found anywhere within human reach almost certainly will have something wrong with them and will be in need of rescue, examination and probably care. Be aware that bats are not able to flap their wings and fly off the ground like birds. They need to gain some height before they can get wind under their wings in order to take off. People that have been in the vicinity when a bat has crash-landed near them may have mistakenly thought that the bat was trying to attack them: the bat crawls along the ground towards the nearest tall object, (in this case the person) and then attempts to climb up it. On rare occasions, bats (usually juveniles that have not yet perfected their flying skills) have crash-landed directly into people. On the off-chance that this ever happens to you, the best way to avoid being injured is to stay still and let the flying-fox get its bearings and maybe climb a little higher so that it can take off again. After such a traumatic experience it will certainly want to be getting out of there as quickly as possible. Trying to shake off or otherwise manhandle a frightened bat is a sure-fire way of getting scratched or bitten, or both.

If bitten or scratched by a bat, wash the wound thoroughly with soap and water for five minutes and apply an antiseptic solution. See a doctor as soon as possible to care for the wound and to assess whether you might require a post-exposure rabies vaccination (these are the same shots given to people who are bitten by monkeys overseas). People such as vets, wildlife researchers, educators or carers who handle bats should be up-to-date with their pre-exposure rabies vaccinations in order to protect themselves against ABL.

What can you do to conserve the flying-fox?

The two most important things you can do to help conserve the flying-fox and help reduce their apparent need for taking refuge in urban and suburban areas (where food is reliable but conflict is common) are:

- Support all efforts to protect and regenerate large areas of forests, woodlands and mangroves, including a mosaic of diet species, across the landscape in order to provide food and shelter throughout the year.
- Tell others the truth about flying-foxes to help dispel the common myths and to encourage appreciation of these wonderful animals and teach people how to live harmoniously with them.



Above: A heavily pregnant grey-headed flying-fox and sleepy "friend" in one of the Sydney colonies.

Photo by Nick Edards/Enigmatech. For more photos of flying-foxes visit Nick's website at www.enigmatech.com.au

Left: This photo was taken a short while later of the same flying-fox with her new baby.

Pregnant grey-headed flying-fox enjoys the spring sun in a Sydney flying-fox camp. Photo: Nick Edards (www.enigmatech.com.au)

Little red flying-fox. Photo: Halley Design

Spectacled flying-fox (*Pteropus conspicillatus*). Photo: Halley Design

Although still dependant on its' mother for nutrition, this young grey-headed flying-fox is starting to take a lot of interest in its' surroundings. Photo: Nick Edards (www.enigmatech.com.au)