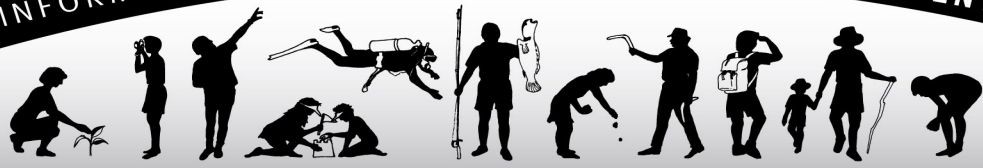


TROPICAL TOPICS

AN INFORMATIVE NEWSLETTER ABOUT THE ENVIRONMENT



Bats

Hendra Virus update 25 July 2011

Flying foxes are complex, highly social and mobile native animals. They make a significant contribution to environmental health and the economy through their role as essential pollinators and seed dispersers for native forest. In turn, these forests provide valuable timber, act as carbon sinks, and stabilise our river systems and water catchments.

Queensland has four native species of flying fox:

- grey-headed flying fox
- black flying fox
- little red flying fox
- spectacled flying fox.

They help maintain the quality of life for Queenslanders, particularly when they access these areas for recreation and commercial tourism.

Flying foxes and Hendra virus

Hendra virus occasionally causes disease in horses and rarely causes disease in humans. Although the disease can be transmitted from horses to humans, there is no evidence that it can be transmitted directly from flying foxes to humans.

The virus was first isolated in 1994 in horses at a racing stable in the suburb of Hendra, Brisbane.

Flying foxes are a natural host for Hendra virus. The spread of Hendra virus from flying foxes to horses is not yet fully understood. However, the virus has been found in the urine, placental material, aborted foetuses and birthing fluids of flying foxes. **(Continued page 3)**

Megas and micros - the great controversy

In the world of bats there are two major divisions; the microchiroptera, which means small hand-wing, and the megachiroptera (large hand-wing).

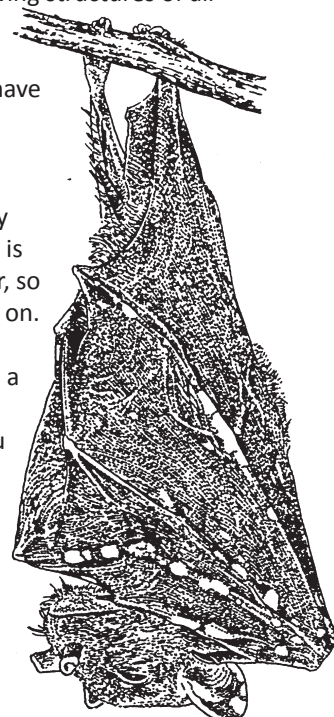
Although some of the megas are quite small the differences between the two groups are marked. The megas are vegetarians while the micros (outside the Americas, see page 2) are insectivores and carnivores. Micros all use sonar (echolocation) while megas depend on vision. Most megas are happy to roost in daylight and do so with their wings wrapped around them while the micros seek out dark places and fold their wings beside their bodies. Megas do not hibernate as many micros do and they have two claws on their forelimbs compared with the micros' one.

While it has long been recognised that micros and megas are very different, the findings of Queensland anatomist and physiologist, Prof. Jack Pettigrew, in the mid 80s provoked uproar in the world of taxonomy and evolutionary science. When working on vision in animals he had been given a flying fox brain to examine. He was amazed to discover that it had a pattern of nerve connections found only in primates (monkeys, apes and us). It was totally unlike the brain of a microbat whose visual nerve pattern is similar to that found in all mammals except primates. His findings raised the question: did the same optic nerve pattern evolve twice (once in primates and once in megabats) or, as Pettigrew claims, did flight evolve twice in mammals (the two bat groups).

He soon amassed a long list of other anatomical differences (ears, noses, skulls, teeth, tails, wing bones, internal

anatomy). Then a statistical technique (cladistic analysis) was used. As many characteristics as possible, from as many species of animal as possible, were sorted and tested for similarity and the megas and micros turned up in quite different categories. The micros ended up, as expected, with the small insectivorous mammals such as shrews (traditionally seen as the evolutionary ancestors of all bats) but the megas kept ending up with primates.

Pettigrew was not actually the first to note the similarity between flying foxes and primates. Linnaeus, the Swedish 'father of taxonomy' had done so in the mid-1770s. Nevertheless, Pettigrew's critics point to the very similar wing structures of all bats, considering it inconceivable that flight might have evolved twice in mammals. The interpretation of DNA analysis may support them but is by no means clear, so controversy rages on. However, the next time you see a flying fox flapping across the sky you can consider it a possible close cousin!



Old tube-nosed bat



Microbats



Ghost bat

Microbats are found all over the world except in the driest desert areas and the poles. Interestingly, although they are exclusively insect and meat eaters elsewhere, in the Americas, where there are no megabats, many microbats eat nectar, pollen and fruit.

Most microbats are social. Almost all avoid daylight by roosting in crevices, caves, treehollows, folded leaves, under bark or in roofs. Unfortunately many of these sites are being destroyed by human activity. This is particularly important when it affects maternity

sites, where temperature, humidity and freedom from disturbance and predators are critical. The newborn young at first hangs on to its mother using its claws and teeth (attached to her nipple) as she flies around. Later the hairless youngsters remain in the maternity site huddled together with one mature female left behind as the 'babysitter'. Mothers are able to locate their own particular babies among thousands, probably using their sense of smell. It seems that females of many species spend little time with the males, forming instead their own closeknit groups and residing in stable colonies, while the males tend to rove around.

Fears and cures

Traditionally bats have been symbols of evil, presumably because of association with night and darkness. On the other hand, they are symbols of health and prosperity for the Chinese (and luck for gamblers) and they have long been associated with medicine.

Bats have become the subject of modern research. For example, study of sonar has proved useful for producing a walking stick with echolocation for blind people and for developing non-destructive testing using ultrasound.

Combatants

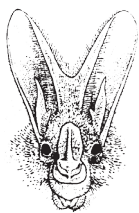
Bat droppings are a rich source of nitrates which were once used to produce gunpowder. Tonnes of bat guano were mined from Johannsons Cave near Rockhampton during the First World War. Odder still was an American plan, during the Second World War, to attach small bombs to freetail bats. The idea was to drop numbers of these mini-bombers from planes on to enemy territory. They would then find their way into buildings where the bombs would detonate. The plan backfired, however, when armed escapee bats roosted in the army's own buildings and blew them up! When several hundred mini-bombers roosted under an elevated petrol tank in a nearby town the project was abandoned and the Americans moved on to the development of the atomic bomb

Micros in the Wet Tropics

The Wet Tropics is home to representatives of all six groups of Australian bats — evening, freetail, Megadermatidae (big-skin), sheathtail bats and two groups of horseshoe bats. A few of the 40 or so Wet Tropics species are featured here.

Ghost bat

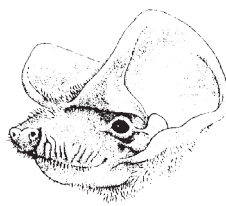
(*Macroderma gigas*)



Australia's only carnivorous bat, the ghost bat, eats frogs, lizards, birds, small mammals (including other bats) as well as large insects. It has good vision and huge ears which are used to listen for noises made by prey, as its sonar is quite weak. It then swoops down on its prey, enveloping it with its wings and killing it with powerful bites. The ghost bat, at 150g (about the size of a magpie lark) is one of the largest microbats in the world. Its distribution is patchy over northern Australia and it is particularly at risk due to limestone mining threatening its habitat.

Northern freetail bat

(*Chaerephon jobensis*)



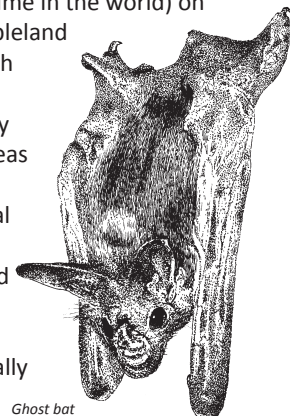
Every year in Cairns and Kuranda there is a rash of enquiries about 'baby flying foxes' found in people's houses. These usually turn out to be freetail bats, one of the commonest of the microbats found in urban areas where they have found house roofs much to their liking. They tolerate the high temperatures that exist in roof spaces but it is possible that finds coincide with the onset of hot weather when roofs become too hot, forcing the bats to leave. They are small (20-30g) with big ears, faces like cocker spaniels, very short hair and long tails. (They are also called mastiff bats.)

Tube-nosed insect bat

(*Murina florium*)



This bat was caught for the first time in Australia (16th time in the world) on the Atherton Tableland in 1981. Although thought to be confined to misty mountainous areas two were later caught on coastal lowlands north of the Bloomfield River. It is not now considered as rare as originally supposed.



Ghost bat



Hearing the way

No bats are blind, although many have small eyes. Microbats depend largely on sonar, or echolocation. Sonar is distance-measuring with sound (not to be confused with radar, which is distance-measuring with radio waves). Some other animals, such as whales, dolphins and shrews also use sonar.

Microbat sonar, at frequencies of 15-200KHz, is produced by a very specialised larynx (voice box) and beamed out through the mouth or the nose at rates up to 200 pulses a second. Sonar is a complex process. Emissions may vary in intensity, frequency and pulse rate and can be varied depending on whether a bat is 'searching' or 'homing in on' prey. If the bat is a nose-sonar specialist, it flies with its mouth closed and has folds of skin around its nose to 'beam' the sound. These are usually called nose-leaves and can be quite bizarre in form. The mouth-sonar bats (such as our little freetail bats) fly with their mouth open and usually lack facial decorations.

Since microbats rely on hearing the reflection of sound waves, they often have big ears with all sorts of wonderful convoluted trumpet and horn-like shapes, to catch and focus the fainter sonar echoes. Those with small ears have a mouth sonar which is probably particularly loud. A large part of a bat's mid-brain is used to interpret the sonar input to the ears. It is thought that the signals are processed to construct the equivalent of our visual picture of the world. It is certainly very accurate. Scientists have been able to train a microbat to distinguish between fine-grade and medium-grade sand-paper to find food! The rare golden-tipped bat (*Kerivoula papuensis*) can detect spiders' webs. It probably hovers and picks its prey from the web — some have been found with stomachs full of orb-weaving spiders. It has the quietest sonar of all Australian bats and probably flies very slowly. It quite easily detects and avoids mist nets used to trap other microbats.

Hendra Virus continued.....

Ongoing research is continually increasing our knowledge about this disease.

Protection of people

There is no evidence of human-to-human or flying fox-to-human spread of Hendra virus. All human infections have been the result of very close contact with infected horses, in particular direct exposure to tissues and secretions from infectious live or dead horses.

People are urged to be extremely vigilant if their horse displays rapid onset of illness such as increased body temperature/fever, increased heart rate and rapid deterioration associated with either respiratory or nervous signs.

Control of flying foxes

Flying foxes and flying fox roosts are protected wildlife under the Nature Conservation Act 1992. Any unauthorised attempts to disturb flying fox colonies are not only illegal but also ineffective. Flying foxes are very mobile animals and occur in most areas of Queensland. They occupy daytime campsites that vary in location, but are commonly found in vegetation along rivers and creeks. Some species, such as the little red flying fox, are

migratory and fly long distances across Queensland following food sources, such as flowering trees. They usually move on when the food source is gone.

There has been much debate about the role of flying foxes in the spread of this disease; however, culling flying foxes is not an effective way to reduce Hendra virus risk, for several reasons:

- flying foxes are an important part of our natural environment
- flying foxes are a protected species
- flying foxes are widespread in Australia and as they are highly mobile, it is not feasible to cull them
- culling or dispersing flying foxes in one location could simply transfer the issue to another location
- there are far more effective steps people can take to reduce the risk of Hendra virus infection in horses and humans.

(Information from QLD DPI, 25 July 2011)

For more information go to:

http://www.dpi.qld.gov.au/4790_2900.htm

<http://www.derm.qld.gov.au/>

Facts and stats

on bats



There are between 800 and 1000 species of bats in the world (depending on the taxonomy used.) Australia has over 70 species, representing six out of 16 families. About half of them are endemic (found only in Australia). They represent about 30 percent of our land mammal species, the second most numerous group after marsupials (45 percent approx.). Over 60 percent are found in the Wet Tropics.



Bats are the only mammals which can fly (some others can glide) and are the third group of vertebrate animals to have taken to the air, after the prehistoric pterosaurs and birds.



By hanging upside down bats are able to reduce the size of muscles in their hips and legs. Tiny legs reduce flight loadings — an evolutionary trade-off for flight.



Some microbats drink by wetting their fur as they fly over water, licking up the moisture later.



Hibernating microbats in high altitudes and latitudes allow their body temperature to fall within a few degrees of air temperature. If the external temperature falls below zero the bat's thermostat switches on an internal heater. Once the temperature reaches about 15deg., which is the point at which the majority of insects start to fly, some mechanism wakes the bats for a feed.



Two rare bats are New Zealand's only native land mammals. One of them lives in burrows and eats fungus!

The smallest bat (and mammal) in the world weighs 1.5g. The bumble-bee bat from Thailand is highly endangered because locals catch and mount them for sale to tourists! One found its way, in a perspex paperweight, to the British Museum where it was discovered to be not only a new species but an entirely new family! Our smallest bat is the Timor pipistrelle which, at 3-5g, weighs the same as an empty matchbox.



A 54g Queensland tubenosed bat has been caught carrying a 30g fig fruit 50m from the nearest fig tree — indicating the potential of these bats as dispersers.



Megabats

Megabats are found all over the world (outside Europe and North and South America) mainly in tropical areas. There are 11 species in Australia. These include five species of flying fox, plus six of their cousins.

The flying foxes (Genus *Pteropus*) are the best known tropical bats largely because their huge size — wingspans reach up to 1.6m — makes them so obvious. They have gained their popular name because their large eyes, simple ears and long snouts are reminiscent of dogs or foxes. Studies have shown that they fly at a rate of 35-40km/h with an average wing beat of 120 a minute, travelling as far as 50km each night.

Living in permanent tree-top camps, flying foxes have a complex social system and use more than 20 different calls for communication. Old males guard the perimeters of the camp on the look out for eagles and pythons which are their main natural predators. (Flying foxes also occasionally fall victim to crocodiles as they swoop over water to drink.) Conception takes place in March/April and one young is born to each female between October and December. An exception to this rule is the little red flying fox which mates in November/December, giving birth in April/May. It is important not to disturb flying fox camps when the young are being suckled. For little reds this means April-August, while for others summer is the vulnerable period.

Despite the strong smells produced by their colonies, flying foxes are extremely clean animals. They constantly groom their fur and wing membranes while at rest. When they wish to urinate or defecate they turn themselves head up.

Of ticks, lychees and flying scapegoats

When it comes to flying foxes passions run high. There are those who love them and fear for their future and there are those who call them vermin and want to see them exterminated.

Among the former is a growing group of foster mums and dads who have taken the growing number of flying fox orphans under their wings (so to speak) and found them to be affectionate and intelligent. For many years these came mainly from mothers caught on power lines but recently orphans have been created as huge numbers of spectacled flying foxes on the Atherton Tableland have fallen victim to tick paralysis. This is almost certainly a new phenomenon, not a natural part of the bats' lifecycle. It has been suggested that deforestation is to blame and that the flying foxes, deprived of a food source high in the canopy, are visiting lower food sources, particularly (non-native) tobacco bushes. By coming uncharacteristically close to the ground the bats are coming into contact with the ticks.

Fruit farmers are often unsympathetic. They see no reason to protect the animals which are raiding their orchards at night.

As long ago as the 1930s Mr Francis Ratcliffe was employed to estimate their population numbers and suggest a method of control. He came to the conclusion, after several years of research, that flying foxes are mainly blossom feeders which will choose

cultivated fruit only as second best to native fruit. It is likely that bat raids on commercial fruits may be a warning sign that all is not well with the forest.

Ratcliffe also pointed out that much commercial fruit is picked by growers before it is ripe — before it can be eaten by the flying foxes. More damage may be done by birds than by bats. These findings still apply today. Indeed recent research indicates that some fruit farmers have every reason to be grateful to flying foxes. Many fruit species such as bananas have been dependent on bats for pollination and seed dispersal during their evolution. Although genetic engineering can produce many desirable characteristics, when plant breeders want to combat a problem such as fungus attack they need to go back to wild stock for fresh genetic attributes. Without flying foxes and their relatives it would not be there.

The best solution for fruit growers seems to be total exclusion netting which has the added advantage of keeping out birds and protecting crops from hail. A mesh size under 44 mm² is recommended to exclude bats as well as birds. Perhaps different solutions can apply to different fruits. Cashew growers have found that flying foxes will carry

the fruit to certain perches and drop the valuable seeds. A grove of native trees in the middle of a plantation could allow the growers to harvest the cashews, neatly cleaned of their fruits, from a central spot in their orchard!

Perhaps the best long-term answer is to give the bats back their natural, preferred food in the form of native trees.

Queensland tube-nosed bat

(Nyctimene robinsoni) pictured above
The 3mm long tubes protruding from this animal's nose make it one of the strangest looking bats. It has been suggested that these tubes allow the bat to smell in 'stereo', thus allowing it to locate food more easily. It is a significant disperser of below-canopy fruits, particularly of figs, its favourite tucker.

This bat has never been seen to roost communally. It is well camouflaged by the white or yellow spots on its wings and ears which cause it to blend in well with sun-dappled foliage. (So good is this disguise one researcher has reported the successful capture of hundreds of dead leaves camouflaged as tube-nosed bats!)



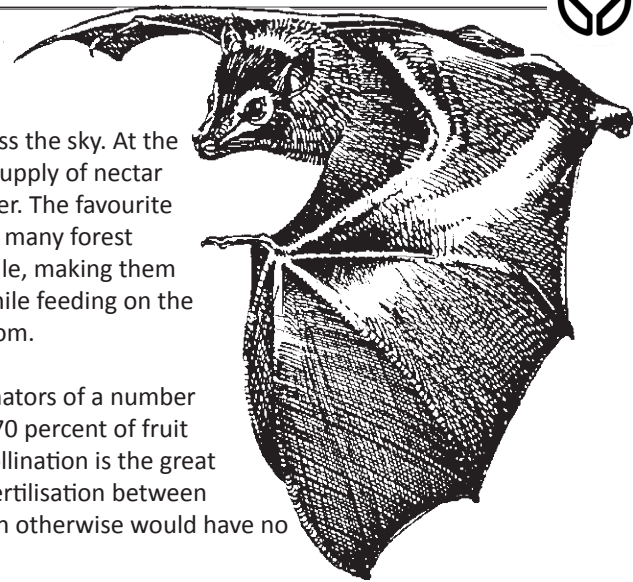
Flying foresters

As night falls millions of flying foxes leave their treetop camps and stream across the sky. At the same time pale blossoms open in the canopy and eucalypt trees increase the supply of nectar to their flowers. These events are linked; the bats and the trees need each other. The favourite food of flying foxes is pollen and nectar so nectar is the inducement offered by many forest trees for pollination services. In these cases the flowers are usually white or pale, making them more obvious for the bats at night. Like huge honey bees the bats land and, while feeding on the flowers, collect a load of pollen on their fur to be transferred to the next blossom.

It is now considered that bats, rather than insects or birds, are the prime pollinators of a number of important timber as well as many fruit species. (It has been estimated that 70 percent of fruit sold on S.E. Asian markets is bat-pollinated.) An additional advantage of bat pollination is the great distance which the animals are able to fly (50km in one night) allowing cross-fertilisation between distant trees. This is particularly important for isolated rainforest patches which otherwise would have no way to 'interbreed'.

Flying foxes also distribute seeds. Forest trees with pale fruits attract bats and often while they are feeding they swallow small seeds such as those of figs. Unlike birds which tend to sit in trees before depositing the seeds which they have ingested, bats can do so in flight and for this reason are considered vital for the regeneration of forest in areas which have been cleared (and thus have no bird perches). A study in Africa found that up to 95 percent of aerial seed dispersal was due to bats. This service is not limited to small seeds. In order to protect their find from other hungry bats flying foxes often carry away large fruits such as mangoes, dropping the seeds some distance from the parent tree.

Megabats are now being referred to as 'linchpin' or 'keystone' species by research scientists. The linchpin keeps the wheel on the axle and the keystone locks the stones of an arch; without them neither would hold together. Similarly, without flying foxes to pollinate and distribute species on which so many other animals, including the cassowary, depend, our rainforest systems could collapse. As Dr Norman Myers expressed it, 'The loss could trigger a cascade of linked extinctions'. 'Loss', in this case, may mean not the extinction of the bat population but a critical reduction in numbers. A colony of 25 000 in a camp covering 1-3ha may seem like a huge number but camps are few and far between (one per 20-50km) so the average may be less than one bat per 10ha. It is possible that many more bats are needed to service the ecosystem. Present bat numbers are only a fraction of previous populations; even now we could be reaching critically low numbers.



Common blossom bat (*Syconycteris australis*) **Northern blossom bat** (*Macroglossus minimus*)

The main differences between these two species are to be found in their teeth and their distribution. Although it is a mega, each blossom bat, at about 15g, is smaller than a mouse. Its pointed nose and long thin tongue are highly specialised for penetrating flowers and licking up the nectar. Any of the trees with 'shavingbrush' flowers are likely to be visited by this bat. A CSIRO study proved its significance as a pollinator of the bumpy satinash tree (*Syzygium cormiflorum*). Results showed that blossom bats performed 46 percent of the pollination while birds and insects were responsible for only 20 percent each.

Spectacled flying fox (*Pteropus conspicillatus*) (pictured right)
A specifically rainforest species, this is the main flying fox inhabitant of the Cairns central swamp.

Little red flying fox (*Pteropus scapulatus*)
Our most widely-distributed flying fox, it is not found outside Australia. Huge numbers of this wandering bat move to coastal areas in years of inland drought and poor eucalypt flowering.

Black flying fox (*Pteropus alecto*)
Camps of up to hundreds of thousands of bats are often situated in mangrove and paperbark swamps.

Bare-backed fruit bat (*Dobsonia magna*)
Restricted, in Australia, to northern Cape York including the Black Mountains, near Cooktown, this is the only Australian mega to roost in the semi-darkness of caves. It is also the only fruit bat which can fly backwards!



Bats as tucker

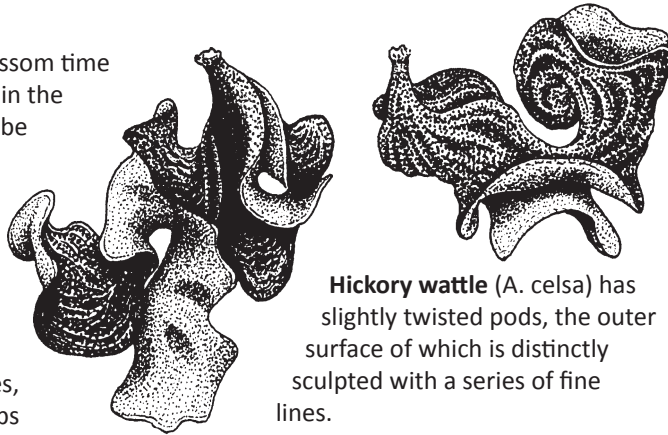
Bats, particularly flying foxes, are a source of food in many parts of the world. They are also believed to have medicinal properties effective against anything from snake bite and asthma to fractures. Sadly the human appetite for bats is seriously endangering many species and with locals in Guam paying up to \$25 a kilo for them a brisk export business has sprung up in other areas. This has led to the extinction of some island species.



Nature notes - April

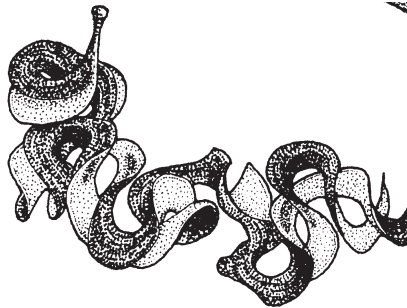
A diary of natural events creates a pleasing journal which grows richer with the passage of time. Watching for the recurrence of an event after noting it in a previous year, and trying to understand what could have caused changes in timing, is intriguing. These notes are from the author's own notebook, or were offered by researchers and fellow naturalists. Readers will, inevitably, note variations between their observations and those appearing here. If you do not keep a nature diary perhaps this will inspire you to begin one.

April is usually wattle-blossom time for several species found in the Wet Tropics. Flowers can be expected from **brown salwood** or **sally wattle**, **northern wattle** and **hickory wattle**. These three are common species along rainforest margins and in exposed situations such as beaches, steep ridges and large gaps within rainforest.



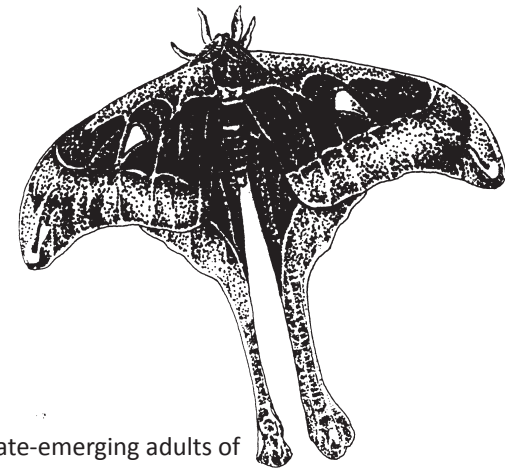
Hickory wattle (*A. celsa*) has slightly twisted pods, the outer surface of which is distinctly sculpted with a series of fine lines.

April air may also carry the scent of paperbark blossom when **weeping teatree** and **cajeput tea-tree** put out their creamy sprays. The generous supply of pollen and nectar in the blossoms attracts numerous birds and bees by day and noisy flying foxes after dark. Both weeping tea-tree (*Melaleuca leucadendra*) and cajeput tea-tree (*M. cajuputi*) grow into big trees. The former has a long narrow leaf in contrast with the latter which has short, broad leaves.



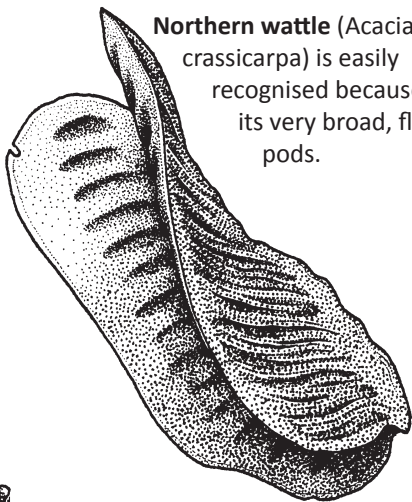
Brown salwood (*A. mangium*) develops tightly coiled seedpods. About the middle of the year sulphur-crested cockatoos will be extracting seeds from these pods, littering the earth with their leftovers.

As autumn shortens the days, birds which visit us from varying distances to the north will be moving away. Waders which breed in the opposite hemisphere will go far beyond the equator. Of the large numbers of shining starlings which breed here, some will travel to New Guinea this month but many are reported to over-winter on Cape York with some recorded around Cairns throughout the year.



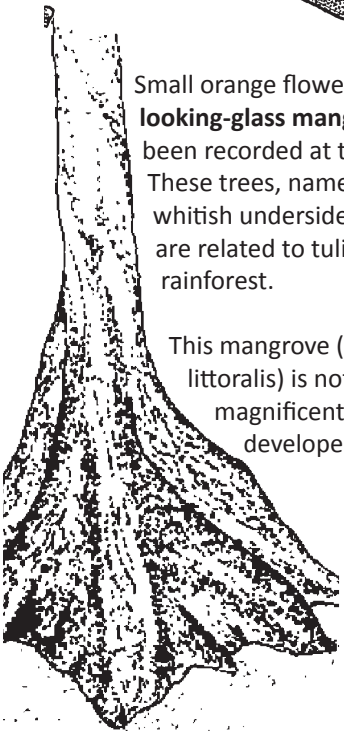
Late-emerging adults of the velvety-brown **atlas moth** - with a wingspan of more than 20cm - may be seen this month. This species is one of the largest moths in the world but the adults cannot feed because they have no proboscis (the tube through which moths and butterflies suck up their food). Atlas moth caterpillars feed on leaves of bleeding heart tree (*Omalanthus populifolius*).

Northern wattle (*Acacia crassicaarpa*) is easily recognised because of its very broad, flat pods.



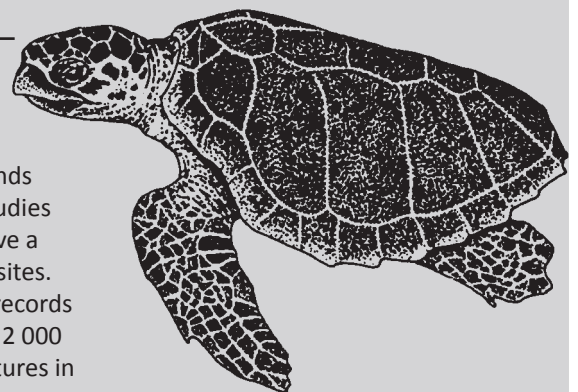
Small orange flowers of the **looking-glass mangrove** have been recorded at this time of year. These trees, named for the glossy whitish undersides of their leaves, are related to tulip oaks of the rainforest.

This mangrove (*Heritiera littoralis*) is noted for the magnificent plank buttresses developed by large trees.



A long swim

Mature **green turtles** which went south to lay their eggs and mate will now be travelling north to particular feeding grounds off the Wet Tropics coastline. Studies of tagged females show they have a strong attachment to particular sites. For example there are multiple records of one green turtle which swam 2 000 kilometres from her marine pastures in Princess Charlotte Bay to lay her eggs at a rookery near Gladstone.



(Acknowledgments to Col Limpus, QNPWS Marine National Parks)