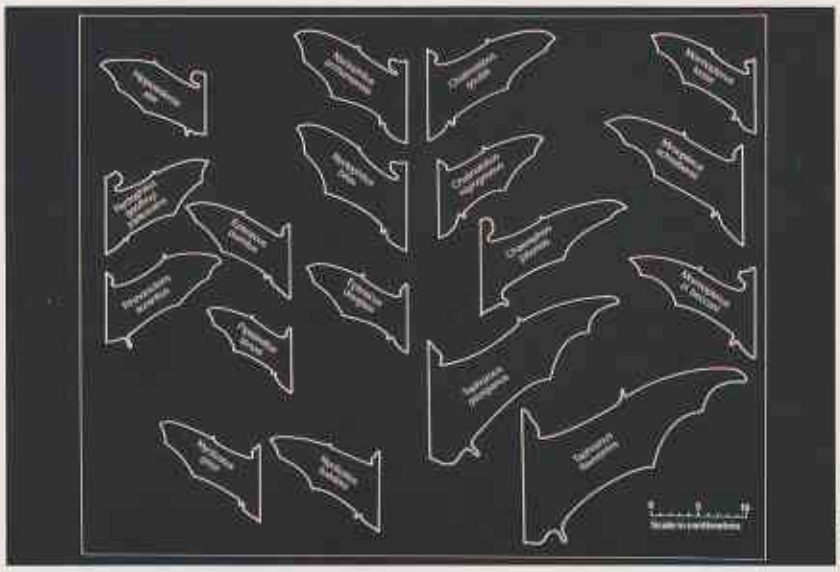
Bats, Bats, and More Bats.

For far too long bats have conjured up images of Count Dracula and spooky castles. In reality they are an amazingly diverse group of warm-blooded animals. **Tony Start**, *CALM'S Pilbara Regional Manager, and* **Norm McKenzie**, *Senior Research Scientist, look at some of W.A.'s fascinating bat species.*

Deep in a maze of shafts that had been a copper mine, a pile of debris, including feathers and bones, provide evidence of the diet of one of W.A.'s most spectacular (and secretive) carnivores.

The old mine was in a spinifex-clad hill in the arid Pilbara region and the carnivores were Ghost Bats. The remains suggest that the flavour-of-the-month had been shared, almost equally, between birds and other bats. All that remained of the birds were wingbones from the shoulder outwards, the unfeathered sections of legs, occasional beaks and some crumpled feathers. Bright green and yellow Budgerygah feathers and the three-toed feet of Little Button-quail were common in the debris.

There was little left of the eaten bats, except the bones of wings which were broken off between the shoulder and the elbows. Ironically, the commonest prey species were the two which shared the



N. McKenzie

Wing shapes of various W.A. bats (left).

Ghost Bat with young (below).

A little cave *Eptesicus* (below right).

J. Tochinai

mine with the Ghost Bats, *Eptesicus findlaysoni*, a tiny brown bat, and *Taphozos georgianus*, a moderate sized Sheath-tailed Bat. (The *Eptesicus*, at any rate, even breeds in the mine!)

Among the remaining bits and pieces, tails and feet of mice were quite common. There were a few mandibles and feet of Dasyurids (tiny marsupial insectivores such as Dunnarts and Planigales), and occasional wings from large beetles.

It seems that reptiles were not much liked because the Ghost Bats had dropped large pieces of the few individuals that they had taken back to the roost.

Ghost Bats are the only Australian members of a peculiar family commonly called False Vampire Bats. The family contains only four other species world wide. Three of them are also carnivores (two in South East Asia and one in Africa). The fourth, the Orange-winged Bat of Africa, is perhaps the world's only diurnal bat, and certainly one of the world's most brightly coloured bats. It hunts large insects from a perch, usually in a low, thorn tree. Hanging quietly, watching for prey, its grey fur makes it quite inconspicuous, but when it takes flight, suddenly spreading bright yellow-orange wings, it is as brilliantly coloured as many birds.

The Ghost Bat is not only the largest of the False Vampires, but, weighing 150 g, it is the world's largest member of the sub-order Microchiroptera which contains all bats except the Flying Foxes and their allies. The little *Eptesicus*, which the Ghost Bats found so tasty, are at the other end of the scale. Weighing little more than four or five grams they are among Australia's smallest bats.

Microchiropterans are mostly insectivorous and in W.A., except for the Ghost Bats, they all eat insects. In the Americas (where there are no old world 'fruit bats'), however, the range of Microchiropteran diets includes insects, scorpions, fish, fruit, nectar, and, of course, blood. (Vampires don't suck blood from their victims. They make a small incision with razor sharp teeth. Anticoagulants in their saliva ensure the wound bleeds freely and the bats lap their meal.)

J. Lochman

There are about 30 species of insectivorous bats in W.A. It is difficult to be precise about this number because taxonomists are still recognising new species. For instance, as recently as last year, Dr Darryl Kitchener of the W.A. Museum, re-examined the species within the genus *Eptesicus*. Some of these species are very similar in appearance; yet following detailed examination he has shown that there are, in fact, five discrete species of *Eptesicus* in the State. As well, zoologists are still discovering distinctive species that are completely new to science. It is likely that the former process will result in further changes, but it is unlikely that many distinctive bats still await discovery in Australia.

Like other animals, bats generally partition a habitat so that co-existing species do not compete directly for resources such as food. CALM research has shown that this is true for the insectivorous bats living in W.A.'s mangrove communities. In the Kimberley 15 species feed on insects in and around mangrove forests. Some fly high over the canopy, some feed adjacent to or in clear areas within the stands, while the rest hunt inside the forests. None of the mangrove forests studied contained all of the 15 species; instead each stand contained a subset of them.

The research found that when wing loading (the weight supported per unit area of the wing) and aspect ratio (the ratio between the wing length and width) are both taken into account, each species of insectivorous bat that occurred in any particular stand of mangroves had unique flight capabilities and thus the ability to exploit different parts of the habitat for food. Each stand of mangroves had its own 'foraging guild' of insectivorous bats.

For example, bats which have high wing loadings and relatively narrow wings (rather like jet

aeroplanes) feed above the mangroves where speed is more important than manoeuvrability, whereas those with low wing loadings and relatively broad wings (rather like crop dusters) feed inside the forests where manoeuvrability is more important than speed. Our subsequent research has shown that the structure of the bat guild is disrupted in disturbed mangrove habitats.

One genus of mangrove tree that occurs widely around the Indian Ocean, including the Kimberley Region, has a particularly interesting association with bats. The genus *Sonneratia* has large flowers which consist of a hard green calyx and a tuft of numerous stamens which are white in one species and maroon with white tips in another. The whole flower looks like a shaving brush.

Sonneratia flowers are pollinated by a Blossom Bat, *Macroglossus minimus*. Blossom Bats feed almost exclusively on nectar and pollen. They are small, about 15 g, and highly adapted to their diets, with long muzzles and very long tongues which have a patch of filamentous papillae at the tip. These 'absorb' nectar like a sponge absorbs liquid. Further back on their tongues there are stouter, backward pointing papillae that are used to comb out the pollen which collects on their fur as they land among the anthers to acquire nectar.

Flowers pollinated by bats are also well adapted to their visitors. They usually open at dusk, provide copious nectar and pollen and are always presented so they are easily accessible to the bats, on the outside of the canopy and often with long stems to hold them away from the crown. Most bat-pollinated flowers are white, but some may be darker colours, typically maroon and purple. The dark colours enhance their silhouette against a relatively pale skyline. Dark coloured flowers always have strategically located white markings to help the bats approach from the correct direction.

The enhancement of visibility is essential because Blossom Bats are members of the other sub-order, the Megachiroptera. As the name suggests, members of this sub-order are generally large. They include the fruit bats and flying foxes which occur throughout the old world tropics.

One of the features separating Megachiroptera from Microchiroptera is the use of eyesight by the former. Echolocation is an efficient means by which insectivorous bats can detect moving prey in the air, but it is not effective for locating stationary fruits or flowers in the canopy of a forest. Megachiropterans, therefore, use their eyesight to find their way around. With the exception of one genus (which does not occur in Australia, and which has independently evolved a crude system of echolocation to help navigate in its cave roosts) megachiropterans don't echolocate.

The other two species of Megachiropterans that live in W.A. are both flying foxes, and occur in the Kimberley and in the coastal areas of the Pilbara.

Their habit of roosting in large colonies in the tops of trees, and their large size, allows flying foxes to be easily observed in daylight. Colonies of 100 000 individuals are not unusual. Furthermore, they are very active in their roosts, often moving from perch to perch and squabbling for position, thus drawing attention to themselves.

Although flying foxes are more common and widespread in the Kimberley than the Pilbara, one of the most readily accessible colonies lives in the date palms close to the Millstream-Chichester National Park headquarters. Each year thousands of people marvel at

W. Hughes/Lochman Transparencies

them after being attracted by the continuous squawks of the squabbling colony.

Flying foxes have prodigious powers of flight and many species are known to fly more than 50 km from their roosts to their feeding grounds, returning before dawn. Partly because it is difficult to study such mobile species while they are off feeding at night, little is known of their diets in W.A. Fruit growers in the tropics suffer some losses from their crops, but cultivated fruit would not usually form a very significant proportion of the bats' diet.

It is known that bats from the Millstream colony feed on the flowers of river gums, cajeput trees and dragon trees (*Sesbania formosa*) as well as the fruit of the introduced date palms in which they roost. Each year numbers in the colony decline markedly at the same time as a wild fig, *Ficus virens*, fruits in the Hamersley Range. Flying foxes feed on the figs. Perhaps some of the Millstream bats move to the Hamersley Range when the figs are fruiting? Each of the food supplies so far identified is available for only a short time during the year and nothing is known of their diet when none of these items is available.

When these bats are travelling from their roost to their feeding grounds, they fly at considerable heights, well above the tree tops. Therefore, it is curious that sometimes dead flying foxes are found hooked up in the barbed wire fences that criss-cross the wide open, spinifex-dominated Pilbara landscape. Presumably they're looking for food, but what they would eat so close to the ground in that environment remains a mystery.

CALM researchers have recently reviewed the conservation status of W.A.'s bats. The good news is that none have become extinct since European settlement of this State, unlike many of the ground-dwelling mammals. The ability to fly allows bats to forage widely and quickly re-colonise areas following periods of food shortage.

The news is not so good elsewhere in the world. Bat numbers are declining in several countries. Breeding caves are being mined, either for their guano deposits, a rich source of fertiliser, or for cement. The mining of limestone strata adjacent to Ghost Bat caves at Mt Etna, in Queensland, is an Australian example.

Widespread use of agricultural insecticides is thought to be another cause of their decline. Insectivorous bats are voracious eaters; many of the insects they eat are pests of man (e.g. mosquitoes) and his crops. For example, the guano bat, *Tadarida brasiliensis*, is known to consume thousands of tonnes of insects per year in the American State of Texas alone; in summer this species is the sole veterbrate predator capable of limiting the numbers of night-flying insects.

Fruit bats also play an important ecological role in the dispersal of seed and in cross-pollination. They consume more than their own body weight in ripe fruit each night and visit many trees in the process. These bats, being powerful flyers with a fast rate of digestion, disperse undamaged seeds widely. The fruit and flower-eating bats of South East Asia are known to visit more than 130 plant species that yield products useful to human beings. For example, durian and kapok trees are pollinated by bats.

Bats, therefore, are far more useful than their Transylvanian PR agents would have us believe. True survivors, they should inspire respect rather than fear.

A. Start

Red-shouldered Fruit-bat (far left).

Flying Foxes take to the sky (left).

Common Sheathtail Bat (below).

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EDITORIAL

Anybody who reads tourist brochures in this State will appreciate that the tourist industry is, to a large extent, dependent on natural features and wildlife for its 'product'. Many people who are concerned with the natural environment are antagonistic to tourism, and it is certainly true that in the past there have been some insensitive tourist developments in the State. But, just as the farming community over the past ten years has become one of the greatest allies of conservation, so, increasingly, is the tourist industry. For example, in a recently published tourist industry report on tourism in the Kimberley, the need to preserve this environment was given top priority.

This report is indicative of the growing awareness in that industry of the symbiotic relationship between tourism and the protection and maintainance of our unique flora, fauna and landscapes. Rather than being despoilers, the tourist industry has the potential to become one of the strongest advocates for conservation in the broadest sense.

There is a great potential for synergism between those interested in the science of conservation and the tourist industry. One of the ways by which the tourist potential of any natural area can be enhanced without any cost to the environment is by providing information to the visitors on the natural science that makes that area special.

Landscope is one avenue by which we are attempting to provide an added dimension to the 'look it's lovely' tourist experience. Interestingly, while *Landscope* receives almost universal acclaim from the general public, there is ongoing, often vigorous, internal debate about how technical we should make the magazine. We would appreciate your views.

Cover Photo

'Now, just how do I find my way out of this Renoir landscape?'
Photographer **Richard Woldendorp** captured this lizard taking a sighting.