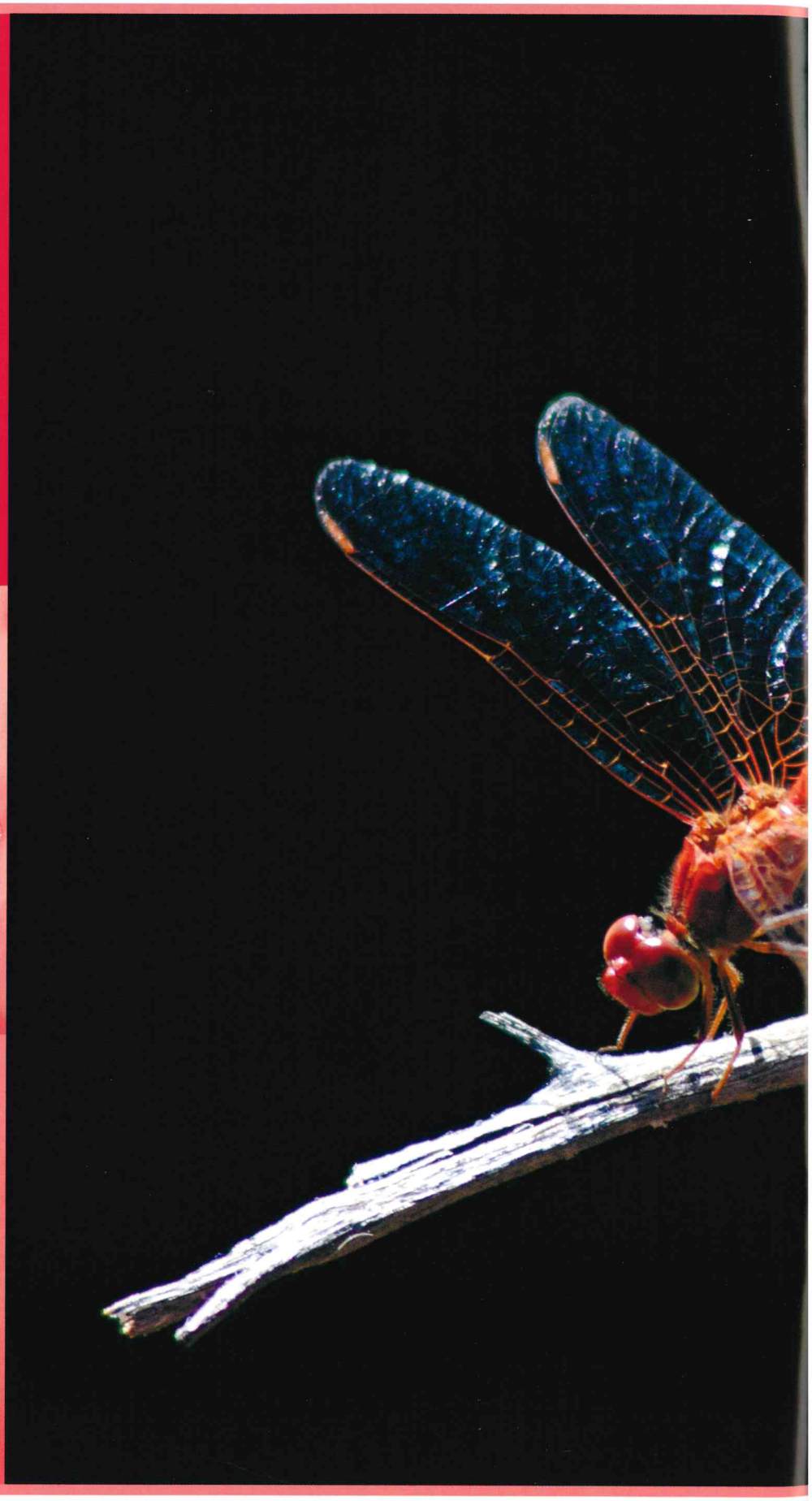
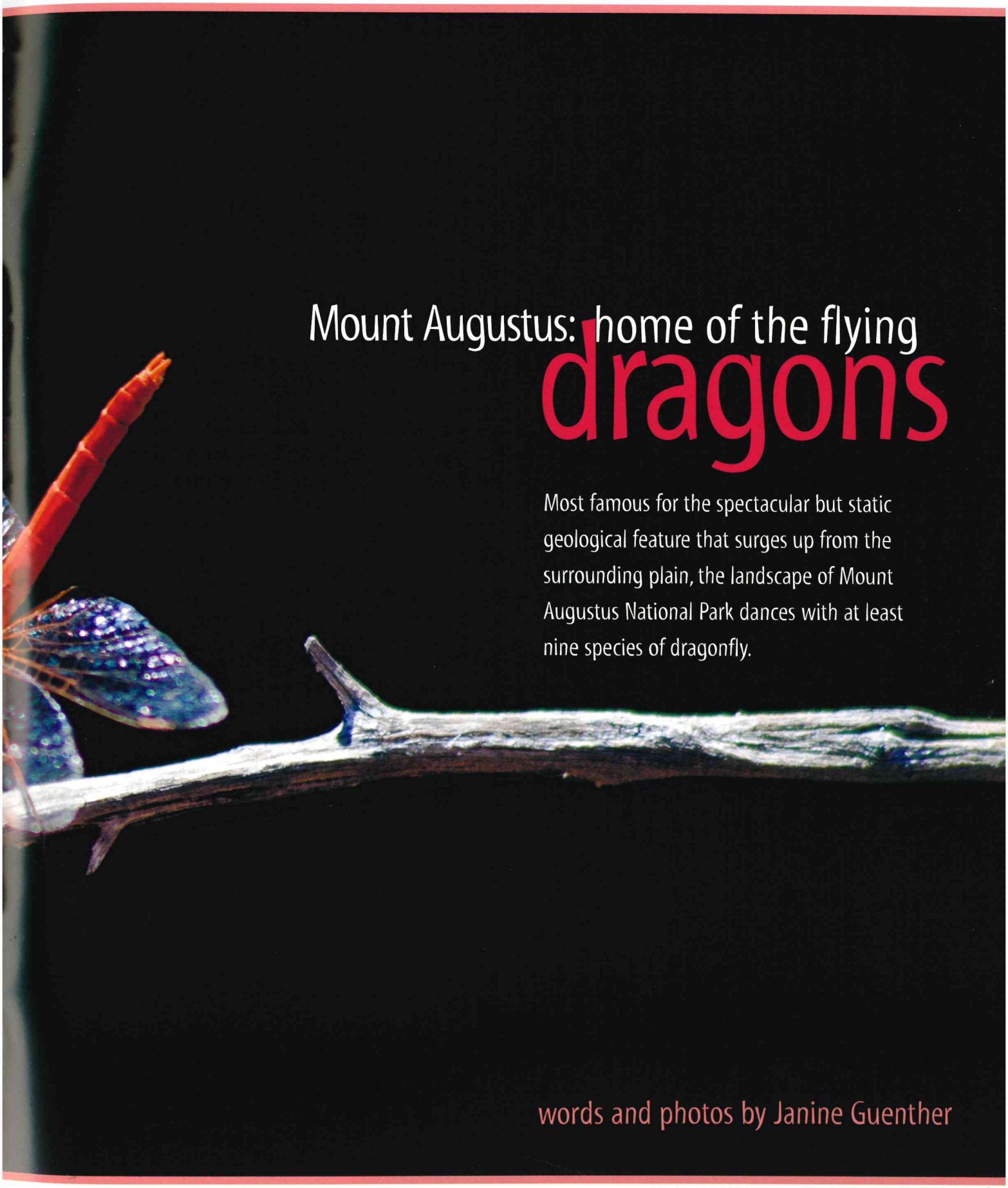




Mount Augustus: home of the flying dragons

Most famous for the spectacular but static geological feature that surges up from the surrounding plain, the landscape of Mount Augustus National Park dances with at least nine species of dragonfly.

words and photos by Janine Guenther

Previous page
The vibrant colour of the scarlet percher makes it one of the most conspicuous dragonfly residents of Mount Augustus National Park.

Below left Edney Spring.

About 430 kilometres north-east of Carnarvon, in the magnificent Gascoyne region, an extraordinary monadnock rises amid the colourful composition of red earth, green acacia scrubland and blue sky. To the traditional owners, the Wajarri, this mountain has been known as Burringurrah for countless generations. Since 31 May 1858, when the explorer Francis Thomas Gregory became the first European to sight the mountain, it has also been known as Mount Augustus. In 1989 this monumental monadnock and a small stretch of acacia scrubland surrounding it were declared a national park.

With its sparsely vegetated flanks made of orange-brown sandstone, its ancient rock art galleries and its lofty summit towering 715 metres above the surrounding plain, the mountain is, without doubt, an attraction in its own right. However, the rock is remarkable not only for its natural beauty and cultural treasures but also for being a haven for wildlife. Among the animals that can be encountered are many typical representatives of the semi-arid outback region, such as euros (*Macropus robustus*), echidnas (*Tachyglossus aculeatus*), dingos (*Canis lupus dingo*), Gould's goannas (*Varanus gouldii*), ring-tailed dragons (*Ctenophorus caudicinctus*) and more than 100 bird species. Perhaps surprisingly, the park is also home to some creatures that are not readily associated with a hot and arid environment—creatures so intriguing that they alone would be worth a trip to this remote national park: dragonflies.

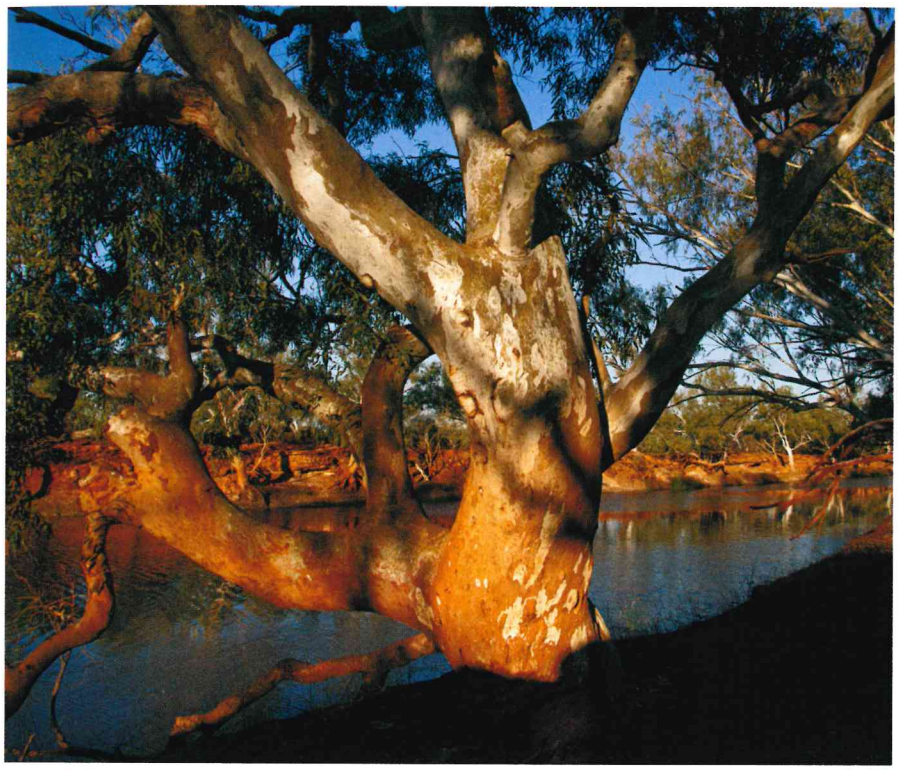
Designed by nature

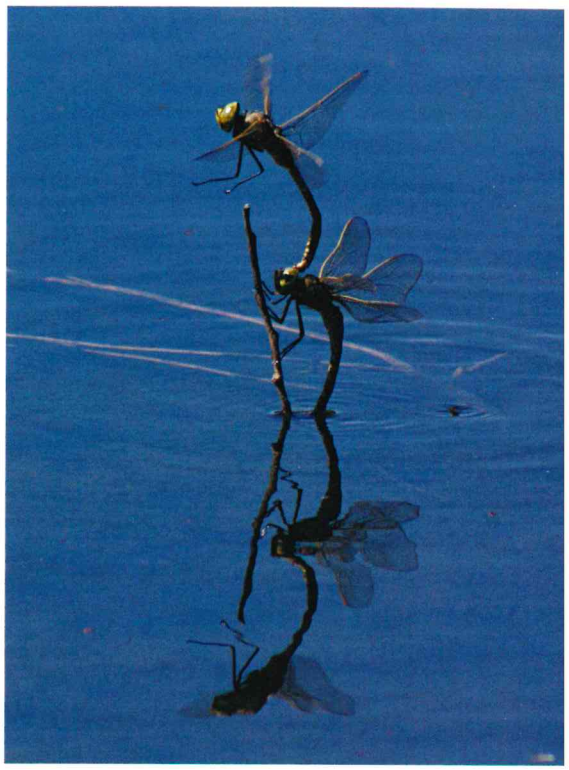
Dragonflies belong to the order Odonata which also comprises the smaller, more slender-built damselflies. The word Odonata derives from the Greek word for tooth and refers to the teeth found on the mandibles of all members of this order.

The body of a dragonfly is, like the body of all insects, divided into three main parts: the head, the thorax, to which legs and wings are attached, and the abdomen, which is made of 10 segments. The most striking physical feature of the dragonfly is the head which is almost completely covered by two large compound eyes. These eyes are composed of many closely packed facets, called ommatidia. Each ommatidium captures a tiny fragment of the overall picture and the higher the number of ommatidia, the more accurate the vision. In dragonflies, each eye consists of up to 28,000 ommatidia—a number unrivalled in the insect world—providing sharp 360-degree vision. In addition to these highly efficient eyes, all members of Odonata are characterised by three simple but extremely light-sensitive eyes positioned at the front of the head, called ocelli. Although only single-lensed, the ocelli serve an important function as they assist the animal to control its flight path by determining the position of the horizon.

No less remarkable than the two sets of eyes are the two pairs of large wings. The two pairs differ slightly in size and shape and are put into motion by powerful flight muscles which enable the dragonfly to fly long distances and even to migrate over hundreds of kilometres. In contrast to many other insects, dragonflies can not only move their wings in unison but are also able to beat them independently. This accounts for their remarkable aerial agility. They can switch into different 'flight modes' simply by altering wing movements and stroke angles.

The wings of most species are translucent, except for a delicate network of veins. A closer look at this seemingly uniform network reveals a few anomalies. The most obvious is a dark spot near each wing-tip known as a pterostigma. These marks are pigmented cells which are believed to reduce wing flutter during gliding by acting as counterweights. In some species, the leading vein, known as the costa, is also distinctively coloured and can therefore provide a valuable clue for identification. This is helpful as the





Above left Goolinee, also known as Cattle Pool, is one of two permanent waterholes in Mount Augustus National Park.

Above An Australian emperor pair during oviposition, or egg laying.

often-similar appearance of Australia's 324 described species of flying dragons—including 113 species of damselflies—can make identification a challenge.

Meet the locals

Although no biological survey has been conducted at Mount Augustus, the national park is known to support at least nine species of dragonfly. The star among these whizzing flashes of colour is the scarlet percher (*Diplacodes haematodes*). With a body length of 3.5 centimetres and a wingspan of only six centimetres, it is by no means the biggest species in the region, but, due to its bright red colour, is undoubtedly one of the most conspicuous. However, as is so often the case in the animal kingdom, only the males are strikingly coloured; the female is a rather pale yellowish-green. In other respects both sexes live up to their name as this species frequently perches on rocks, grasses and branches close to the ground and water. This behaviour is typical for all five Australian members of the genus *Diplacodes*, including the wandering percher (*D. bipunctata*) which is also a resident in the park. The wandering percher is smaller in size and not so brilliantly coloured. It also differs from its showy cousin by having black markings on the abdomen.

Another eye-catcher at Mount Augustus is the narrow-lobed glider (*Tramea stenoloba*). Whereas the majority of species have translucent wings, the wings of this dragonfly are partly coloured. Although the colouration is restricted to the base of the wing, the narrow-lobed glider clearly stands out from the other species. The males are orange-brown to red with equally coloured wing patches, and the females are of a yellowish colour with brown wing patches. With wingspans of up to 11 centimetres, the narrow-lobed glider is significantly bigger than the scarlet percher.

Being the only bluish-coloured dragonfly in the park, the blue skimmer (*Orthetrum caledonicum*) can also be easily identified. The intense colour is typical only for mature adults. Young males are much paler, while females change colour with age from yellow and black to bluish-grey. This common dragonfly can grow to a body length of 4.5 centimetres and is widespread throughout Australia. Of similar size is a rose-coloured relative which can also be frequently seen, the rosy skimmer (*O. migratum*).

Size is the most striking feature of the Australian emperor (*Hemianax papuensis*). It is the largest species in the park and one of the largest in Australia, reaching body lengths of up to seven centimetres and wingspans of 13 centimetres. The leading vein of the wings is a distinctive yellow colour and the abdomen is patterned with yellow and black. Similar patterns and colours characterise the three remaining species: the Pilbara tiger (*Ictinogomphus dobsoni*) and two representatives of the genus *Hemicordulia*, the Pilbara emerald (*H. koomina*) and the tau emerald (*H. tau*).

Water means life

Mount Augustus National Park incorporates two permanent waterholes which provide an ideal environment and breeding ground for dragonflies: the small freshwater spring Edney Spring, located in a picturesque gully at the foot of the mountain, and a large waterhole on the Lyons River called Goolinee, also known as Cattle Pool, about two kilometres north of the mountain. After heavy rain, which usually occurs during the summer months, several semi-permanent

Above Mount Augustus the famed mondanock of the national park.

Left A narrow-lobed glider.

Below left Blue skimmer.

waterholes create additional habitat for a thriving population of dragonflies.

Water plays an essential role in the life cycle of dragonflies. Not only are these magnificent insects dependent on water for reproduction but they also spend most of their lives submerged. The life of a dragonfly is divided into three stages: egg, larva (also known as nymph) and adult. The first two stages are aquatic and, depending on the species, can last up to several years. Eggs are laid into water, by either dropping them directly into it or inserting them into plant tissue. Once hatched, the nymphs become aggressive hunters that prey on aquatic invertebrates, small tadpoles and other larvae, particularly those of mosquitoes. Equipped with internal gills, the nymphs do not need to surface to breathe. Oxygen is absorbed from water pumped through the gills that are located at the end of the abdomen. The water is drawn in and expelled through the anus. This way of breathing has a positive side effect. Water squirted out through the anus can be used as a jet propulsion, enabling the nymph to move quickly forward without using its legs.

Right A pair of Australian emperor dragonflies during oviposition.

The growing nymphs moult frequently, in some species more than a dozen times. When fully developed and ready for its last moult, the nymph leaves the water, crawls up a stick or leaf and flicks its body until the back of the skin splits open. Very slowly the winged adult emerges. Body fluids are pumped into the thorax, legs, abdomen and, finally, into the wings, causing them to swell, expand and harden. It can take several hours before the wings are hard enough for flying. Only then can the dragonfly take off for its maiden flight.

Life as an adult

Once the dragonfly has shed its nymphal skin, it enters the last stage of its life which is comparably short—on average only a few months. At the beginning of their adult stage, all dragonflies are pale yellowish to green. Their body is soft as it can take up to two days before the exoskeleton, the external skeleton, is fully hardened. While hardening, their species-specific pigmentation develops.

It takes another few days or, in some species, up to several weeks to reach sexual maturity. To avoid encounters with aggressive, sexually mature males, immature dragonflies stay away from the water until they are ready to mate and face their rivals.

Like the nymphs, the adults are ferocious predators that feed mostly on other insects, including mosquitoes, flies, butterflies and wasps. Prey is caught and devoured in flight. Only larger prey is eaten while perching. Quite often, however, the skilful hunter becomes the hunted. During all their life stages, dragonflies are highly susceptible to predation. Eggs and nymphs are preyed on by fish, frogs and other predatory insects, while the adults have to be on the look out for birds such as Australian kestrels (*Falco cenchroides*) and rainbow bee-eaters (*Merops ornatus*). They also have to keep their compound eyes open for spider webs, especially for the strong webs made by golden orb spiders of the genus *Nephila* and those of long-jawed spiders of the genus *Tetragnatha* which are commonly built close to the water. Once entangled in a web, there is usually no escape—at least not for smaller dragonflies.

For those who survive until they reach maturity, it becomes time to return to the water. While the males of non-territorial species fly up and down the water bodies to 'hunt' for females, the males of most species select a territory and secure a suitable breeding ground where they wait for receptive females. It is within the borders of these territories that the most exciting air shows take place.

Acrobats of the air

Few insects are more captivating and more challenging to watch than dragonflies. They are not only extremely fast flyers, with some species reaching up to 60 kilometres per hour, but they are also among the most manoeuvrable insects in the world. Dragonflies are able to fly backwards, shift sidewards, move up and down like

Identifying dragonflies

It is not only colour and size that help to distinguish between the species but also their behaviour during oviposition. The keen observer will note at least four different behaviour patterns.

Scarlet perchers remain in tandem during the entire egg-laying process. Together they flit across the water's surface until they suddenly swoop down for a fraction of a second while the female dips the tip of its abdomen into the water and deposits the first batch of eggs. This procedure is repeated frequently and performed at such a high speed that one can hardly follow it with one's eyes—let alone with the camera.

Male and female of the narrow-lobed glider also stay together until oviposition is completed. However, they do not stay physically attached all the time. Just before the female is ready to lay eggs, the male opens its claspers and lets the female go. During egg-laying, the male hovers above the female to recapture it the moment the female has finished.

The Australian emperor differs from most other species in that the female does not lay the eggs directly into water. Instead, the eggs are inserted into plant tissue, which is cut open by the female's knife-like ovipositor, a structure at the end of its abdomen specifically designed to cut into plants and lay eggs. This ovipostion strategy is typical of all members of the family Aeshnidae which in Australia is represented by seven genera, comprising 13 species.

The male of the blue skimmer does not guard the egg-laying process but separates from the female after mating. The female can be watched flying close to the water's surface, dipping the tip of its abdomen repeatedly into the water.

Right Narrow-lobed glider.

Below right A blue skimmer pair mating in the wheel position.

helicopters, glide motionless, swoop down like kookaburras and hover like hummingbirds. Sudden changes of direction and speed in mid air are also mastered effortlessly. This makes it very pleasing—but also quite difficult—to watch these unpredictable and restless acrobats of the air. However, it is during the mating season that the acrobats show what they are really made of.

The male dragonfly not only possesses two sets of eyes and wings but also two sets of genitalia: a primary set near the tip of the abdomen to produce sperm, and a secondary set closer to the thorax that is used to insert the sperm into the female. Before a male can mate with a female, it must move the sperm produced in the primary set to the secondary set. This is achieved by curling the abdomen so that the two sets of genitalia touch.

Once this first acrobatic stunt has been accomplished—which either takes place in flight or while perching—the male literally swoops down on the next female entering its territory or, in non-territorial species, the next female in sight. The males of most species are anything but gentlemen and do not waste time and energy with extravagant courtship displays. Instead, they firmly grab the female at the back of the head with their claw-like abdominal appendages, called under claspers. Made of formidable spines and hooks, under the magnifying glass, claspers resemble medieval torture instruments and, indeed, can scratch or sometimes even punch holes into the head and eyes of the female.

Male and female stay hooked together in a tandem position for the rest of the mating process and, depending on the species, also during egg-laying. Contrary to popular belief they do not mate while flying in tandem. Copulation takes place in a wheel position while the receptive female bends its body until it touches the male's secondary set of genitalia, enabling the male to insert its penis. Interestingly, the penises of dragonflies are not only designed to introduce sperm but also to remove it—namely the sperm of predecessors. There is a high competition between males for females and it is not uncommon for males to try to capture newly fertilised females in order to remove the sperm of a rival. For this reason, the males of many species guard the females or even stay with them in tandem until all eggs are laid. The egg-laying process, known as oviposition, starts immediately after mating. With the first eggs laid into water, the life cycle starts again and a new generation of dragonflies grows up to continue to intrigue visitors to Mount Augustus National Park.

Janine Guenther has visited Australia many times from her home country Germany, accumulating more than five years' residence in Australia, much of which has been spent in outback Western Australia. She joined the Department of Environment and Conservation (DEC) campground host program and spent time in Mount Augustus National Park in 2008 and 2011. Janine can be contacted by email (j.guenther@verlag360grad.com).

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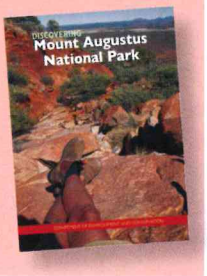
A new title in DEC's Discovering Book series Discovering Mount Augustus National Park*—also authored by Janine—details the history, geology, walk trails and common plants and animals of Mount Augustus National Park. This can be purchased using the order form in this magazine or at www.dec.wa.gov.au/shop.*



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